

**SECTION 31 23 23.33
FLOWABLE FILL**

SPEC WRITER NOTES:

1. Use this section only for NCA projects. Delete text between // _____ // not applicable to project. Edit remaining text to suit project.
2. Use this section when potential exists for soil backfill conditions where it will not be possible to provide specified compaction of fill or backfill as a result of limited or restricted space or access conditions.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cementitious slurry used as fill or backfill in lieu of compacted earth.

1.2 DEFINITIONS

- A. Flowable Fill: Ready-Mix Controlled Low Strength Material used as an alternative to compacted soil, and is also known as controlled density fill, and several other names, some of which are trademark names of material suppliers. Flowable fill (Controlled Low Strength Material) differs from Portland Cement concrete as it contains low cementitious content to reduce strength development for possible future removal. Design strength for this permanent type flowable fill is 2.1 MPa (300 psi) minimum compressive strength at 28 days. Chemical admixtures may also be used in flowable fill to modify performance properties of strength, flow, set and permeability.

SPEC WRITER NOTE:

Clearly designate whether there are instances where excavatable flowable fill is required. Utility trench crossings are typical locations where excavatable flowable fill would be required for NCA projects. Indicate whether machine or hand excavation is required.

- B. Excavatable Flowable Fill: Flowable fill designed with compressive strength that will allow excavation as either machine tool excavatable at maximum compressive strength of 1.5 MPa (200 psi) at 1 year, or hand

tool excavatable at maximum compressive strength of 0.7 MPa (100 psi) at 1 year.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American Concrete Institute (ACI):
 - 1. 229R-13 - Report on Controlled Low-Strength Materials.
- C. ASTM International (ASTM):
 - 1. C33/C33M-16 - Concrete Aggregates.
 - 2. C39/C39M-16 - Compressive Strength of Cylindrical Concrete Specimens.
 - 3. C150/C150M-16 - Portland Cement.
 - 4. C260/C260M-10a - Air-Entraining Admixtures for Concrete.
 - 5. C494/C494M-15a - Chemical Admixtures for Concrete.
 - 6. C940-16 - Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.

1.4 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.

SPEC WRITER NOTE: Edit participant list to ensure entities influencing outcome attend.

- 1. Required Participants:
 - a. Contracting Officer's Representative (COR).
 - b. // Architect/Engineer. //
 - c. // Inspection and Testing Agency. //
 - d. Contractor.
 - e. Installer.
 - f. // Manufacturer's field representative. //
 - g. Other installers responsible for adjacent and intersecting work, including // _____ //.

SPEC WRITER NOTE: Edit meeting agenda to incorporate project specific topics.

- 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Installation schedule.
 - b. Installation sequence.

- c. Preparatory work.
 - d. Protection before, during, and after installation.
 - e. Installation.
 - f. Terminations.
 - g. Transitions and connections to other work.
 - h. Inspecting and testing.
 - i. Other items affecting successful completion.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

- A. Submit according to Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Pre-Approval Procedures: Use of flowable fill during any part of project is restricted to those incidences where, due to field conditions, Contractor has made COR aware of conditions for which he recommends use of flowable fill, and COR has confirmed those conditions and approved use of flowable fill, in advance. During submittal process, prepare and submit various flowable fill mix designs corresponding to required conditions or if flowable fill is desired for economic reasons. Obtain COR approval of flowable fill strength // through submittal process, // when Contractor desires, or is required, to use flowable fill at specific locations within project. Before beginning field operations, establish procedures to maintain optimum working conditions and coordinate this work with related and adjacent work.
- C. Flowable Fill Mix Design: Provide mix design containing cement and water. At Contractor's option, it may also contain fly ash, aggregate, or chemical admixtures in any proportions such that final product meets specified strength and flow consistency and shrinkage requirements.
- D. Certificates: Certify products incorporated in flowable fill, following achievement of the required strength, do not represent a threat to groundwater quality.
- E. Qualifications: Substantiate qualifications comply with specifications.
 - 1. Manufacturer with project experience list.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Regularly manufactures specified products.

2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.

a. Project Experience List: Provide contact names and addresses for completed projects.

1.7 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

1.8 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.9 FIELD CONDITIONS

A. Environment:

1. Weather Limitations: Install flowable fill only when approved in advance by COR and when existing and forecasted weather conditions are within limits established by manufacturer of materials and products used.

1.10 WARRANTY

SPEC WRITER NOTE: Always retain construction warranty. FAR includes Contractor's one year labor and material warranty.

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

SPEC WRITER NOTE:
Modify following paragraph as required, for site conditions and potential for conditions that may require the use of flowable fill.

A. Flowable Fill: Fluid that sets within required time and, after curing, obtains desired strength properties as evidenced by laboratory testing of specific mix design, at locations shown on drawings or as directed by COR, // verbally // in writing // verbally or in writing //. Flowable fill for use as structural fill to // remain excavatable using

hand tools // remain easily excavatable using a backhoe as would be utilized for adjoining earth // remain permanently //.

2.2 PRODUCTS

- A. Provide each product from one manufacturer. If not otherwise specified, comply with ACI 229R recommendations.

SPEC WRITER NOTES:

Modify following material items as required. Whenever possible use standards already developed by local State Department of Transportation (DOT) for use in cast-in-place concrete or, if applicable, (CLSM) or flowable fill.

1. Portland Cement: ASTM C150/C150M, // Type 1 or Type 2. // Meeting _____ (Insert state in which the project is being built) State DOT standards. //
2. Mixing Water: // Fresh, clean, and potable. // Meeting _____ (Insert State in which the project is being built) State DOT standards for use as mix-water for cast-in-place concrete. //
3. Air-Entraining Admixture: ASTM C260/C260M.
4. Chemical Admixtures: ASTM C494/C494M.
5. Aggregate: ASTM C33/C33M.

2.3 MIXES

- A. Flowable Fill Mix: Provide minimum cementitious materials and water. Cementitious materials to be portland cement, pozzolanic materials, or other self-cementing materials, or combinations thereof, at Contractor's option, provided certification of no degradation of groundwater quality has been submitted. Flowable fill mix design may also contain, fine aggregate or filler, and chemical admixtures in any proportions for final product to meet specified strength, flow consistency and shrinkage requirements.

1. Mix Design: Consistency that at time of placement does not require manual means for placement.
2. Minimum Strength: 2.1 MPa (300 psi) according to ASTM C39/C39M at 28 days after placement.
3. Minimum Subsidence and Bleed Water Shrinkage: Bleed water evaporation to result in maximum 10.4 mm per m (1/8 inch per foot) shrinkage of flowable fill depth (for mixes containing high fly ash content), as measured in ASTM C940 Section 10.

SPEC WRITER NOTES:

1. Select appropriate unit weight based upon type and strength of flowable fill to be used. Contact providers within maximum allowable transit time for specific unit weight parameters for flowable fill material provided locally to project.

4. Flowable Fill Unit Weight: // 1500-1900 kg/cu. m (90-115 lbs/cu. yd.) // 1900-2300 kg/cu. m (115-145 lbs/cu. yd.) // 320-1300 kg/cu. m (20-80 lbs/cu. yd.) // measured at point of placement after 60-minute ready-mix truck transport. If strength data is not submitted, maximum cementitious content to be 90 kg/cu. m (150 lbs/cu. yd.).
- B. In-Place Yield: // Minimum 98 percent of design yield for permanent type // Maximum 110% of design yield for removable types at 1 year //.
- C. Provide equipment as recommended by manufacturer and comply with manufacturer's instructions for addition of additives, at production plant or before placement at project site.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.

3.2 FLOWABLE FILL APPLICATION

- A. Secure tanks, pipes and other members to be encased in flowable fill. Ensure that no exposed metallic pipes, conduits, or other items will be in contact with flowable fill after placement. If so, replace with non-metallic materials or apply manufacturer's recommended coating to protect metallic objects before flowable fill placement. Replacement or protection of metallic objects is subject to COR approval.

3.3 PROTECTION

- A. Protect exposed surfaces of flowable fill from premature drying, wash by rain or running water, wind, mechanical injury, and excessively hot or cold temperature, by curing method subject to COR approval.

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