SECTION 312323.33 - FLOWABLE FILL

This section includes flowable lean concrete mix used for structure backfill, utility bedding and backfill and other subgrade site work. Applications also include filling abandoned structures and utilities that remain in place. Flowable fill is often used as an alternate to soil and aggregate fill and backfill.

1. GENERAL
	* + 1. RELATED DOCUMENTS
				1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			2. SUMMARY
				1. Section Includes:

Flowable fill for:

Structure backfill.

Utility bedding.

Utility backfill.

Filling abandoned utilities.

* + - 1. DEFINITIONS
				1. Utility: Any buried pipe, duct, conduit, manhole, tank, or cable.
				2. Excavatable Flowable Fill: Lean cement concrete fill used where future excavation may be required, such as fill for utility trenches, bridge abutments, and culverts.
				3. Non-excavatable Flowable Fill: Lean cement concrete fill used where future excavation is not anticipated, such as fill below structure foundations and filling abandoned utilities.
				4. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
				5. Landscaped Areas: Areas not covered by structures, walks, roads, paving, or parking.
			2. REFERENCE STANDARDS

List reference standards included within text of this section. Edit the following for project conditions.

* + - * 1. ASTM International:

ASTM C33 - Standard Specification for Concrete Aggregates.

ASTM C94 - Standard Specification for Ready-Mixed Concrete.

ASTM C150 - Standard Specification for Portland Cement.

ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

ASTM C403 - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.

ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.

ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

ASTM C1040 - Standard Test Methods for Density of Unhardened and Hardened Concrete in Place By Nuclear Methods.

ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.

* + - * 1. New York State Department of Transportation (NYS DOT)

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* + - 1. SUBMITTALS

Only request submittals needed to verify compliance with project requirements.

* + - * 1. Submittals for this Section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Manufacturer's Certificate: Certify that [**products**] meet or exceed [**specified requirements**].
				5. Field Quality-Control Submittals:

Mix Design:

Furnish flowable fill mix design for each specified strength.

Furnish separate mix designs when admixtures are required for the following:

Flowable fill Work during hot and cold weather.

Air entrained flowable fill Work.

Identify design mix ingredients, proportions, properties, admixtures, and tests.

Furnish test results to certify flowable fill mix design properties meet or exceed specified requirements.

USE PARAGRAPH BELOW WITH EPD REQUIREMENT WHEN PROJECT ESTIMATE IS $1M OR MORE.

* + - * 1. Submit an Environmental Product Declaration (EPD) from the manufacturer for each concrete mix within this specification section, if available. A statement of the contractor’s good faith effort to obtain the EPD shall be provided if not available.

Manufacturer-provided EPDs must be Product Specific Type III (Third-Party Reviewed), in adherence with ISO 14025 *Environmental labels and declarations*, ISO 14044 *Environmental management – Life cycle assessment*, and ISO 21930 *Core rules for environmental product declarations of construction products and services.*

* + - * 1. Delivery Tickets:

Furnish duplicate delivery tickets indicating actual materials delivered to Project Site.

* + - * 1. Qualifications Statements:

Coordinate the following subparagraphs with the requirements specified in "Qualifications" article.

Submit qualifications for supplier.

* + - 1. QUALITY ASSURANCE

Use this article to specify compliance with overall reference standards affecting all products and installation included in this section.

Include the following paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain [**copy**] [<\_\_> **copies**] of each standard affecting the Work of this Section on Site.
			1. QUALIFICATIONS
				1. Supplier:

Company specializing in supplying products specified in this Section with minimum [**three**]years’ [**documented**] experience.

Product source approved by **[Director’s Representative]**.

* + - 1. ENVIRONMENTAL REQUIREMENTS
				1. Section 015000 - Construction Facilities and Temporary Controls: specifies ambient condition control facilities for product storage and installation.
				2. Minimum Conditions: Do not install flowable fill during inclement weather or when ambient temperature is less than 40 degrees F.
			2. FIELD MEASUREMENTS

Include this article when field measurements are required to determine quantities provided under unit price payment methods.

* + - * 1. Verify field measurements before installing flowable fill to establish quantities required to complete the Work.
1. PRODUCTS
	* + 1. FLOWABLE FILL

Select fill types required. Specify locations for each fill type here or ensure that fill types are indicated on drawings.

* + - * 1. Flowable Fill: Shall consist of a mixture of Portland cement, sand, water and admixtures proportioned to provide a non-segregating, free-flowing, self-consolidating material that will result in a hardened, dense backfill.
			1. MATERIALS

Edit materials to correspond with types of flowable fill required to suit project conditions.

* + - * 1. Portland Cement: ASTM C150 [**Type I - Normal;**] [**Type IA - Air Entraining;**] [**Type II - Moderate;**] [**Type IIA - Air Entraining;**] [**Type III - High Early Strength;**] [**Type IIIA - Air Entraining;**] manufactured by <**Insert Manufacturer**>.

Edit the following paragraph to suit local conditions and aggregate supply. Itemize gradation when special aggregates are required.

* + - * 1. Fine Aggregates: [**ASTM C33**]**.**
				2. Water: Clean and not detrimental to concrete.
			1. ADMIXTURES
				1. Furnish materials according to <**ACI 301, Chapter 2**>.

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with products specified above.

Admixtures are used for air entrainment and specific changes desired in properties of workability of mix, setting time and corrosion resistance.

* + - * 1. Air Entrainment: ASTM C260.
				2. Chemical Admixture: ASTM C494.

Select admixtures that are permitted or delete subparagraphs to allow manufacturer to select admixtures.

[**Type A - Water Reducing**].

[**Type B - Retarding**].

[**Type C - Accelerating**].

[**Type D - Water Reducing and Retarding**].

[**Type E - Water Reducing and Accelerating**].

[**Type F - Water Reducing, High Range**].

[**Type G - Water Reducing, High Range and Retarding**].

Fly Ash is classified as follows:

Class F - Fly Ash with pozzolanic properties produced from burning anthracite or bituminous coal.

Class C - Fly Ash with pozzolanic and cementitious properties from lignite or subbituminous coal.

* + - * 1. Fly Ash: ASTM C618 Class C or F obtained from residue of electric generating plant using ground or powdered coal.
				2. Plasticizing: ASTM C1017 [**Type I, plasticizing.**] [**Type II, plasticizing and retarding.**]
			1. MIXES
				1. Mix and deliver flowable fill according to ASTM C94, Option C.

Coordinate mix design with NYSDOT standard specifications for project specific application.

* + - * 1. Flowable Fill Design Mix:

Cement Content:

Excavatable: **[75 to 100]** lb./cu. yd.

Non-Excavatable: **[100 to 150]** lb./cu. yd.

Fly Ash Content: <Insert Content of Fly Ash>

Excavatable: None.

Non-Excavatable: **[150-600]** pcf.

Water Content:

Excavatable: As specified.

Non-Excavatable: As specified.

Air Entrainment:

Excavatable: 5 to 35 percent.

Non-Excavatable: 5 to 15 percent**.**

28-Day Compressive Strength:

Excavatable: [**40**-**150]** psi

Non-Excavatable: **[125-150]** psi.

Unit Mass (Wet):

Excavatable: **[80 to 110]** pcf**.**

Non-Excavatable: **[100 to 125]** pcf.

Temperature, Minimum, at Point of Delivery:

Excavatable: **[50]** degrees F.

Non-Excavatable: **[50]** degrees F.

* + - * 1. Provide water content in design mix to produce self-leveling, flowable fill material at time of placement.
				2. Design mix air entrainment and unit mass are for laboratory design mix and source quality control only.
			1. SOURCE QUALITY CONTROL
				1. [**Test**] [**and**] [**analyze**] properties of flowable fill design mix and certify results for the following:

Design mix proportions by weight of each material.

Aggregate: ASTM C33 for material properties and gradation.

Properties of plastic flowable fill design mix including:

Temperature.

Slump.

Air entrainment.

Wet unit mass.

Yield.

Cement factor.

Properties of hardened flowable fill design mix including:

Compressive strength at 1 day, 7 days, and 28 days. Report compressive strength of each specimen and average specimen compressive strength.

Unit mass for each specimen and average specimen unit mass at time of compressive strength testing.

* + - * 1. Prepare delivery tickets containing the following information:

Project designation.

Date.

Time.

Class and quantity of flowable fill.

Actual batch proportions.

Free moisture content of aggregate.

Quantity of water withheld.

1. EXECUTION
	* + 1. EXAMINATION
				1. Section 013000 - Administrative Requirements: Verification of existing conditions before starting Work.
				2. Verify [**Earthwork specified in Section 310000**] is complete.
				3. Verify utility installation **<\_\_\_\_>** is complete and tested before placing flowable fill.
				4. Verify excavation is dry [**and dewatering system is operating**].
			2. PREPARATION

When flowable fill is used for utility bedding, ensure temporary supports to maintain elevation and alignment are included in section where utility is specified.

* + - * 1. Support and restrain utilities to prevent movement and flotation during installation of flowable fill.
				2. Protect structures and utilities from damage caused by hydraulic pressure of flowable fill before fill hardens.
				3. Protect utilities [**and foundation drains**] to prevent intrusion of flowable fill.
			1. INSTALLATION - FILL, BEDDING, AND BACKFILL
				1. Place flowable fill by chute, pumping or other methods [**approved by Director’s Representative**].

Include tremie placement procedures when dewatering is not possible.

When required, place flowable fill under water using tremie procedure.

Do not place flowable fill through flowing water.

* + - * 1. Place flowable fill in lifts to prevent lateral pressures from exceeding structural capacity of structures and utilities.
				2. Place flowable fill evenly on both sides of utilities to maintain alignment.
				3. Place flowable fill to elevations indicated on Drawings without vibration or other means of compaction.
			1. INSTALLATION - FILLING ABANDONED UTILITIES
				1. Verify pipes and conduits are not clogged and are sufficiently empty to permit gravity installation of flowable fill for entire length indicated to be filled.
				2. Seal lower end of pipes and conduits by method to contain flowable fill and to vent trapped air caused by filling operations.
				3. Place flowable fill using method to ensure there are no voids.

Fill pipes and conduits from high end.

Fill manholes, tanks, and other structures from grade level access points.

* + - * 1. After filling pipes and conduits seal both ends.
			1. FIELD QUALITY CONTROL

Select test standards referenced in the following paragraph appropriate for fill materials and project requirements.

* + - * 1. Perform [**inspection and**] testing according to ASTM C94.

Take samples for tests for every **[150]** cu. yd.of flowable fill, or fraction thereof, installed each day.

Sample, prepare and test four compressive strength test cylinders according to ASTM D4832. Test one specimen at 3 days, one at 7 days, and two at 28 days.

Measure temperature at point of delivery when samples are prepared.

The following density tests are used to determine when flowable fill has set sufficiently to support traffic. These tests are not used to determine acceptance of flowable fill.

* + - * 1. Perform in place penetration (density) tests using handheld penetrometer to measure penetration resistance of hardened flowable fill according to ASTM C403.

Perform tests at locations as directed by [**Director’s Representative**].

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Perform in-place density tests using nuclear test device according to ASTM C1040.

Perform tests at locations as directed by [**Director’s Representative**].

* + - * 1. Defective Flowable Fill: Fill failing to meet the following test requirements or fill delivered without the following documentation.

Test Requirements:

Minimum temperature at point of delivery.

Compressive strength requirements for each type of fill.

Documentation: Duplicate delivery tickets.

* + - 1. CLEANING
				1. Remove spilled and excess flowable fill from Project Site.
				2. Restore facilities and Site areas damaged or contaminated by flowable fill installation to existing condition before installation.

END OF SECTION 312323.33