

**SECTION 31 23 23.33
LEAN CONCRETE FILL**

PART 1 - GENERAL

1.1 INTRODUCTION:

- A. Lean Concrete fill refers to a cementitious slurry consisting of a mixture of fine aggregate or filler, water, and cementitious material(s), which is used as a fill or backfill in lieu of compacted earth. This mixture is capable of filling all voids in irregular excavations and hard to reach places (such as under undercuts of existing slabs), is self-leveling, and hardens in a matter of a few hours without the need for compaction in layers.
- B. Lean Concrete fill materials will be used only as a structural fill replacement on VA projects. The materials and mix design for the lean concrete fill should be designed to produce a comparable compressive strength to the surrounding stabilized soil after hardening.

1.2 DESCRIPTION:

- A. Furnish and place lean concrete fill in a fluid condition, that sets within the required time and, after curing, obtains the desired strength properties as evidenced by the laboratory testing of the specific mix design, at locations shown on the plans. This section specifies lean concrete fill for use as structural fill to exhibit properties similar to the surrounding stabilized soils.

1.3 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

1.4 DEFINITIONS:

- A. Lean Concrete fill - Ready-mix Controlled Low Strength Material used as an alternative to compacted soil. Lean Concrete fill differs from portland cement concrete as it contains a low cementitious content to reduce strength development for possible future removal. Unless specifically approved otherwise, by the Project Engineer, lean concrete fill shall be designed as a permanent material, not designed for future removal. Design strength for this permanent type flowable fill shall be a compressive strength of 2.1 MPa (300 psi) minimum at 28 days. Chemical admixtures may also be used in lean concrete fill to modify performance properties of strength, flow, set and permeability.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

- B. Lean Concrete fill Mix Design: Provide lean concrete fill mix design containing cement and water. At the contractor's option, it may also contain fly ash, aggregate, or chemical admixtures in any proportions such that the final product meets the strength and flow consistency, and shrinkage requirements included in this specifications.
1. Test and Performance - Submit the following data:
 - a. Lean Concrete fill shall have a minimum strength of 2.1 MPa (300 psi) according to ASTM C 39 at 28 days after placement.
 - b. Lean Concrete fill shall have minimal subsidence and bleed water shrinkage. Evaporation of bleed water shall not result in shrinkage of more than 10.4 mm per m (1/8 inch per ft.) of lean concrete fill depth (for mixes containing high fly ash content). Measurement of a Final Bleeding shall be as measured in Section 10 of ASTM C 940 "Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.
 - c. Lean Concrete fill shall have a unit weight of 1900 - 2300 kg/m³ (115 - 145 lb/feet³) measured at the point of placement after a 60 minute ready-mix truck ride.
 - C. Provide documentation that the admixture supplier has experience of at least one year, with the products being provided and any equipment required to obtain desired performance of the product.
 - D. Manufacturer's Certificates: Provide Project Engineer with a certification that the materials incorporated in the lean concrete fill, following achievement of the required strength, do not represent a threat to groundwater quality.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - D4832-02.....Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
 - C618-03.....Standard Specifications for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as Mineral Admixture in Concrete. (Use Fly Ash conforming to the chemical and physical requirements for mineral admixture, Class F listed, including Table 2 (except for Footnote A). Waive the loss on ignition requirement.)

- C403/C403M-05.....Standard Test Method for Time of Setting of
Concrete Mixtures by Penetration Resistance.
- C150-99 Rev.A-04.....Standard Specification for Portland Cement
- C33-03.....Standard Specification for Concrete Aggregates
- C494/C494M-04.....Standard Specification for Chemical Admixtures
for Concrete
- C940 RevA-98.....Standard Specification for Expansion and
Bleeding of Freshly Mixed Grouts for Preplaced -
Aggregate Concrete in the Laboratory
- C. American Concrete Institute (ACI):
- SP-150-94.....Controlled Low-Strength Materials

1.7 QUALITY ASSURANCE:

- A. Manufacturer: Lean Concrete fill shall be manufactured by a ready-mix concrete producer with a minimum of 1 year experience in the production of similar products.
- B. Materials: For each type of material required for the work of this Section, provide primary materials that are the products of one manufacturer. If not otherwise specified here, materials shall comply with recommendations of ACI 229, "Controlled Low Strength Materials."

1.8 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver and handle all products and equipment required, in strict compliance with manufacturer's recommendations. Protect from damage due to weather, excessive temperatures, and construction operations.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Provide lean concrete fill containing, at a minimum, cementitious materials and water. Cementitious materials shall be portland cement, pozzolanic materials, or other self-cementing materials, or combinations thereof, at the contractor's option, and following approval by the Project Engineer. The lean concrete fill mix design may also contain, fine aggregate or filler, and/or chemical admixtures in any proportions such that the final product meets the strength, flow consistency and shrinkage requirements included in this specification, as approved by the Project Engineer.
- A. Portland Cement: ASTM C150, Type 1 or Type 2. Meeting North Dakota State DOT standards.
- B. Mixing Water: Fresh, clean, and potable. Meeting North Dakota State DOT standards for use as mix-water for cast-in-place concrete.
- C. Air-Entraining Admixture: ASTM C260.
- D. Chemical Admixtures: ASTM C494.

E. Aggregate: ASTM C33.

2.2 LEAN CONCRETE FILL MIXTURE:

- A. Mix design shall produce a consistency that will result in a flowable product at the time of placement which does not require manual means to move it into place.
- B. Lean Concrete fill shall have a minimum strength of 2.1 MPa (300 psi) according to ASTM C39 at 28 days after placement.
- C. Lean Concrete fill shall have minimal subsidence and bleed water shrinkage. Evaporation of bleed water shall not result in shrinkage of more than 10.4 mm per m (1/8 inch per foot) of flowable fill depth (for mixes containing high fly ash content). Measurement of a Final Bleeding shall be as measured in Section 10 of ASTM C 940 "Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.
- D. Lean Concrete fill shall have a unit weight of 1900 - 2300 kg/m³ (115 - 145 lbs/feet³) measured at the point of placement after a 60 minute ready-mix truck ride. In the absence of strength data the cementitious content shall be a maximum of 90 kg/m³ (150 lbs/cy).
- E. Lean Concrete fill shall have an in-place yield of at least 98% of design yield for permanent type.
- F. Provide equipment as recommended by the Manufacturer and comply with manufacturer's recommendations for the addition of additives, whether at the production plant or prior to placement at the site.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine conditions of substrates and other conditions under which work is to be performed and notify Project Engineer, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 APPLICATION OF FLOWABLE FILL:

- A. Insure that there are no exposed metallic pipes, conduits, or other items that will be in contact with the lean concrete fill after placement. If so, replace with non-metallic materials or apply manufacturers recommended coating to protect metallic objects before placing the lean concrete fill. Replacement or protection of metallic objects is subject to the approval of the Project Engineer.

3.3 PROTECTION AND CURING:

- 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. Curing method shall be subject to approval by Project Engineer.

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SECTION 31 32 16
CHEMICAL TREATMENT SOIL STABILIZATION

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section includes the soil stabilization work beneath existing generator room floor, generator pad and switch board pad.
- B. Structural Chemical Grouting includes the use of chemical fluid grout injected into the soil matrix to solidify the existing soil allowing excavation in locations as shown on the drawings.

1.2 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23 SHOP DRAWINGS, product data and samples.
- B. Contractors shall propose an engineered system. Provide calculations and description of the work method.
- C. Shop Drawings: Submit dimensioned drawings for approval of chemical grouting placement configuration prior to start of work.
 - 1. Show complete dimensions on drawings, including penetration depths and details showing grouting locations and extents.
 - 2. Provide stamped engineered drawings for all components of the chemical grouting design.

1.3 QUALITY ASSURANCE:

- A. Installer Qualifications: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

1.4 PROJECT CONDITIONS:

- A. Work Included: In general terms, the following work is included in this section.
 - 1. Provide soil stabilization to allow excavation in locations as shown on drawings.
- B. Geotechnical Investigation Evaluation - Contractor shall include a Professional Engineer's Geotechnical Investigation Evaluation in the work of this section.
- C. Protect existing building components that will remain in place. Monitor existing structure for signs of cracking or movement during stabilization process.

1.5 COORDINATION:

- A. The work of this section shall be coordinated with the work of all other trades.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Provide chemical grouting adequate to stabilize soil conditions beneath generator room floor, generator pad and switchboard pad.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Coordinate Chemical Grouting with related demolition and earthwork.
- B. Inject chemical grouting as required by the engineer's design and per manufacturer's recommendations.

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