SECTION 313213.16 - CEMENT SOIL STABILIZATION

This section includes treatment of existing site subsurface soil for physical stability and to encourage stabilization prior to placement of subsequent construction. The mixture contains subsurface soil, cement, mineral aggregate, sand and water sometimes referred to as "soil cement."

The ratio of mix materials and water is highly dependent on actual soil conditions and degree of stabilization required; refer to subsurface investigation report for recommendations. As there are different methods for introducing cement and water into dry mix materials, this section is based on the more common method of excavating subsurface soil, site or central plant mixed materials, then replacing mixture to required dimensions. Indicate surface area dimensions, elevations, and depth of stabilization work required on drawings.

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:

Excavating and treating soil.

Placing soil cement mix.

* + - 1. REFERENCES
				1. ASTM International:

ASTM D1633 - Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders.

* + - 1. SUBMITTALS
				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. Product Data:

Submit mix design and materials mix ratio to achieve specified requirements.

Submit data for geotextile fabric indicating fabric and construction.

Submit data for curing seal.

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.*

Include the following paragraph for testing of fill materials.

* + - * 1. Samples: Submit sample of each type of fill in air-tight containers, to testing laboratory in amounts described in Section 310001 Earthwork Materials.
				2. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
			1. SUSTAINABLE DESIGN SUBMITTALS

Delete article if product does not include LEED/sustainability requirements.

* + - * 1. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.

Edit material certifications list to suit products specified in this section and project sustainable design requirements.

Materials Resources Certificates:

Certify recycled material content for recycled content products.

Certify source for regional materials and distance from Project site.

* + - * 1. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

Provide cost data for the following products:

Edit list of material cost data to suit products specified in this section and project sustainable design requirements.

Products with recycled material content.

Regional products.

**<Insert product>**.

* + - 1. QUALITY ASSURANCE

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

* + - * 1. Maintain [**one copy**] of each standard affecting Work of this Section on Site.
			1. ENVIRONMENTAL REQUIREMENTS
				1. Do not install mixed materials in wind in excess of [**10 mph**] or when temperature is below [**40 °F**].
1. PRODUCTS
	* + 1. MIX MATERIALS

Adjust material limits and grading to local availability. Determine when excavated subsurface soil is suitable for backfill material. Refer to geotechnical report.

In the following paragraphs edit material sections as indicated and coordinate with referenced specification sections for each material. Delete paragraphs below if materials are not to be used.

* + - * 1. Subsurface soil:

[**Insert subsurface soil type**] as specified in [**Section 310001 Earthwork Materials**].

Delete subparagraph above or below to suit project.

Existing reused.

* + - * 1. Aggregate:

[**Insert aggregate type**] as specified in **[Section 310001 Earthwork Materials]**.

* + - * 1. Cement:

As specified in [**Section 033000 Cast-in-Place Concrete**].

* + - 1. ACCESSORIES
				1. Curing Seal: [**Asphalt emulsion primer.**]**.**

Coordinate paragraph below with referenced specification section.

* + - * 1. Geotextile Fabric:

As specified in [**Section 310001 – Earthwork Materials**].

* + - 1. SUSTAINABILITY CHARACTERISTICS

Edit sustainable design requirements to suit content of this section and project sustainable design requirements. Delete Article if project does not include LEED/sustainability requirements.

* + - * 1. Materials and Resources Characteristics:

Recycled Content Materials: Furnish materials with maximum available recycled content [**including:**] [**.**]

List materials specified in this section required to have recycled content.

<**Insert materials**>.

Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site [**including:**] [**.**]

List materials specified in this section required to be regional materials.

<**Insert materials**>.

* + - 1. EQUIPMENT
				1. Equipment: Capable of excavating subsurface soil, mixing and placing materials, wetting, consolidating, and compacting material.
			2. SOIL CEMENT MIX

Paragraphs below specifies compressive strength for completed and cured mix. This option should only be utilized when subsurface investigation report identifies that a particular or target compressive strength can be achieved.

* + - * 1. Mix subsurface soil, cement, and aggregates(s)**.**

Cement: Maximum [**10 percent**] of dry mixed materials by volume.

Mix to obtain minimum compressive strength of [**450 psi**] at [**7 days**].

* + - * 1. Add water to mix to achieve homogeneous damp mixture without lumping, yet not creating wet plastic consistency.
1. EXECUTION
	* + 1. EXAMINATION
				1. Do not backfill over frozen or spongy subgrade surfaces.
			2. PREPARATION
				1. Coordinate requirements with piling operations.
			3. EXCAVATION
				1. Protect adjacent structures from damage by this work.
				2. Excavate subsurface soil [to depth indicated].
				3. Proof roll subgrade to identify soft areas; excavate those areas in accordance with [**Section 310000 Earthwork**].
				4. Do not excavate within normal [**45 degree**] bearing splay of any foundation.
				5. Remove lumped subsurface soil, boulders, and rock up to [**1 cubic yard**] measured by volume. Remove larger material as specified in [**Section 312316.26 Rock Removal**].
				6. Notify Director’s Representative of unexpected subsurface conditions. Discontinue affected Work in area until notified to resume work.
				7. Correct areas over-excavated in accordance with [**Section 310000 Earthwork**].
				8. Remove excess excavated materials from [**State**] property and dispose of offsite.

Delete paragraph above or below to suit project.

* + - * 1. Transport excess materials to spoil areas on [**State**] property designated by the Director’s Representative and dispose of materials as directed.
			1. SOIL TREATMENT AND BACKFILLING
				1. Place geotextile fabric over subsurface soil surface, lap edges and ends.
				2. [**Site**] [**Plant**] mix subsurface soil, backfill [**and compact**]. Blend treated subsurface soil mix to achieve mix formulation and required stabilization.
				3. Place mix material in continuous layers, maximum [**8 inches**].
				4. Maintain optimum moisture content of mix materials to attain required stabilization. When placing more than one layer, maintain lower layer at optimum moisture until next layer is placed.
				5. Place mixed materials within [**2.5 hours**] of adding water to mix.
				6. Do not exceed [**30 minutes**] in placing adjacent mixed material.
				7. Commence compaction of mix no later than [**60 minutes**] after placement.
				8. Compact mix to [**ASTM D1633**].
				9. Slope grade away from building.
				10. Shape to required line, grade, and cross section.
				11. Make grade changes gradual. Blend slopes into level areas.
				12. At end of day, terminate completed Work by forming straight and vertical construction joint.
				13. Replace damaged fill with new mix to full depth of original mix.
				14. Remove surplus mix materials from site.
			2. CURING
				1. Immediately following compaction of mix, seal top surface with [**curing seal.**] [**water fogging.**]
			3. TOLERANCES
				1. Top Surface of Fill: Plus or minus [**one inch**] from required elevations.
			4. FIELD QUALITY CONTROL

The following paragraph identifies test method for compression testing site made cone cylinders of mixed materials. Other test methods can also be considered, depending on actual project and material mix requirements.

* + - * 1. Testing: Compression test and analysis of hardened fill material in accordance with [**ASTM D1633**].
				2. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

Specify frequency of testing when performed by Contractor.

* + - * 1. Frequency of Tests: <**Insert frequency**>.

END OF SECTION 313213.16