

**Section 02252****CEMENT STABILIZED SAND****1.0 GENERAL****1.01 SECTION INCLUDES**

- A Cement stabilized sand for backfill and bedding.
- B References to Technical Specifications:
  - 1. Section 01350 – Submittals
  - 2. Section 02255 – Bedding, Backfill, and Embankment Materials
  - 3. Section 01450 – Testing Laboratory Services
- C Referenced Standards:
  - 1. American Society for Testing and Materials (ASTM)
    - a. ASTM D 558, “Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures”
    - b. ASTM D 1632, “Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory”
    - c. ASTM D 1633, “Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders”
    - d. ASTM C 150, “Standard Specification for Portland Cement”
    - e. ASTM C 33, “Standard Specification for Concrete Aggregates”
    - f. ASTM D 2487, “Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)”
    - g. ASTM C 142, “Standard Test Method for Clay Lumps and Friable Particles in Aggregates”
    - h. ASTM C 123, “Standard Test Method for Lightweight Particles in Aggregate”
    - i. ASTM C 40, “Standard Test Method for Organic Impurities in Fine Aggregates for Concrete”
    - j. ASTM C 4318, “Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils”
    - k. ASTM C 94, “Standard Specification for Ready-Mixed Concrete”
    - l. ASTM C 31, “Standard Practice for Making and Curing Concrete Test Specimens in the Field”

**1.02 MEASUREMENT AND PAYMENT**

- A Unless indicated as an Extra Item, no separate payment will be made for cement stabilized sand under this Section. Include cost in Bid Items for applicable utility or structure installation.
- B If use of cement stabilized sand is allowed, based on the Engineer's direction, and indicated in Section 00300 – Bid Proposal as an Extra Item, measurement will be on a per ton basis. A conversion between volumes calculated based on theoretical limits and total weight will be made based on a ratio of 1.64 tons per cubic yard.

**1.03 SUBMITTALS**

- A Make Submittals required by this Section under the provisions of Section 01350 – Submittals.
- B Submit material qualification and design mix tests to include:
  - 1. Three series of tests of sand or fine aggregate material from the proposed source. Tests shall include procedures defined in this Section, 2.01 “Materials”.
  - 2. Three moisture-density relationship tests prepared using the material qualified by the tests in this Section, 1.03B1. Blends of fine aggregate from crushed concrete and bank run sand shall be tested at the ratio to be used for the design mix testing.
  - 3. Design mix report to meet the specifications of this Section, 1.04 “Design Requirements”. The design mix shall include compressive strength tests after 48-hours and 7 days curing.

**1.04 DESIGN REQUIREMENTS**

- A Design sand-cement mixture to produce a minimum unconfined compressive strength of 100 pounds per square inch in 48 hours when compacted to a minimum 95 percent in accordance with ASTM D 558 and when cured in accordance with ASTM D 1632, and tested in accordance with ASTM D 1633. Mix shall contain a minimum of 1-1/2 sacks of cement per cubic yard. Compact mix with a moisture content on the dry side of optimum.

**2.0 PRODUCTS****2.01 MATERIALS**

- A Cement shall be Type 1 Portland cement conforming to ASTM C 150.
- B Sand shall be clean, durable, and meet grading requirements for fine aggregates of ASTM C 33 and the following requirements:
  - 1. Classified as SW, SP or SM by the United Soil Classification System of ASTM D 2487.
  - 2. Deleterious material content:
    - a. Clay lumps shall comprise less than 0.5 percent by ASTM C 142.
    - b. Lightweight pieces shall comprise less than 5.0 percent by ASTM C 123.
    - c. Organic impurities shall produce color no darker than the standard color by ASTM C 40 ASTM.
  - 3. Plasticity index of 4 or less when tested in accordance with ASTM D 4318.
- C Fine aggregate, manufactured from crushed concrete meeting the quality requirements for crushed rock material in Section 02255 - Bedding, Backfill, and Embankment Materials, may be used as a complete or partial substitute for Bank Sand. The blending ratio of fine aggregate from crushed concrete and Bank Sand shall be defined in the mix design report.

- D Water shall be potable, free of oils, acids, alkalies, organic matter, or other deleterious substances, meeting requirements of ASTM C 94.

## **2.02 MIXING MATERIALS**

- A Thoroughly mix sand, cement and water in proportions of the mix design using a pugmill-type mixer. The plant shall be equipped with automatic weight controls to ensure correct mix proportions.
- B Stamp batch ticket at plant with time of loading directly after mixing. Material not placed and compacted within 4 hours after mixing shall be rejected.

## **3.0 EXECUTION**

### **3.01 PLACEMENT AND COMPACTION**

- A Place sand-cement mixture in 8-inch-thick loose lifts and compact to a minimum of 95 percent of ASTM D 558, unless otherwise specified on Plans. The moisture content during compaction shall be on the dry side of optimum but sufficient for hydration. Perform and complete compaction of sand-cement mixture within 4 hours after addition of water to mix at the plant.
- B Do not place or compact sand-cement mixture in standing or free water.

### **3.02 FIELD QUALITY CONTROL**

- A Testing will be performed under provisions of Section 01450 - Testing Laboratory Services.
- B Mixing plant inspections will be performed periodically. Material samples will be obtained and tested in accordance with this Section, 2.01 "Materials", if there is evidence of change in material characteristic.
- C One sample of cement stabilized sand shall be obtained for each 150 tons of material placed per day with no less than one sample per day of production. Random samples of delivered cement stabilized sand shall be taken in the field at point of delivery in accordance with ASTM 3665. Obtain three individual samples of approximately 12 to 15 lb each from the first, middle, and last third of the truck and composite them into one sample for test purpose.
- D Prepare and mold four specimens (for each sample obtained) in accordance with ASTM D558, Method A, without adjusting moisture content. Samples will be molded at approximately same time material is being used, but no later than 4 hours after water is added to mix.
- E After molding, specimens will be removed from molds and cured in accordance with ASTM D 1632.

- F Specimens will be tested for compressive strength in accordance with ASTM D 1633, Method A. Two specimens will be tested at 48 hours plus or minus 2 hours and two specimens will be tested at 7 days plus or minus 4 hours.
- G A strength test will be average of strengths of two specimens molded from same sample of material and tested at same age. Average daily strength will be average of strengths of all specimens molded during one day's production and tested at same age.
- H Precision and Bias: Test results shall meet recommended guideline for precision in ASTM D 1633 Section 9.
- I Reporting: Test reports shall contain, as a minimum, the following information:
1. Supplier and plant number
  2. Time material was batched
  3. Time material was sampled
  4. Test age (exact hours)
  5. Average 48-hour strength
  6. Average 7-day strength
  7. Specification section number
  8. Indication of compliance / non-compliance
  9. Mixture identification
  10. Truck and ticket numbers
  11. The time of molding
  12. Moisture content at time of molding
  13. Required strength
  14. Test method designations
  15. Compressive strength data as required by ASTM D 1633
  16. Supplier mixture identification
  17. Specimen diameter and height, in.
  18. Specimen cross-sectional area, sq. in.
- J The cement content will be checked on samples obtained in the field whenever there are apparent changes in the mix properties.

### 3.03 ACCEPTANCE

- A Strength level of material will be considered satisfactory if:
1. The average 48-hour strength is greater than 100 psi with no individual strength test below 70 psi.
  2. All 7-day individual strength tests (average of two specimens) are greater than or equal to 100 psi.
- B Material will be considered deficient when 7-day individual strength test (average of two specimens) is less than 100 psi but greater than 70 psi. See Paragraph 3.04 Adjustment for Deficient Strength.
- C The material will be considered unacceptable and subject to removal and replacement at Contractors expense when individual strength test (average of two specimens) has 7-day strength less than 70 psi

- D When moving average of three daily 48-hour averages falls below 100 psi, discontinue shipment to project until plant is capable of producing material, which exceeds 100 psi at 48 hours. Five 48-hour strength tests shall be made in this determination with no individual strength tests less than 100 psi.
- E Testing laboratory shall notify Contractor, Project Manager, and material supplier by facsimile of tests indicating results falling below specified strength requirements within 24 hours.
- F If any strength test of laboratory cured specimens falls below the specified strength, Contractor may, at his own expense, request test of cores drilled from the area in question in accordance with ASTM C42. In such cases, three (3) cores shall be taken for each strength test that falls below the values given in 3.03.A.
- G Cement stabilized sand in an area represented by core tests shall be considered satisfactory if the average of three (3) cores is equal to at least 100 psi and if no single core is less than 70 psi. Additional testing of cores extracted from locations represented by erratic core strength results will be permitted.

#### **3.04 ADJUSTMENT FOR DEFICIENT STRENGTH**

- A When mixture produces 7-day compressive strength greater than or equal to 100 psi, then material will be considered satisfactory and bid price will be paid in full.
- B When mixture produces 7-day compressive strength less than 100 psi and greater than or equal to 70 psi, material shall be accepted contingent on credit in payment. Compute credit by the following formula:

$$\text{Credit per Cubic Yard} = \frac{\$30.00 \times 2 (100 \text{ psi} - \text{Actual psi})}{100}$$

- C When mixture produces 7-day compressive strength less than 70 pounds per square inch, then remove and replace cement-sand mixture and paving and other necessary work at no cost to City.

END OF SECTION