

Section 02338

PORTLAND CEMENT STABILIZED SUBGRADE

PART 1 GENERAL

1.01 SUMMARY

This Section includes foundation course of Portland cement stabilized natural subgrade material.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for Portland cement stabilized subgrade is on per ton basis compacted in place to proper density. Separate measurement will be made for each different required thickness of subgrade course.
  - a. Limits of measurement shall match actual pavement replaced, but no greater than maximum pavement replacement limits shown on Plans. Limits for measurement will be extended to include installed Portland cement stabilized subgrade material that extends to 2 feet beyond outside edge of pavement to be replaced, except where proposed pavement section shares common longitudinal or transverse edge with existing pavement section. No payment will be made for Portland cement stabilized subgrade in areas beyond these limits.
  - b. Limits of measurement and payment shall match pavement replacement limits shown on Plans, except as noted in Paragraph 1.02.A.1.a, or as approved by Project Manager.
2. Payment for Portland cement is by ton of 2,000 pounds dry-weight basis.
3. Refer to Section 01270 – “Measurement and Payment” for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

- A. ASTM C150/C150M - Standard Specification for Portland Cement.
- B. ASTM D558 - Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures.
- C. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
- D. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

- E. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit certification that Portland cement complies with these specifications.

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01454 – “Testing Laboratory Services”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Water

Water: clean, clear and free from oil, acids, alkali, or organic matter.

- B. Portland Cement

ASTM C150/C150M Type I; bulk or sacked.

- C. Soil

Provide soil consisting of approved material free from vegetation or other objectionable matter encountered in existing roadbed.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

- A. Examination

1. Verify compacted subgrade is ready to support imposed loads.
2. Verify subgrade lines and grades are correct.

B. Preparation

1. Backfill for utilities below future grade.
2. Verify subgrade is firm and able to support, without displacement, construction equipment at specified density. Correct soft or yielding subgrade and stabilize by scarifying and aerating or by adding cement and compacting to uniform stability.
3. Grade, shape, and compact, as required, to allow construction of Portland cement treatment for in-place materials to lines, grades, thickness, and typical cross section shown on Plans. Remove unsuitable soil or material and replace with acceptable material.
4. Pulverize soil so that at completion of moist-mixing, 100 percent by dry weight passes 1-inch sieve, and minimum of 80 percent passes No. 4 sieve, exclusive of gravel or stone retained on these sieves. Pulverize existing bituminous wearing surfaces so that 100 percent will pass 2-inch sieve.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Equipment

Apply Portland cement treatment with machine or combination of machines and auxiliary equipment to produce specified results. Mixing may be accomplished by multiple-pass traveling mixing plant or single-pass traveling mixing plant. Provide sufficient equipment to enable continuous progression of work.

B. Mixing

1. Do not place and mix cement when temperature is below 40 degrees F and falling. Place base when temperature taken in shade and away from artificial heat is above 35 degrees F and rising.
2. Spread cement uniformly on soil at rate specified by laboratory. When bulk cement spreader is used, position it by string lines or other approved method to ensure uniform distribution of cement. Apply cement only to area where operations can be continuous and completed in daylight, within 1 hour of application. Amount of moisture in soil at time of cement placement shall not exceed quantity that will permit uniform mixture of soil and cement during dry mixing operations. Do not exceed specified optimum moisture content for soil cement mixture.
3. Do not allow equipment other than that used in spreading and mixing, to pass over freshly spread cement until it is mixed with soil.
4. Dry mix cement with soil after cement application. Continue mixing until cement has been sufficiently blended with soil to prevent formation of cement balls when water is applied. Mixture of soil and cement that has not been compacted and finished shall not remain undisturbed for more than 30 minutes.

5. Immediately after dry mixing is complete, uniformly apply water as necessary and incorporate it into mixture. Pressurized equipment must provide adequate supply to ensure continuous application of required amount of water to sections being processed within 3 hours of cement application. Ensure proper moisture distribution at all times. After last increment of water has been added, continue mixing until thorough and uniform mix has been obtained.
6. Ensure percentage of moisture in mixture, based on dry weights, is within 2 percentage points of specified optimum moisture content prior to compaction. When uncompacted soil cement mixture is wetted by rain indicating that average moisture content exceeds tolerance given at time of final compaction, reconstruct entire section in accordance with this Section at no additional cost.

C. Compaction

1. Prior to beginning compaction, ensure mixture is in loose condition for its full depth. Uniformly compact loose mixture to specified density, lines, and grades.
2. After soil and cement mixture is compacted, apply water uniformly as needed and mix thoroughly. Then reshape surface to required lines, grades, and cross section and lightly scarify to loosen imprints left by compacting or shaping equipment.
3. Roll resulting surface with pneumatic-tired roller and “skin” surface with power grader. Thoroughly compact with pneumatic roller, adding small increments of moisture, as needed. When aggregate larger than No. 4 sieve is present in mixture, make one complete coverage of section with flat-wheel roller immediately after skinning operation. When approved by Project Manager, surface finishing methods may be varied from this procedure, provided dense uniform surface, free of surface compaction planes, is produced. Maintain moisture content of surface material at its specified optimum during finishing operations. Compact and finish surface within period not to exceed 2 hours, to produce smooth, closely knit surface, free of cracks, ridges, or loose material, conforming to crown, grade, and line shown on Plans within period not to exceed 2 hours.

D. Construction Joints

At end of each day's construction, form straight transverse construction joint by cutting back into total width of completed work to form true 2-inch depth vertical face free of loose and shattered material. Construct cement treatment for large wide areas in series of parallel lanes of convenient length and width approved in advance by Project Manager.

E. Curing

1. Moist cure for minimum of 3 days before placing base or surface course, or opening to traffic. When open, restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.

2. Keep subgrade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.
3. Place base and surface within 14 days after final mixing and compaction, unless prior approval is obtained from Project Manager.

3.04 REPAIR/RESTORATION (NOT USED)

3.05 FIELD QUALITY CONTROL

A. Tolerances

1. Completed surface: smooth and conforming to typical section and established lines and grades.
2. Top of compacted surface: Plus or minus ¼-inch in cross section or in 16-foot length.

B. Testing shall be performed under provisions of Section 01454 – “Testing Laboratory Services”.

C. In-place density shall be determined in accordance with ASTM D6938 or ASTM D1556. Minimum of three tests shall be taken for each 1000 feet per lane of roadway or 500 square yards of embankment.

3.06 – 3.07 NOT USED

3.08 DEMONSTRATION / TESTING AND INSPECTION

A. Testing shall be performed under provisions of Section 01454 – “Testing Laboratory Services”.

B. Tests and analysis of soil materials shall be performed in accordance with ASTM D4318.

C. Soil shall be evaluated to establish ratio of cement to soil to obtain desired stability. Normal range is 6 percent to 10 percent by weight.

D. The percentage of moisture in soil, at time of cement application, shall be determined by ASTM D558. Moisture shall not be allowed to exceed quantity that will permit uniform, complete mixture of soil and cement during dry mixing operations nor specified optimum moisture content for soil cement mixture, as determined.

3.09 PROTECTION

A. Maintain stabilized subgrade to lines and grades and in good condition until placement of base or surface course.

B. Repair defects immediately by replacing material to full depth.

3.10 SCHEDULES (NOT USED)

END OF SECTION