SECTION 02725
PORTLAND CEMENT-STABILIZED BASE SUBGRADE

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

A. Foundation course of Portland cement-stabilized natural subgrade material.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices:

1. Payment for Portland cement-stabilized subgrade is on a square yard basis compacted in place to proper density. Separate measurement shall be made for each different required thickness of subgrade course.
    a. Limits of measurement shall be actual pavement replaced, but not beyond the maximum pavement replacement limits shown on the Drawings. Limits for measurement shall be extended to include installed Portland cement-stabilized subgrade material that extends two foot (2 Ft) beyond outside edge of pavement to be replaced except where proposed pavement section shares common longitudinal or transverse edge with existing pavement section. No separate payment shall be made for Portland cement-stabilized subgrade beyond these limits.
    b. Limits of measurement and payment shall match pavement replacement limits shown on the Drawings, except as noted in Paragraph 1.2.A.1.a or as approved by the Project Manager.
2. Payment for Portland cement is by the ton of two thousand pounds (2000 Lbs) dry-weight basis.
3. Refer to Section 01270 – Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum):

1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulate Price.

1.3 REFERENCES

A. ASTM – American Society for Testing and Materials.

1. ASTM C150 – Standard Specification for Portland Cement.
2. ASTM D558 – Standard Test Method for Moisture-Density Relations of Soil-Cement-Mixtures.
3. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12.44ft-lbf/ft_3).

4. ASTM D2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
5. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

B. CFTS – City of Friendswood Technical Specifications.

1.4 SUBMITTALS

A. Conform to requirements of Section 01330 – Submittal Procedures.
B. Submit certification that Portland cement complies with these Technical Specifications.

PART II: PRODUCTS

2.1 WATER

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

2.2 PORTLAND CEMENT

A. ASTM C150 Type I; bulk or sacked.

2.3 SOIL

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

2.4 TESTS

A. Testing shall be performed under provisions of Sections 01470 – Testing Laboratory Services and 01475 – Quality Control Testing Procedures.
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 six percent (6%) to ten percent (10%) by weight.
D. The percentage of moisture in soil, at tome of cement applications, shall be determined by ASTM D558. Moisture shall not be allowed to exceed quantity that shall permit uniform, complete mixture of soil and cement during dry mixing operations nor specified optimum moisture content for soil cement mixture, as determined.

PART III: EXECUTION

3.1 EXAMINATION

A. Verify compacted subgrade is ready to support imposed loads.
B. Verify subgrade lines and grades are correct.

3.2 EQUIPMENT

A. Apply Portland cement treatment with machine or combination of

machines and auxiliary equipment to produce specified results. Mixing may be accomplished by multi-pass traveling mixing plant or single-pass traveling mixing plant. Provide sufficient equipment to enable continuous prosecution of work.

3.3 PREPARATION

A. Backfill for utilities below future grade.

B. 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.

C. 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 on the Drawings. Remove unsuitable soil or material and replace with acceptable material.

D. Pulverize soil so that at completion of moist-mixing, one hundred percent (100%) by dry weight passes one inch (1 In) sieve and a minimum of eighty percent (80%) passes a No. 4 sieve, exclusive of gravel or stone retained on these sieves. Pulverize existing bituminous wearing surfaces so that one hundred percent (100 %) shall pass two inch (2 In) sieve.

3.4 MIXING

A. Do not place and mix cement when the ambient temperature is below forty degrees Fahrenheit (40° F) and falling. Place base when ambient temperature when taken in the shade and away from artificial heat is above thirty-five degrees Fahrenheit (35° F) and rising.

B. 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 in area where operations can be continuous and completed in daylight, within one hour (1 Hr) of application. Amount of moisture in soil at time of cement placement shall not exceed quantity that shall permit uniform mixture of soil and cement during dry mixing operations. Do not exceed specified optimum moisture content for soil-cement mixture.

C. Do not allow equipment other than that used in spreading and mixing, to pass over freshly spread cement until it is mixed with soil.

D. 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 thirty minutes (30 Min).

E. 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 three hours (3 Hrs) 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.

F. Ensure percentage of moisture in mixture, based on dry weights, is within two (2) percentage points of specified optimum moisture content prior to compaction. When un-compacted soil-cement mixture is wetted by rain indicating that average moisture content exceeds tolerance given at the time of final compaction, reconstruct entire section in accordance with this Section at no additional cost to the City.

3.5 COMPACTION

A. Prior to beginning compaction, ensure mixture is in loose condition for its full depth. Uniformly compact the loose mixture to specified density, lines and grades.

B. After soil and cement mixture is compacted, apply water uniformly as needed and mix thoroughly. Reshape surface to required lines, grades and cross section and lightly scarify to loosen imprints left by compacting or shaping equipment.

C. Roll resulting surface with pneumatic-tired roller and “skin” surface with power grader. Thoroughly compact mixture with pneumatic roller, adding small increments of moisture, as needed. When aggregate larger than No. 4 sieve is present in mixture, make one (1) complete coverage of section with flat-wheel roller immediately after skinning operation. When approved by the 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 a period not to exceed two hours (2 Hrs), to produce smooth, tight surface, free of cracks, ridges or loose material, conforming to crown, grade and line shown on the Drawings within the period not to exceed two hours (2 Hrs).

3.6 CONSTRUCTION JOINTS

A. At end of each day’s construction, form straight transverse construction joint by cutting back a total width of completed work to form true two inch (2 In) depth of 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 the Project Manager.

3.7 CURING

A. Moist cure for a minimum of three days (3 D) before placing base or surface course or opening to traffic. When open, restrict traffic to light pneumatic rollers or vehicles weighing less than ten tons (10 Tn).

B. Keep subgrade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.

C. Place base and surface within fourteen days (14 D) after the final mixing

and compaction, unless prior approval is obtained by the Project Manager.

3.8 TOLERANCES

A. Completed surface: smooth and conforming to typical section and established lines and grades.

B. Top of compacted surface: Plus or minus one-quarter inch (±1/4 In) in cross section or in sixteen feet (16 Ft) of length.

3.9 FIELD QUALITY CONTROL

A. Testing shall be performed under provision of Sections 01470 – Testing Laboratory Services and 01475 – Quality Control Testing Procedures.

B. In-place density shall be determined in accordance with ASTM D2922 or ASTM D698. A minimum of three (3) tests shall be taken for each one thousand feet (1000 Ft) per lane of roadway or five hundred square yards (500 Sy) of embankment.

3.10 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.

END OF SECTION