SECTION 02700
CEMENT-STABILIZED BASE COURSE

PART I: GENERAL

1.1 GENERAL REQUIREMENTS
- A. Foundation course of cement-stabilized crushed stone.
- B. Foundation course of cement-stabilized bank run gravel.

1.2 MEASUREMENT AND PAYMENT
- A. Unit Prices:
  1. Payment for cement-stabilized base course is on a square yard basis. Separate pay items are used for each different required thickness of base course.
  2. Payment for asphaltic seal cure is by the gallon.
  3. Refer to Section 01270 – Measurement and Payment for unit price procedures.
  4. Refer to Paragraph 3.9, Unit Price Adjustment.
- B. Stipulated Price (Lump Sum):
  1. If Contract is Stipulated Price Contract, payment for Work in this Section is included in Total Stipulated Price.

1.3 REFERENCES
- A. ASTM – American Society for Testing and Materials.
  1. ASTM C131 – Standard Test Method for Resistance to Degradation of Small-Size Course Aggregate by Abrasion and Impact in Los Angeles Machine.
  2. ASTM C150 – Standard Specification for Portland Cement.
  3. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soils Using Standard Effort (12,400 ft-lbf/ft_3 (600kN kN-m/m_3).
  4. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
  5. ASTM D2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
  6. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- B. CFTS – City of Friendswood Technical Specifications.
- C. TxDOT – Texas Department of Transportation.
  1. TxDOT Tex-101-E – Preparing Soil and Flexible Base Materials for Testing.
  2. TxDOT Tex-110-E – Particle Size Analysis of Soils.
  3. TxDOT Tex-120-E – Soil-Cement Testing.

1.4 SUBMITTALS
- A. Conform to requirements of Section 01330 – Submittal Procedures.

B. Submit samples of crushed stone, gravel and soil binder for testing.
C. Submit manufacturer's description and characteristics for pug mill and associated equipment, spreading machine and compaction equipment for approval.

1.5 TESTS
A. Perform testing under provisions of Sections 01470 – Testing Laboratory Services and Section 01475 – Quality Control Testing Procedures.
B. Perform tests and analysis of aggregate and binder materials in accordance with ASTM D1557 and ASTM D4318.

1.6 DELIVERY, STORAGE AND HANDLING
A. Make stockpiles from layers of processed aggregate to eliminate segregation of materials. Load material by making successive vertical cuts through entire depth of stockpile.
B. Store cement in weatherproof enclosures. Protect from ground dampness.

1.7 QUALITY ASSURANCE
A. Provide manufacturer's affidavits that material was manufactured in compliance with standards and Technical Specifications referenced in this Section.

PART II: PRODUCTS

2.1 CEMENT
A. ASTM C150 Type I; bulk or sacked.

2.2 WATER
A. Clean, clear; and free from oil, acids, alkali or vegetable matter.

2.3 AGGREGATE
A. Crushed Stone: Material retained on No. 40 Sieve meeting following requirements:
1. Durable particles of crusher-run broken limestone, sandstone or granite obtained from approved source.
2. Los Angeles abrasion test percent of wear not to exceed forty (40) when tested in accordance with ASTM C131.
B. Gravel: Durable particles of bank run gravel or processed material.
C. Soil Binder: Material passing No. 40 Sieve meeting following requirements when tested in accordance with ASTM D4318:
1. Maximum Liquid limit: thirty-five (35).
2. Maximum Plasticity index: ten (10).
D. Mixed aggregate and soil binder shall meet the following requirements:
1. Grading in accordance with TxDOT Tex-101-E and Tex-110-E within the specified limits in TABLE 4.1 – SIEVE ANALYSIS.
2. Obtain prior permission from the Project Manager for use of

additives to meet above requirements.

2.4 ASPHALT SEAL CURE
- A. Cutback Asphalt: MC30 conforming to requirements of Section 02730 – Prime Coat.
- B. Emulsified Petroleum Resin: EPR-1 Prime conforming to requirements of Section 02730 – Prime Coat.

2.5 MATERIAL MIX
- A. Design mix for a minimum average compressive strength of two hundred pounds per square inch (200 psi) at forty-eight hours (48 Hrs) using TxDOT Tex-120-E unconfined compressive strength testing procedures. Provide a minimum cement content of one and one-half (1-1/2) sacks, weighing ninety-four pounds (94 Lbs) each, per ton of mix.
- B. Increase cement content when average compressive strength of tests on field samples fall below two hundred pounds per square inch (200 psi). Refer to Part III concerning field samples and tests.
- C. Mix in stationary pug mill equipped with feeding and metering devices for adding specified quantities of base material, cement and water into mixer. Dry mix base material and cement sufficiently to prevent cement balls from forming when water is added.
- D. Resulting mixture shall be homogeneous and uniform in appearance.

2.6 SOURCE QUALITY CONTROL
- A. Perform testing under provisions of Sections 01470 – Testing Laboratory Services and Section 01475 – Quality Control Testing Procedures.
- B. Perform testing for unconfined compressive strength by TxDOT Test Method Tex-120-E as follows:
  1. Mold a minimum of three (3) samples each day or three (3) for each three hundred tons (300 Tn) of production.
  2. Compressive strength shall be the average of the minimum of three (3) samples or of the three (3) tests for each production lot.

PART III: EXECUTION

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

3.2 PREPARATION
- A. Complete backfill of new utilities below future grade.
- B. Prepare subgrade in accordance with requirements of Section 02115 – Embankment and Section 02135 – Excavation for Roadway.
- C. Correct subgrade deviations in excess of plus or minus one-quarter inch (±1/4 In) in cross section or in sixteen foot (16 Ft) length by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

D. Prepare sufficient subgrade in advance of base course for efficient operations.

3.3 PLACEMENT

A. Do not mix and place cement-stabilized base when the ambient temperature is below forty degrees Fahrenheit (40° F) and falling. Base may be placed when the ambient temperature taken in the shade and away from artificial heat is above thirty-five degrees Fahrenheit (35° F) and rising.
B. Place material on prepared subgrade in uniform layers to produce thickness indicated on the Drawings. Depth compacted of layers shall not exceed six inches (6 In).
C. Spread with approved spreading machine. Conduct spreading so as to eliminate planes of weakness or pockets of non-uniformly graded material resulting from hauling and dumping operations.
D. Provide construction joints between new material and stabilized base that has been in place four hours (4 Hrs) or longer. Joints shall be approximately vertical. Form joint with temporary header or make vertical cut of previous base immediately before placing subsequent base.
E. Use only one (1) longitudinal joint at center line under main lanes and shoulder unless shown otherwise on the Drawings. Do not use longitudinal joints under frontage roads and ramps unless indicated on the Drawings.
F. Place base so that projecting reinforcing steel from curbs remain at approximate center of base. Ensure proper firm bond between reinforcement and base.

3.4 COMPACTION

A. Start compaction as soon as possible but not more than sixty minutes (60 Mins) from start of moist mixing. Compact loose mixture with approved tamping rollers until entire depth is uniformly compacted. Do not allow stabilized base to mix with underlying material.
B. Correct irregularities or weak spots immediately by replacing material and recompacting.
C. Apply water to maintain moisture between optimum and two percent (2%) above optimum moisture as determined by ASTM D698. Mix in with spiked tooth harrow or equal. Reshape surface and lightly scarify to loosen imprints made by equipment.
D. Remove and reconstruct sections where average moisture content exceeds ranges specified at time of final compaction.
E. Finish by blading surface to final grade after compacting final course. Seal with approved pneumatic-tired rollers which are sufficiently light to prevent surface hair line cracking. Rework and recompact at areas where hair line cracking develops.
F. Compact to a minimum density of ninety-five percent (95%) of maximum dry density at moisture content of treated material between optimum and

two percent (2%) above optimum as determined by ASTM D1557, unless otherwise indicated on the Drawings.

G. Maintain surface to required lines and grades throughout operation.

3.5 CURING

A. Moist cure for a minimum of seven days (7 D) before adding pavement courses. Restrict traffic on base to local property access. Keep subgrade surface damp by sprinkling.

B. If indicated on the Drawings, cover base surface with curing membrane as soon as finishing operation is complete. Apply with approved self-propelled pressure distributor at following rates or as indicated on the Drawings:

1. MC30: One tenth gallon per square yard (0.1 Gal/Sy).
2. EPR-1 Prime: Fifteen hundredths gallon per square yard (0.15 Gal/Sy).

C. Do not use cutback asphalt during period of April 16th to September 15th.

3.6 TOLERANCES

A. Smooth and conform completed surface to typical section and established lines and grades.

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

3.7 FIELD QUALITY CONTROL

A. Perform testing under provisions of Sections 01470 – Testing Laboratory Services and Section 01475 – Quality Control Testing Procedures.

B. Take a minimum of one (1) core at random locations per one thousand linear feet (1000 Lf) per lane of roadway or one (1) per every five hundred square yards (500 Sy) of base to determine in-place depth.

C. Request additional cores in vicinity of cores indicating nonconforming in-place depths at no extra cost to the City. When average of tests fall below required depth, place additional material and compact at no additional cost to the City.

D. Perform compaction testing in accordance with ASTM D698 or ASTM D2922 and ASTM D3017 at randomly selected locations. Remove and replace areas that do not conform to compaction requirements at no additional cost to the City.

E. Fill cores and density test sections with new compacted cement-stabilized base.

3.8 NONCONFORMING BASE COURSE

A. Remove and replace areas of base course found deficient in thickness by more than ten percent (10%), or that fail compressive strength tests, with cement-stabilized base of thickness shown on the Drawings.

B. Replace nonconforming base course sections at no additional cost to the City.

3.9 UNIT PRICE ADJUSTMENT

A. Make the unit price adjustments for in-place depth determined by cores as follows:
   1. Adjusted unit price shall be ratio of average thickness as determined by cores to thickness bid upon, times the unit price.
   2. Apply adjustment to lower limit of ninety percent (90%) and upper limit of one hundred percent (100%) of the unit price.

3.10 PROTECTION

A. Maintain stabilized base in good condition until completion of Work. Repair defects immediately by replacing base to full depth.
B. Protect asphalt membrane, when used, from being picked up by traffic. Membrane may remain in place when proposed surface courses or other base courses are to be applied.

PART IV: TABLES

4.1 SIEVE ANALYSIS

Sieve	**Percent Retained**			
	Crushed Stone	Processed G. 1	Processed G. 2	Bank run Gravel
1 3/4 inch	0 to 10	0 to 5	-	0 to 5
1/2 inch	-	-	0	-
No. 4	45 to 75	30 to 75	15 to 35	30 to 75
No. 40	55 to 80	60 to 85	55 to 85	65 to 85

END OF SECTION