

ITEM 222

PORTLAND CEMENT STABILIZED SUBGRADE

222.1 Description. This item shall consist of treating the subgrade by the pulverizing, the addition of Portland cement, mixing, wetting and compacting the mixed material to the required density. This item applies to natural ground, embankment or existing pavement structure and shall be constructed as specified herein and in conformity to the typical sections, lines and grades as shown, on the plans or as established by the Engineer.

Cement treatment shall not be mixed or placed when the air temperature is below 40° F and falling, but may be mixed or placed when the air temperature is above 35° F and is rising, the temperature being taken in the shade and away from artificial heat and with the further provision that cement treatment shall be mixed or placed only when weather conditions, in the opinion of the Engineer, are suitable.

222.2 Materials

- A. Soil shall consist of approved material free from vegetation or other objectionable matter encountered in the existing roadbed and other acceptable material used in the preparation of the roadbed in accordance with this specification.
- B. Portland cement shall be Type I of a standard brand of cement and shall conform to the requirements of ASTM Designation C150.

One sack, containing 1 cubic foot of cement, shall be considered as weighing 94 pounds net. One barrel of cement shall be considered as weighing 376 pounds net and containing 4 cubic feet.

The Contractor, at his option, may use bulk cement, provided the apparatus for handling, weighing and spreading the cement is approved by the Engineer. Cement weighing equipment shall meet the requirements of the Item, "Weighing and Measuring Equipment".

- C. Water shall be free from substances deleterious to the hardening of the cement treatment and shall meet the requirements of the Item, Concrete Pavement.

The ratio of cement to soil will be based on dry material weight and shall be established by the Engineer in the field to provide the desired stability. The normal range is 6-percent to 10-percent by weight. The percentage of moisture in the soil, at the time of the cement application shall not exceed the quantity that will permit the uniform and intimate mixture of soil and cement during the dry mixing operations and shall not exceed the specified optimum

moisture content for the soil cement mixture, as determined by ASTM Method D558.

222.3 Equipment. Equipment necessary for proper construction of the work shall be on the project, in first-class working condition and be approved by the Engineer, both as to type and condition, prior to the start of construction operations. The Contractor shall at all times provide sufficient equipment to enable continuous prosecution of the work.

Portland cement treatment for materials in-place may be constructed with any machine or combination of machines and auxiliary equipment that will produce the results as outlined in this specification.

Mixing may be accomplished by a multiple-pass traveling mixing plant or a single-pass traveling mixing plant.

The equipment provided by the Contractor shall be operated by experienced and capable workmen and shall be that necessary to provide a cement treatment meeting the requirements herein specified.

222.4 Construction Methods. It is the primary requirement of this specification to secure a completed course of treated material containing a uniform Portland cement mixture free from loose or segregated areas, of uniform density and moisture content, well bound for its full depth and with a smooth surface suitable for placing subsequent courses. It shall be the responsibility of the Contractor to regulate the sequence of his work, to process a sufficient quantity of material to provide full depth as shown on the plans, to use the proper amount of Portland cement, maintain the work and rework the courses as necessary to meet the above requirements.

The Portland cement shall be mixed to the full depth shown on the plans and in no case, shall it be less than six (6) inches.

The subgrade shall be firm and able to support, without displacement, the construction equipment at the density hereinafter specified. Soft or yielding subgrade shall be corrected and made stable by scarifying and aeration or adding cement and compacting until it is of uniform stability.

Before other construction operations are begun, the subgrade shall be graded, shaped and compacted, as required, to construct the Portland cement treatment for materials in-place in conformance with the lines, grades, thickness and typical cross section shown on the plans. Unsuitable soil or material shall be removed and replaced with acceptable material.

The soil shall be so pulverized that, at the completion of moist-mixing 100-percent by dry weight passes a 1-inch sieve, and a minimum of 80-percent passes a No. 4 sieve, exclusive of gravel or stone retained on these sieves.

Old bituminous wearing surfaces shall be pulverized so that 100 percent will pass a 2-inch sieve.

Portland cement shall be spread uniformly on the soil at the rate specified or as approved by the Engineer. If a bulk cement spread is used, it shall be positioned by string lines or other approved methods during spreading to insure a uniform distribution of cement.

Cement shall be applied only to such an area that all operations can be continuous and completed in daylight and within 5 hours of such application.

The percentage of moisture in the soil at the time of cement application, shall not exceed the quantity that will permit uniform and intimate mixture of the soil and cement during dry mixing operations, and it shall not exceed the specified optimum moisture content for the soil cement mixture.

No equipment, except that used in spreading and mixing, will be allowed to pass over the freshly spread cement, until it is mixed with the soil.

After the cement has been applied, it shall be dry mixed with the soil. Mixing shall continue until the cement has been sufficiently blended with the soil to prevent the formation of cement balls when water is applied. Any mixture of soil and cement that has not been compacted and finished shall not remain undisturbed for more than 30 minutes.

Immediately after dry mixing of soil and cement is complete, water as necessary shall be uniformly applied and incorporated into the mixture. Pressurized equipment shall provide an adequate supply to insure continuous application of the required amount of water to the sections being processed within 3-hours of the application of the cement. Proper care shall be exercised to insure proper moisture distribution at all times. After the last increment of water has been added, mixing shall continue until a thorough and uniform mix has been obtained.

The material shall be compacted to not less than 95-percent of standard proctor density (ASTM Method D698). At the start of compaction, the percentage of moisture in the mixture and in the un-pulverized soil lumps, based on dry weights, shall not be below or more than two percentage points above the specified optimum moisture content and shall be less than that quantity which will cause the soil cement mixture to become unstable during compaction and finishing. When the uncompacted soil cement mixture is wetted by rain so that the average moisture content exceeds the tolerance given at the time of final compaction, the entire section shall be reconstructed in accordance with this specification at the sole expense of the Contractor.

The specified optimum moisture content and field density shall be determined from representative samples of the soil, taken in the fields and

blended cement in a materials laboratory setting in accordance with ASTM Method D698.

Prior to the beginning of compaction, the mixture shall be in a loose condition for its full depth. The loose mixture shall then be uniformly compacted to the specified density lines and grades.

After the soil and cement mixture is compacted, water shall be uniformly applied, as needed, and thoroughly mixed. The surface shall then be reshaped to the required lines, grades and cross section and then lightly scarified to loosen any imprint left by compacting or shaping equipment.

The resulting surface shall be thoroughly rolled with a pneumatic tire roller and "skinned" by a power grader to achieve final grade, removing all loosened soil and cement from the section. The surface shall then be thoroughly compacted with the pneumatic roller, adding small increments of moisture as needed during rolling. If aggregate larger than a No. 4 screen is present in the mixture, one complete coverage of the section with the flat wheel roller shall be made immediately after the skinning operation. When directed by the Engineer, surface finishing methods may be varied from this procedure, provided a dense uniform surface, free of surface compaction planes, is produced. The moisture content of the surface material must be maintained at its specified optimum during all finishing operations. Surface compaction and finishing shall proceed in such a manner as to produce, in not more than 2-hours, a smooth, closely knit surface, free of cracks, ridges or loose material conforming to the crown, grade and line shown on the plans.

222.5

Curing. After the cement treated course has been finished as specified herein, the surface shall be protected against rapid drying by either of the following curing methods for a minimum period of 3-days, or as directed by the Engineer. These methods of curing are:

- A. Maintain in a thorough and continuously moist condition by sprinkling.
- B. Apply an asphalt membrane to the treated course, immediately after its completion. The material for the asphalt membrane shall be MC-30. The asphaltic material shall meet the requirements of Item 300, "Asphalt Oils and Emulsions" contained in the Texas Highway Department; "Standard Specifications for Construction of Highways, Streets and Bridges," Latest Edition. The quantity and type of asphalt approved for use by the Engineer shall be sufficient to completely cover and seal the total surface of the base and fill all voids. If the Contractor elects to use this method, it shall be his responsibility to protect the asphalt membrane from being picked up by the traffic. The asphalt membrane may remain in-place when the proposed surface or base courses are placed. The surface or other base courses may be applied on the finished base as soon after completion as operations will permit.

222.6 Construction Joints. At the end of each day's construction a straight transverse construction joint shall be formed by cutting back into the total width of completed work to form a true two-inch depth vertical face free of loose and shattered material.

Cement treatment for large wide areas shall be built in a series of parallel lanes of convenient length and width meeting the approval of the Engineer.

222.7 Traffic. After the 3 day curing period, or as directed by the Engineer, completed sections of cement treated material in-place, may be opened immediately to local traffic and to construction equipment and to all traffic after the curing period, provided the cement treated course has hardened sufficiently to prevent marring or distorting the surface by equipment or traffic.

222.8 Maintenance. The Contractor shall be required, within the limits of his contract, to maintain the cement treated course in good condition until all work has been completed and accepted. Maintenance shall include immediate repairs to any defects that may occur. This work shall be done by the Contractor at his own expense and repeated as often as may be necessary to keep the area continuously intact. Faulty work shall be replaced for the full depth at treatment. It is the intent of this specification that the Contractor construct the plan depth of cement treatment in one homogenous mass. The addition of thin stabilized layers will not be permitted in order to provide the minimum specified depth.

222.9 Quality Assurance. The Testing Laboratory's representative will determine the Moisture-Density Relationships in accordance with ASTM Method D698 on material secured from the roadway. Samples will be blended with Portland cement for each type of material encountered.

The Testing Laboratory' representative will determine the in-place density in accordance with ASTM Methods D2922 or D1556. The minimum level of testing will consist of at least three tests for each 1,000 feet per lane of roadway or 4,000 square feet (500 square yards) of embankment.

222.10 Measurement. The work performed and the material furnished as prescribed by this item will be measured as follows:

A. Manipulation of cement during stabilization of the subgrade will be measured by the square yard of surface area of the completed and accepted work in-place.

B. Portland cement will be measured by the ton of 2,000 pounds.

222.11 Payment. The work performed and material furnished as prescribed by this item and measured in accordance with the method indicated in the proposal and in accordance with the applicable provisions of measurement above, will be paid for as follows:

- A. "Manipulation of Cement for Stabilized Subgrade" shall be paid for at the contract unit price per **square yard**. The unit price bids shall each be full compensation for preparing the subgrade, for furnishing all material, for all freight involved, for weighing the material, for pulverizing, applying cement, water, asphalt membrane, all processing, mixing, spreading, sprinkling, compacting, finishing and curing cement treated soil; and for all manipulations, labor, equipment, fuel, tools, and all incidentals necessary to complete the work.
- B. Cement used in stabilized subgrade shall be paid for at the contract unit price per **ton** for "Cement for Subgrade Stabilization".

END OF ITEM 222