

ITEM 231

CEMENT STABILIZED CRUSHED AGGREGATE BASE COURSE

231.1 Description. This item shall consist of a foundation for surface course or for other base courses and shall be composed of a mixture of crushed aggregate, Portland cement and water and shall be constructed as herein specified and in conformity with the typical cross sections shown on the plans and to the lines and grades established by the Engineer.

231.2 Materials. Cement shall be Type I of a standard brand of Portland cement and shall conform to the requirements of ASTM Designation C150. Bulk cement or sack cement may be used.

Water shall meet the requirements for water of ASTM Specification C94.

The aggregate shall consist of durable particles of crushed aggregate, mixed with approved binding material. The crushed material shall have a minimum compressive strength of 45 psi at 0 psi lateral pressure and 175 psi at 15 psi lateral pressure using triaxial testing procedures.

The crushed aggregate shall meet the following gradation when tested in accordance with ASTM Method C136.

Retained on Sieve Conforming to ASTM E11	Percent Retained, By Weight
1-3/4"	0
7/8"	10 - 35
3/8"	30 - 50
No. 4	45 - 65
No. 40	70 - 85

The material passing the No. 40 sieve shall meet the following requirements, when tested in accordance with ASTM Method D4318.

The liquid limit shall not exceed 35.

The plasticity index shall not exceed 10.

All material retained on the No. 40 sieve shall have a Los Angeles Abrasion percent of wear not exceeding 40 when tested in accordance with ASTM Method C131.

With prior permission of the Engineer, additives may be used to meet the above requirements.

Where materials are specified to be measured or proportioned by weight, equipment shall conform to the requirements of the Item, "Weighing and Measuring Equipment". Equipment necessary for proper prosecution of the

work shall be on the project and approved by the Engineer prior to the beginning of construction operations. All equipment used shall be maintained in a satisfactory working condition. The Contractor shall employ adequate methods in performing the work and shall conduct his operations in a satisfactory and workmanlike manner.

The mix shall be designed with the intention of producing a minimum average compressive strength of 650 psi at seven days, using unconfined compression testing procedures. Cement stabilized specimens shall be prepared, cured and tested as outlined in Test Method Tex-120-E. The cement content shall be a minimum of 1-1/2 sacks per ton of mix, as laid.

231.3 Construction Methods. The crushed aggregate and cement shall be dry-mixed in a pug mill of either the batch or continuous flow type. The plant shall be equipped with feeding and metering devices which will add the crushed aggregate, cement and water into the mixer in the specified quantities. The crushed aggregate, and cement shall be mixed sufficiently to prevent cement balls from forming when water is added. Mixing shall continue until a uniform and intimate mixture of crushed aggregate cement and water is obtained.

The cement stabilized base shall be placed in uniform layers on the prepared subgrade to produce the depth specified on the plans. The depth of layers shall be as approved by the Engineer. To insure homogeneous distribution of the base material in each layer, the material shall be placed using an approved spreader. The spreading operations shall be done in such a manner as to eliminate nests or pockets of material on non-uniform gradation resulting from segregation in the hauling or dumping operations and in such a manner as to eliminate planes of weakness. Construction joints between new cement stabilized base and cement stabilized base that has been in place four hours or longer shall be approximately vertical. The plane of the joint may be formed by a header which shall be removed immediately prior to placing the subsequent base or the base placed first may be cut to an approximately vertical edge immediately prior to placing the new base.

Only one longitudinal joint will be permitted where cement stabilized base is placed underneath main lanes and shoulders unless otherwise permitted by the Engineer. This joint shall normally be placed at the centerline of the roadway. Longitudinal joints will not be permitted underneath frontage roads and ramps unless otherwise permitted by the Engineer.

Cement stabilized base shall not be placed when the air temperature is below 40 F. and is falling, but may be 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 stabilized base shall be mixed or placed only when weather conditions, in the opinion of the Engineer, are suitable for such work.

Not more than 60 minutes shall lapse between the start of moist mixing and the start of compaction of the mixture. The layer of Portland cement mixture shall be uniform in thickness and surface contour and in such quantity that the completed base will conform to the required grade, cross section and governing specifications. Dumping of the mixture in piles or windrows upon the subgrade will not be permitted.

The material shall be compacted to not less than 95-percent of Modified Proctor density (ASTM Method D1557) at optimum moisture content. At the start of compaction the percentage of moisture in the mixture, based on oven-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 Portland cement treatment mixture to become unstable during compaction and finishing. When the uncompacted 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.

Prior to the beginning of compaction, the mixture shall be in loose condition for its full depth. The loose mixture shall then be uniformly compacted to the specified density within 2-hours.

After the mixture is compacted, water shall be uniformly applied as needed and thoroughly mixed in with a spike tooth harrow or equal. 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.

The surface shall then be compacted with the pneumatic tire roller, adding small increments of moisture as needed during rolling. One complete coverage of the section with the flat wheel roller shall be made immediately after the clipping 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 two hours, a smooth closely knit surface, free of cracks, ridges or loose material conforming to the crown, grade and line shown on the plans.

After the Portland cement treatment for the base has been finished as specified herein, the surface shall be protected against rapid drying by either of the following curing methods for a period of not less than 3-days, or until the surface or an additional base course is applied:

- A. Maintain a thorough and continuously moist condition by sprinkling.
- B. Apply an asphalt membrane on the course, immediately after the surface is completed. The material for the asphalt membrane shall be MC-30. The amount of asphaltic material shall be sufficient to completely cover and seal the total surface and fill all the voids. The asphalt shall meet the requirements of Item 300, "Asphalts, Oils and Emulsions of the Texas Department of Transportation", "Standard Specifications For Construction of Highways, Streets and Bridges".

The cement stabilized base shall be kept free from traffic for a period of 72-hours after completion of compaction.

The Contractor will be required within the limits of his contract to maintain the cement stabilized base in good condition until all work has been completed or accepted. Maintenance shall include immediate repair of any defects that may occur. This work shall be done by the Contractor at his entire expense and shall be repeated as often as may be necessary to keep the area continuously intact. Repairs to cement stabilized base shall be effected by replacing the base for its full depth, rather than by adding a thin layer of cement stabilized material to the layer of base in need of repair.

- 231.4 Quality Assurance. The Testing Laboratory's representative will determine the Moisture-Density Relationship in accordance with ASTM Method D1557 on material secured from the source of supply, or the Contractor.

The Testing Laboratory's representative will mold three samples, each day, or for each 1,000 tons of production for unconfined compressive strength in accordance with Test Method Tex-120-E. The compressive strength for that lot of production is the average of the three samples. If the average compressive strength is less than the specified compressive strength, the cement content will be increased to the extent necessary to yield the desired strength.

The Testing Laboratory representative will determine the in-place density 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.

- 231.5 Acceptance Requirements. The acceptance requirements for this item shall be the same as outlined in Item 230.5, of "Crushed Aggregate Base Course".

- 231.6 Measurement. "Cement Stabilized Crushed Aggregate Base", will be measured by the square yard of material, furnished and compacted in place and to the thickness specified, or as shown on the plans.

231.7 Payment. The work performed and the material furnished as prescribed by this item and measured in accordance with the method outlined above, will be paid for at the unit price bid for "Cement Stabilized Crushed Aggregate Base" of the depth specified, or as shown on the plans.

The unit price bid will be full compensation for securing and furnishing all materials; including all royalty and freight involved; for all processing, crushing and loading; for all hauling, delivery, placing, spreading, blading, mixing, stripping, dragging, finishing, curing, asphalt membrane, and maintaining; for all fine grading; for wetting and compaction and all manipulation, labor, tools and incidentals necessary to complete the work. If necessary, adjustments will be made in the payment for this item, as outlined in Section 230.5 of the specifications.

END OF ITEM 231