

Item 276

Cement Treatment (Plant-Mixed)



1. DESCRIPTION

Construct a base course composed of flexible base, hydraulic cement, and water, mixed in an approved plant.

2. MATERIALS

Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of proposed sources of materials and of changes in material sources. The Engineer will verify that the specification requirements are met before the sources can be used. The Engineer may sample and test project materials at any time before compaction. Use Tex-100-E for material definitions.

- 2.1. **Cement.** Furnish hydraulic cement that meets the requirements of DMS-4600, "Hydraulic Cement," and the Department's *Hydraulic Cement Quality Monitoring Program* (HCQMP). Sources not on the HCQMP will require testing and approval before use.
- 2.2. **Flexible Base.** Furnish base material that meets the requirements of Item 247, "Flexible Base," for the type and grade shown on the plans, before the addition of cement.
- 2.3. **Water.** Furnish water that is free of industrial waste and other objectionable material.
- 2.4. **Asphalt.** Furnish asphalt or emulsion that meets the requirements of Item 300, "Asphalts, Oils, and Emulsions," when permitted for curing purposes as shown on the plans or as directed.
- 2.5. **Mix Design.** Using the materials proposed for the project, the Engineer will determine the target cement content and optimum moisture content necessary to produce a stabilized mixture meeting the strength requirements shown in Table 1 for the class specified on the plans. The mix will be designed in accordance with Tex-120-E. The Contractor may propose a mix design developed in accordance with Tex-120-E. The Engineer will use Tex-120-E to verify the Contractor's proposed mix design before acceptance. The Engineer may use project materials sampled from the plant or the quarry, and sampled by the Engineer or the Contractor, as determined by the Engineer. Limit the amount of asphalt concrete pavement to no more than 50% of the mix unless otherwise shown on the plans or directed.

Table 1
Strength Requirements

Class	7-Day Unconfined Compressive Strength, Min psi
L	500
M	300
N	As shown on the plans

3. EQUIPMENT

Provide machinery, tools, and equipment necessary for proper execution of the work. Provide rollers in accordance with Item 210, "Rolling." Provide proof rollers in accordance with Item 216, "Proof Rolling," when required.

- 3.1. **Cement Storage Facility.** Store cement in closed, weatherproof containers.

- 3.2. **Mixing Plant.** Provide a stationary pugmill, weigh-batch, or continuous mixing plant as approved. Equip plants with automatic proportioning and metering devices that produce a uniform mixture of base material, cement, and water in the specified proportions.
- 3.3. **Spreader Equipment.** Provide equipment that will spread the cement-treated mixture in a uniform layer in 1 pass when shown on the plans. Equip spreaders with electronic grade controls when shown on the plans.

4. CONSTRUCTION

Construct each layer uniformly, free of loose or segregated areas and with the required density and moisture content. Provide a smooth surface that conforms to the typical sections, lines, and grades shown on the plans or established by the Engineer. Start placement operations only when the air temperature is at least 35°F and rising or is at least 40°F. The temperature will be taken in the shade and away from artificial heat. Suspend operations when the Engineer determines that weather conditions are unsuitable.

- 4.1. **Mixing.** Thoroughly mix materials in the proportions designated on the mix design, in a mixing plant that meets the requirements of Section 276.3.2., "Mixing Plant." Mix at optimum moisture content, unless otherwise directed, until a homogeneous mixture is obtained. Do not add water to the mixture after mixing is completed unless directed. The Engineer may sample the mixture to verify strength in accordance with Tex-120-E and adjust cement content to achieve the target strength for work going forward.

- 4.2. **Placing.** Place the cement-treated base on a subgrade or base prepared in accordance with details shown on the plans. Bring the prepared roadway to the moisture content directed. Haul cement-treated base to the roadway in clean trucks and begin placement immediately. Place cement-treated base only on an area where compacting and finishing can be completed during the same working day. Spread and shape in a uniform layer with an approved spreader. Construct individual layers to the thickness shown on the plans. Maintain the shape of the course by blading. Correct or replace segregated areas as directed, at no additional expense to the Department.

Construct vertical joints between new cement-treated base and cement-treated base that has been in place 4 hr. or longer. The vertical face may be created by using a header or by cutting back the face to approximately vertical. Place successive base courses using the same methods as the first course. Offset construction joints by at least 6 in.

- 4.3. **Compaction.** Compact each layer immediately after placing. Complete compaction within 2 hr. after plant-mixing water with dry material. Complete compaction of the final lift within 5 hr. after adding water to the treated base used in the first lift when multiple lifts are permitted.

Moisture content in the mixture at the plant may be adjusted so that during compaction it is within 2.0 percentage points of optimum as determined by Tex-120-E. Measure the moisture content of the material in accordance with Tex-115-E or Tex-103-E during compaction daily and report the results the same, unless otherwise shown on the plans or directed. Maintain uniform moisture content by sprinkling the treated material in accordance with Item 204, "Sprinkling."

Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least 1/2 the width of the roller unit. Begin rolling at the low side and progress toward the high side on superelevated curves. Offset alternate trips of the roller. Operate rollers at a speed between 2 and 6 mph, as directed.

Achieve at least 95% of maximum density determined in accordance with Tex-120-E when compaction is complete. The Engineer will determine roadway density and moisture content in accordance with Tex-115-E. Remove material that does not meet density requirements. Remove areas that lose required stability, compaction, or finish. Replace with cement-treated mixture, compact, and test in accordance with density control methods.

The Engineer may accept the section if no more than 1 of the 5 most recent density tests is below the specified density and the failing test is no more than 3 pcf below the specified density.

- 4.4. **Finishing.** Clip, skin, or tight blade the surface of the cement-treated material with a maintainer or subgrade trimmer to a depth of approximately 1/4 in. immediately after completing compaction. Remove loosened material and dispose of at an approved location. Roll the clipped surface immediately with a pneumatic tire roller until a smooth surface is attained. Add small increments of water as needed during rolling. Shape and maintain the course and surface in conformity with the typical sections, lines, and grades shown on the plans or as directed.
- Trim grade deviations greater than 1/4 in. in 16 ft. measured longitudinally or greater than 1/4 in. over the entire width of the cross-section in areas where surfacing is to be placed. Remove excess material, reshape, and then roll with a pneumatic tire roller. Correct as directed if material is more than 1/4 in. low. Do not surface patch.
- 4.5. **Microcracking.** Maintain moisture content of the finished cement-treated base for a period of 24 to 48 hr. when shown on the plans. Roll the finished course with a vibratory roller to induce microcracking during this time, but not sooner than 24 hours. The vibratory roller must be in accordance with Item 210, "Rolling," with a static weight equal to or more than 12 tons and the vibratory drum must be not less than 20 in. wide. The roller must travel at a speed of 2 mph, vibrating at maximum amplitude, and make 2 to 4 passes with 100% coverage exclusive of the outside 1 ft. of the surface crown, unless otherwise directed by the Engineer. Additional passes may be required to achieve the desired crack pattern as directed. Notify the Engineer 24 hr. before the microcracking begins.
- 4.6. **Curing.** Cure for at least 3 days by sprinkling in accordance with Item 204, "Sprinkling," or by applying an asphalt material at the rate of 0.05 to 0.20 gal. per square yard, as shown on the plans or directed. When a section is microcracked, cure section for an additional 2 days after microcracking. Maintain the moisture content during curing at no lower than 2 percentage points below optimum. Continue curing until placing another course.

5. MEASUREMENT

Cement-treated base will be measured by the ton, cubic yard, or square yard as a composite mixture of cement, flexible base, and recycled materials.

Measurement by the cubic yard in final position and square yard is a plans quantity measurement. The quantity to be paid for is the quantity shown in the proposal unless modified by Article 9.2., "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

Measurement is further defined for payment as follows:

- 5.1. **Cubic Yard in Vehicles.** Cement-treated base will be measured by the cubic yard in vehicles as delivered on the road.
- 5.2. **Cubic Yard in Final Position.** Cement-treated base will be measured by the cubic yard in its completed and accepted final position. The volume of each course will be computed in-place between the original subgrade surfaces and the lines, grades, and slopes of the accepted base course as shown on the plans, and calculated by the method of average end areas.
- 5.3. **Square Yard.** Cement-treated base will be measured by the square yard of surface area. The dimensions for determining the surface area are established by the dimensions shown on the plans.
- 5.4. **Ton.** Cement-treated base will be measured by the ton (dry weight) in vehicles as delivered on the road. The dry weight is determined by deducting the weight of the moisture in the material at the time of weighing from

the gross weight of the material. The Engineer will determine the moisture content in the material in accordance with Tex-103-E from samples taken at the time of weighing.

When material is measured in trucks, the weight of the material will be determined on certified scales, or the Contractor must provide a set of standard platform truck scales at an approved location. Scales must conform to the requirements of Item 520, "Weighing and Measuring Equipment."

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Cement Treatment (Plant-Mix)" of the class (strength), flexible base type, grade, and thickness (for square yard measurement) specified. For cubic yard measurement, "In Vehicle" or "In Final Position" will be specified. This price is full compensation for furnishing and disposing of materials (including cement and base); storing, mixing, hauling, placing, sprinkling, compacting, microcracking, finishing, curing, and maintaining and reworking treated base; and equipment, labor, tools, and incidentals.

Sprinkling and rolling, except proof rolling, will not be paid for directly but will be subsidiary to this Item, unless otherwise shown on the plans. When proof rolling is shown on the plans or directed by the Engineer, it will be paid for in accordance with Item 216, "Proof Rolling."

Where subgrade or base courses are constructed under this Contract, correction of soft spots will be at the Contractor's expense. Where subgrade or base is not constructed under this Contract, correction of soft spots will be paid for in accordance with pertinent Items and Article 4.4., "Changes in the Work."

Asphalt used solely for curing will not be paid for directly but will be subsidiary to this Item. Asphalt placed for curing and priming will be paid for under Item 310, "Prime Coat."

Removal and disposal of existing asphalt concrete pavement will be paid for in accordance with pertinent Items or Article 4.4., "Changes in the Work."

6.1. Thickness Measurement for Cubic Yard In Final Position and Square Yard Payment Adjustment.

Before final acceptance, the Engineer will select the locations of tests within each unit and measure the treated base depths in accordance with Tex-140-E.

6.1.1. Units for Payment Adjustment.

6.1.1.1. **Roadways and Shoulders.** Units for applying a payment adjustment for thickness to roadways and shoulders are defined as 1,000 ft. of treated base in each placement width. The last unit in each placement width will be 1,000 ft. plus the fractional part of 1,000 ft. remaining. Placement width is the width between longitudinal construction joints. For widening, the placement width is the average width placed of the widened section that is deficient in thickness.

6.1.1.2. **Ramps and Other Areas.** Units are defined as 2,000 sq. yd. or fraction thereof for establishing an adjusted unit price for ramps, intersections, irregular sections, crossovers, entrances, partially completed units, transitions to ramps, and other areas designated by the Engineer.

6.1.2. Price Adjustments of Deficient Areas.

6.1.2.1. **Thickness Deficiency ≤ 1.0 in.** Table 2 will govern the price adjustment for each unit with deficient areas ≤ 1.0 in.

Table 2
Measurements and Price Adjustment for Each Unit

Thickness Deficiency	Additional Measurements	Average Thickness Deficiency of 3 Measurements		Price Adjustment
≤ 0.5 in.	None	N/A		Full Payment
> 0.5 in.	2	≤ 0.5 in.		Full Payment
		> 0.5 in.	≤ 0.8 in.	75% Payment
		> 0.8 in.	≤ 1.0 in.	50% Payment
		> 1.0 in.		In accordance with Section 276.6.1.2.2., "Thickness Deficiency ≥ 1.0 in."

6.1.2.2. **Thickness Deficiency ≥ 1.0 in.** Remove and replace areas of treated base found deficient in thickness by more than 1.0 in., unless otherwise approved. Take exploratory measurements at 50-ft. intervals parallel to the centerline in each direction from the deficient measurement until a measurement is not deficient by more than 1.0 in. The minimum limit of non-pay will be 100 ft.

6.2. **Excess Thickness and Width.** For cubic yard in final position and square yard measurement, no additional payment will be made for thickness or width exceeding that shown on the plans.