

Subsection 4.06 Cement Treatment (Road-Mixed)

I. Scope: Mix and compact cement, water, and subgrade or base (with or without asphalt concrete pavement) in the roadway.

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

A. Cement: Furnish hydraulic cement that meets the requirements of DMS-4600, "Hydraulic Cement," and TxDOT's Hydraulic Cement Quality Monitoring Program (HCQMP). Sources not on the HCQMP will require the contractor testing and approval by ODR before use.

B. Flexible Base: Furnish base material that meets the requirements of Subsection 4.05, "Flexible Base," for the type and grade shown on the plans, before the addition of cement.

C. Water: Water usage shall conform to Subsection 3.04 "Requirements for Water Usage."

D. Asphalt: When permitted for curing purposes, furnish asphalt or emulsion that meets the requirements of Subsection 4.23, "Asphalts, Oils, and Emulsions."

E. Mix Design: The contractor will submit a proctor for approval to determine the target cement content and optimum moisture content to produce a stabilized mixture that meets the design strength requirements. The mix will be designed in accordance with Tex-120-E or will be based on prior experience with the project materials. The Contractor may propose a mix design developed in accordance with Tex-120-E. The ODR or Engineer may use Tex-120-E to verify the Contractor's proposed mix design before acceptance. Submit additional mix designs or partial designs necessitated by changes in the material or requests by the Contractor. When treating existing materials, limit the amount of asphalt concrete pavement to no more than 50% of the mix.

III. Equipment: Provide machinery, tools, and equipment necessary for proper execution of the work. Provide rollers in accordance with Subsection 4.27, "Rolling."

A. Cement Storage Facility: Store cement in closed, weatherproof containers.

B. Cement Slurry Equipment. Use slurry tanks equipped with agitation devices to slurry cement on the project or other approved location. The ODR or Engineer may approve other slurring methods. Provide a pump for agitating the slurry when the distributor truck is not equipped with an agitator. Equip the distributor truck with an approved sampling device.

C. Dry Cement Distribution Equipment: Provide equipment to spread cement evenly across the area to be treated. Provide equipment with a rotary vane feeder when shown on the plans.

D. Pulverization Equipment: Provide pulverization equipment that:

1. Cuts and pulverizes material uniformly to the proper depth with cutters that will plane to a uniform surface over the entire width of the cut,
2. Provides a visible indication of the depth of cut at all times, and
3. Uniformly mixes the materials.

IV. 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.

A. Preparation of Subgrade or Existing Base for Treatment: Before treating, remove existing asphalt concrete pavement in accordance with pertinent Subsections and the plans or as directed. Shape existing material in accordance with applicable bid items to conform to the typical sections shown on the plans and as directed. Correct soft spots as directed. For borrow sources, provide proctor before beginning hauling operations. When new base is required to be mixed with existing base, deliver, place, and spread the new material in the required amount per station. Manipulate and thoroughly mix new base with existing material to provide a uniform mixture to the specified depth before shaping.

B. Pulverization: Pulverize or scarify existing material after shaping so that 100% passes a 2-1/2-inch sieve. If the material cannot be uniformly processed to the required depth in a single pass, excavate and windrow the material to expose a secondary grade to achieve processing to plan depth.

C. Application of Cement: Uniformly apply cement using dry placement. Add cement at the percentage determined in Section 4.06.II.5, "Mix Design." Apply cement only on an area where mixing, compacting, and finishing can be completed during the same working day. Start cement application 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 application when the ODR or Engineer determines that weather conditions are unsuitable. Before applying cement, bring the prepared roadway to approximately optimum moisture content. When necessary, sprinkle in accordance with Subsection 4.27, "Sprinkling." Distribute the required quantity of dry cement with approved equipment. Minimize dust and scattering of cement by wind. Do not apply cement when wind conditions, in the opinion of the ODR or Engineer, cause blowing cement to become dangerous to traffic or objectionable to adjacent property owners.

D. Mixing: Thoroughly mix the material and cement until a homogeneous mixture is obtained. Sprinkle the treated materials during the mixing operation to maintain optimum mixing moisture. Spread and shape the completed mixture in a uniform layer. After mixing, the ODR or Engineer may sample the mixture at roadway moisture and test in accordance with Tex-101-E, Part III to determine compliance with the gradation requirements in Table 1. The contractor will sample the mixture to verify the design strength is met in accordance with Tex-120-E and adjust cement content to achieve the target strength for work going forward.

Table 1
Gradation Requirements Minimum % Passing

Sieve Size	Base	Subgrade
1-3/4 inch	100	100
3/4 inch	85	85
No. 4	-	60

a) Compaction: Compact the mixture in one lift using density control. Complete compaction within 2 hours after the application of water to the mixture of material and cement. Sprinkle or aerate the treated material in accordance with Subsection 4.32, "Sprinkling," to adjust the moisture content during compaction so that 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 day to the ODR. Adjust operations as required. Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least one-half the width of the roller unit. On superelevated curves, begin rolling at the low side and

progress toward the high side. Offset alternate trips of the roller. Operate rollers at a speed between 2 and 6 MPH, as directed. Before completion the ODR will select locations of tests in each application area to be tested by the contractor for depth in accordance with Tex-140-E. Correct areas deficient by more than 1/2 inch in thickness or more than 1/2% in target cement content as required, reshaping, recompacting, and refinishing at the Contractor's expense. Remove or rework areas that lose required stability, compaction, or finish. When a section is reworked more than 4 hours after completion of compaction, add additional cement. Provide additional work and material at the Contractor's expense.

- (1) **Ordinary Compaction:** Correct irregularities, depressions, and weak spots immediately by scarifying the areas affected, adding or removing treated material as required, reshaping, and recompacting.
- (2) **Density Control:** Compact to at least 95% of the maximum density of the proctor of the subgrade. Compact to at least 100% of the maximum density of the proctor on base courses the Contractor will determine roadway density in accordance with Test Method Tex-115-E and will verify strength in accordance with Tex-120-E and adjust cement content to achieve the target strength for work going forward. Remove material that does not meet density requirements or rework by adding the target cement content, reshaping, recompacting and refinishing at the Contractor's expense. The ODR may accept the section if no more 1 of the 5 most recent density tests is below the specified density and the failing test is no more than 3 pounds per cubic foot below the specified density.

b) Finishing: Immediately after completing compaction, 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 inch. Remove loosened material and dispose of it 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. Finish grade of constructed subgrade to within 0.1 foot in the cross section and 0.1 foot in 16 feet measured longitudinally. Correct grade deviations of constructed base greater than 1/4 inch in 16 feet measured longitudinally or greater than 1/4 inch over the entire width of the cross-section in areas where surfacing is to be placed. Remove excess material, reshape and roll with a pneumatic-tire roller. Correct if material is more than 1/4 inch low. Do not surface patch.

c) Microcracking: When shown on the plans, maintain moisture content of the finished cement treated base for a period of 24 to 48 hours. During this time, but not sooner than 24 hours, roll the finished course with a vibratory roller to induce microcracking. The vibratory roller must be in accordance with Subsection 4.27 "Rolling," with a static weight equal to or more than 12 tons and the vibratory drum must be not less than 20 inches wide. The roller must travel at a speed of 12 miles per hour, vibrating at maximum amplitude, and make 2 to 4 passes with 100% coverage exclusive of the outside 1 foot of the surface crown, unless otherwise directed by the ODR. Additional passes may be required to achieve the desired crack pattern as directed. Notify the ODR 24 hours before the microcracking begins.

d) Curing: Cure for at least 3 days by sprinkling in accordance with Subsection 4.32, "Sprinkling," or by applying an asphalt material shown in Subsection 4.23 "Asphalts, Oils, and Emulsions" at the rate of 0.05 to 0.20 gallons per square yard. Maintain the moisture content during curing at no lower than 2 percentage points below optimum. Continue curing until placing another course or opening the finished section to traffic.

V. Measurement

A. Cement: Cement will be measured by the ton (dry weight). When cement is furnished in trucks, the weight of cement will be determined on certified scales, or the Contractor must provide a set of standard platform truck scales at a location approved by the ODR. Scales must conform to the requirements of Subsection 4.26, "Weighing and Measuring Equipment." When cement is furnished in bags, indicate the manufacturer's certified weight. Bags varying more than 5% from that weight may be rejected. The average weight of bags in any shipment, as determined by weighing 10 bags taken at random, must be at least the manufacturer's certified weight.

B. Cement Treatment: Cement treatment will be measured by the square yard of surface area. The dimensions for determining the surface areas are established by the widths shown on the plans and lengths measured at placement.

VI. Payment: The work performed and materials furnished in accordance with this Subsection and measured as provided under "Measurement" will be paid in accordance with Section 4.06.V.a, "Cement," or Section 4.06.V.b, "Cement Treatment." Furnishing and delivering new base will be paid for in accordance with Subsection 4.05 "Flexible Base." Mixing, spreading, blading, shaping, compacting, and finishing new or existing base

material will be paid for under Section 4.06.V.a, "Cement Treatment." Removal and disposal of existing asphalt concrete pavement will be paid for in accordance with pertinent Subsections. Sprinkling and rolling, except proof-rolling, will not be paid for directly but will be subsidiary to this Subsection, unless otherwise shown on the plans. Microcracking, when shown, will not be measured, but will be subsidiary to the subsection. Correction of soft spots in the subgrade or existing base will be at the Contractor's expense. Asphalt used for curing will not be paid for directly, but will be subsidiary to this Item.

a) Cement: Cement will be paid for at the unit price bid for "Cement." This price is full compensation for materials, delivery, equipment, labor, tools, and incidentals.

b) Cement Treatment. Cement treatment will be paid for at the unit price bid for "Cement Treatment (Existing Material)," "Cement Treatment (New Base)," or "Cement Treatment (Mixing Existing Material and New Base)," for the depth specified. No additional payment will be made for thickness or width exceeding that shown on the plans. This price is full compensation for shaping existing material, loosening, mixing, pulverizing, providing cement, spreading, applying cement, compacting, finishing, curing, curing materials, blading, shaping and maintaining shape, replacing mixture, disposing of loosened materials, processing, hauling, preparing secondary subgrade, water, equipment, labor, tools, and incidentals.

LAST PAGE OF SECTION