SPECIAL SPECIFICATION

XXXX

Cementitious Slurry (Plant Mix)

1. **Description.** Pneumatically mix of cementitious materials with water for modification and stabilization of subgrade soils, sub-bases, and bases.

2. **Definitions.** The terms used throughout the specification are defined as follows:

   - Cementitious – Bonding particles together by a cementing affect.
   - Soil-cement - Uniform mixture of a cementitious slurry and in-situ soils.

3. **Materials.** Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and/or specifications. Notify the Engineer of the proposed material sources and of changes to material sources. The Engineer will verify that the specifications are met before the sources can be used. The Engineer may sample and test project materials at any time before placement.

   A. Cement. Furnish cement conforming to DMS-4600, "Hydraulic Cement." store cement to prevent moisture damage. Do not use material which has become caked due to moisture absorption. Do not use cement containing lumps or foreign matter of a nature and in amounts that may be deleterious to the mixing operations.

   B. Supplementary Cementitious Materials (SCMs)

   A. Fly Ash. Furnish fly ash conforming to DMS-4610, "Fly Ash".
   B. Ultra-Fine Fly Ash (UFFA). Furnish UFFA conforming to DMS-4610, "Fly Ash".
   C. Ground Granulated Blast-Furnace Slag (GGBFS). Furnish GGBFS conforming to DMS-4620, "Ground Granulated Blast-Furnace Slag", Grade 100 or 120.
   D. Silica Fume. Furnish silica fume conforming to DMS-4630, "Silica Fume".
   E. Metakaolin. Furnish metakaolin conforming to DMS-4635, "Metakaolin".
   F. Alkali By-pass Dust (ABD). Furnish Alkali By-pass Dust conforming to DMS-46XX, "Alkali By-pass Dust".

   C. Additives. Proprietary blend consist of approximately 0.06 % of total batched weight.

   D. Water. Furnish water free of industrial wastes and other objectionable matter.

4. **Equipment.** Provide a mixing plant, tools, and equipment necessary for proper mixing and delivery of slurry.

   A. Storage Facility. Store all components, except water, in weatherproof containers.

   B. Slurry Plant. Provide a pneumatic/hydraulic mixing plant with monitoring devices to regulate flow rates and line pressures. Regulate slurry proportions by calibrated scales. Include all storage silos, weather protection, sheds, scales, pumps, mixers, valves, gauges and regulating devices required to continuously measure and mix cementitious slurry at the batch plant. The plant should provide safe and easy access for the QC personnel so they may obtain samples. All mechanical mixing must be pump driven and can not rely on lime slaking tanks, paddle driven mixers or other similar technology.

   C. Delivery equipment. Deliver slurry to the project site in a non-baffle tank. Do not stir or agitate with any form of mechanical device.

   D. Tickets. To be generated through the function of the calibrated plant scales. Tickets should document the amount of cementitious product in a dry ton mass.

5. **Slurry Physical Requirements**

   A. Physical Requirements. Slurry should meet the following requirements:

Table 1

Lab Tests

Mix Property	Test Procedure	Requirement %, Min.
Percent solids	TEX-103-E, Part I	55
Viscosity *	Tex-130-E, Part IV	Min. of 1 minute

* Note: Perform test 30 minutes after batching with a minimum of 60 second flow rate

All rejected loads must be verified by a second round of testing within 30 minutes after the failed test.

6. **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 as directed.

   A. **Preparation of Subgrade or Existing Base for Treatment.** Before treating, pulverize, mill or remove existing pavement in accordance with pertinent bid items or plans as directed. Shape existing material to conform to the typical sections shown on the plans or as directed. When shown on the plans or directed, proof roll the roadbed in accordance with Item 216, "Proof Rolling," before pulverizing or scarifying existing material. Correct soft spots as directed. 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.** After shaping, pulverize or scarify existing material so that 100% passes a 2-1/2-in. sieve. If the material cannot be uniformly processed to the required depth in a single pass, windrow and excavate the material to expose a secondary grade to achieve plan depth.

   C. **Application of Cementitious Slurry.** Uniformly apply cementitious material using slurry placement. The Engineer will determine the percent content to produce a stabilized mixture that meets the requirements shown on the plans. The percentage will be based on laboratory results or prior experience with the project materials. The Engineer will use the tests shown in Tables 1 and 2 for acceptance of the mixture.

      1. Determine the placement rate in a percentage converted into a coverage area of dry pounds per square yard.
      2. Complete all mixing and compaction operations within 2 hours after the initial mixing of slurry to the soil.

      Apply cementitious material only on an area where mixing, compacting, and finishing can be completed during the same working day. Start application only when the air temperature is at least 35°F and rising. The temperature will be taken in the shade and away from any artificial heat. Suspend application when the Engineer determines that weather conditions are unsuitable.

1. **Slurry Placement.** Mix cementitious material with water, as approved. Provide slurry free of objectionable materials and with a uniform consistency that can be easily applied. Slurry should be placed on material that is at optimum moisture or slightly higher. Distribute slurry uniformly by making successive passes over a measured section of the roadway until the specified content is reached.

D. Mixing. Thoroughly mix the material and slurry using approved equipment. Mix until a homogeneous mixture is obtained. Sprinkle the treated materials during the mixing operation, as directed, to maintain optimum mixing moisture. Spread and shape the completed mixture in a uniform layer. After mixing, the Engineer will 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.

Table 1
Gradation Requirements Minimum % Passing

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

D. Compaction. Compact the mixture in one lift using density control unless otherwise shown on the plans. Complete compaction within 4 hours after thoroughly mixing of cementitious material into the soil. Sprinkle or aerate the treated material in accordance with Item 204, "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. Determine the moisture content of the mixture at the beginning and during compaction in accordance with Tex-115-E. 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 super elevated 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. Remove areas that lose required stability, compaction, or finish. Replace with cementitious mixture at the Contractor's expense.

1. Ordinary Compaction. Roll with approved compaction equipment, as directed. Correct irregularities, depressions, and weak spots immediately by scarifying the areas affected, adding or removing treated material as required, reshaping, and re-compacting.

2. Density Control. Compact to at least 95% of the maximum density determined in accordance with Tex-120-E. The Engineer will determine roadway density in accordance with Test Method Tex-115-E. If necessary, remove material that does not meet density requirements. Remove areas that lose required stability, compaction, or finish. Replace with cementitious mixture and 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.

E. Finishing. Immediately after completing compaction, clip, skin, or tight-blade the surface of the cementitious 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 shown on the plans or as directed.

Finish grade of constructed subgrade, subbase or base in accordance with Item 132.3.F.1, "Grade Tolerances." Finish grade of constructed subgrade, subbase or base in accordance with Item, "Finishing." Do not surface patch.

F. Curing. Cure for at least 3 days by sprinkling in accordance with Item 204, "Sprinkling," by maintaining the moisture content no lower than two percentage points below optimum or by applying an asphalt material at the rate of 0.05 to 0.20 gallon per square yard, as shown on the plans or directed by the engineer. Do not allowed equipment on the finished course during curing except as required for sprinkling, unless otherwise approved.

7. **Measurement.** The treated area will be measured by the square yard of surface area at the specified depth shown on the plans or approved by the Engineer. Cementitious slurry will be measured by the dry ton weight of cementitious material used to produce the slurry. The mass of cementitious material shall be determined by calibrated load cells on the mixing plant during the manufacturing of the slurry. This known mass shall be recorded on all delivery tickets to the project. Areas of overlapping will not be measured more than once. Quantities of cementitious materials placed during remixing to achieve the required specification or fell outside the mixing area will not be measured for payment unless approved by the Engineer.

8. **Payment.** The unit prices bid for the cementitious slurry will be fully compensated if all equipment, materials, testing, and labor were furnished as required to correctly install cementitious slurry. The slurry must meet the specified test requirements and placed within the plan area. No separate measurement will be made for additional quantities of cementitious slurry installed to overcome obstructions. Transportation and disposal of soil mix spoil will be subsidiary to this procedure and will not be a separate pay item.