

SPECIFICATION 02700

CEMENT KILN DUST TREATMENT AND STREET RECLAMATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Mix and compact cement kiln dust (CKD), water, and subgrade or base (with or without asphalt concrete pavement) in the roadway

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for Cement Kiln Dust will be paid for by the ton at the unit price bid for "Cement Kiln Dust." This price is full compensation for materials, delivery, equipment, labor, tools, and incidentals
2. Payment for cement kiln dust treatment will be paid for by the cubic-yard at the unit price bid for "Street Reclamation," all depths. 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 kiln dust, spreading, applying cement kiln dust, 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.
3. Payment for furnishing and delivering new base, if required, will be paid for in accordance with "Flexible Base, Supplemental." Mixing, spreading, blading, shaping, compacting, and finishing reclaimed existing asphalt pavement and base material will be paid for under "Street Reclamation."
4. 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 TxDOT Item 216, "Proof Rolling."
5. Where subgrade is constructed under this Contract, correction of soft spots in the subgrade or existing base will be at the Contractor's expense. Where subgrade is not constructed

under this Contract, correction of soft spots in the subgrade or existing base will be in accordance with Item "Flexible Base Supplemental."

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

7. Measurement

- a. Cement Kiln Dust. Cement kiln dust will be measured by the ton (dry weight). When cement kiln dust is furnished in trucks, the weight of cement kiln dust will be determined on certified scales, or the Contractor must provide a set of standard platform truck scales at a location approved by the Engineer. Scales must conform to the requirements of TxDOT Item 520, "Weighing and Measuring Equipment."

- b. When cement kiln dust 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.

- c. Cement kiln dust slurry will be measured by the ton (dry weight) of the cement kiln dust used to prepare the slurry at the job site or from the minimum percent dry solids content of the slurry, multiplied by the weight of the slurry in tons delivered.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.01 REFERENCES

A. TxDOT Item 520, "Weighing and Measuring Equipment."

C. TxDOT Item 216, "Proof Rolling."

D. TxDOT Item 204, "Sprinkling."

E. TxDOT Tex-100-E

F. TxDOT Tex-115-E

G. TxDOT Tex-145-E

H. TxDOT Tex-620-

I. TxDOT Tex-146-E

J. TxDOT Tex-129-E

1.01 SUBMITTALS

A. Certify compliance with TXDOT DMS-11000

B. Provide certification of Cement Kiln Dust production testing data showing compliance with the following requirements:

PART 2 PRODUCTS

2.01 MATERIALS

A. Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Certify compliance with TXDOT DMS-11000, "Evaluating and Using Non-Hazardous Recyclable Materials Guidelines." Notify the Engineer of the proposed material sources and of changes to 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 TxDOT standard laboratory test procedure Tex-100-E for material definitions.

B. Furnish a mixture with a sulfate content less than or equal to 3000 ppm when tested in accordance with Tex-145-E. When reinforced concrete will be in contact with the mixture, furnish a mixture with a chloride content less than or equal to 1000 ppm when tested in accordance with Tex-620-J.

C. When steel elements will be in contact with the mixture, the resistivity will be more than 3000 ohms-cm as determined by Tex-129-E. Material with a resistivity between 1500 and 3000 ohms-cm may be used provided the chloride content does not exceed 100 ppm as determined by Tex-146-E and the sulfate content does not exceed 200 ppm as determined by Tex-145-E.

D. Cement Kiln Dust. Furnish cement kiln dust (CKD) of uniform consistency that meets the requirements contained herein. The supplier must fully comply with all rules and regulations concerning health and safety issues by all appropriate regulating entities. When requested, provide documentation demonstrating compliance with the following table:

Table 1 02700-1

Items tested at least weekly:	
Sulfur Trioxide (SO ₃), maximum, percent, as measured by ASTM C 114	10.0
Equivalent Alkalies (Na ₂ O + 0.658K ₂ O), maximum, percent, as measured by ASTM C 114	10.0
Moisture Content, maximum, percent, as measured by ASTM C 114	3.0
pH, minimum	12.0
Chloride, maximum, percent, as measured by ASTM C 114	5.0
Total Calcium Oxide (CaO), maximum percent variation, from the certified CaO content of sample provided for determination of addition rates during mixture design shall not exceed plus or minus, as measured by ASTM C 114	12.0
Total Free Lime, maximum percent variation, from the certified free lime content of the sample provided during mixture design, as measured by ASTM C 114	30.0
Loss on Ignition (LOI), variation in percentage points of LOI from the certified total LOI of the sample provided during mixture design shall not exceed plus or minus, as measured by ASTM C 114	5.0
Fineness, variation in percentage points retained on the No. 325 (45 µm) sieve from the certified percentage of sample provided for determination of addition rates during mixture design shall not exceed plus or minus, as measured by ASTM C 430	5.0
Items tested semi-annually	
Increase of drying shrinkage of mortar bars at 28 days, maximum, percent, as measured by ASTM C 157	0.03
Include with the certification average test results for the following additional properties: SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , MgO and volatiles	

E. Flexible Base. Furnish base material that meets the requirements of TxDOT Item 247, "Flexible Base," for the type and grade shown on the plans, before the addition of cement kiln dust.

F. Water. Furnish water free of industrial waste and other objectionable material.

- G. Asphalt. When permitted for curing purposes, furnish asphalt or emulsion that meets the requirements of TxDOT Item 300, "Asphalts, Oils, and Emulsions," as shown on the plans or directed.

2.02 MIX DESIGN.

- A. Unless otherwise stated, the Engineer will determine the target cement kiln dust content and optimum moisture content to produce a stabilized mixture that meets the strength requirements shown on the plans. 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 Engineer will use Tex-120-E to verify the Contractor's proposed mix design before acceptance. Reimburse the City for subsequent 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 unless otherwise shown on the plans or directed.

2.03 EQUIPMENT

- A. Provide machinery, tools, and equipment necessary for proper execution of the work. Provide rollers in accordance with TxDOT Item 210, "Rolling." Provide proof rollers in accordance with TxDOT Item 216, "Proof Rolling," when required
- B. Cement Kiln Dust Storage Facility. Store cement kiln dust in closed, weatherproof containers.
- C. Cement Kiln Dust Slurry Equipment. Use slurry tanks equipped with agitation devices to slurry cement kiln dust on the project or other approved location. The Engineer may approve other slurrying 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.
- 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.

PART 3 EXECUTION

1.02 CONSTRUCTION

- A. 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.

3.02 PREPARATION OF SUBGRADE OR EXISTING BASE FOR TREATMENT

- A. Before treating, reclaim existing asphalt concrete pavement and base to the required depth in accordance with pertinent Items and the plans or as directed. As required, excavate, treat, and shape existing subgrade in accordance with applicable bid items to conform to the typical sections shown on the plans or as directed.
- B. When shown on the plans or directed, proof roll the roadbed in accordance with TxDOT Item 216, "Proof Rolling," before replacing reclaimed material. Correct soft spots as directed.
- C. When required per typical section shown on the plans or as directed, reclaimed existing asphalt concrete pavement and base, treated with cement kiln dust, shall be placed prior to addition of new base material.

3.03 PULVERIZATION

- A. Pulverize or scarify existing material after shaping 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, excavate and windrow the material to expose a secondary grade to achieve processing to plan depth.

3.04 APPLICATION OF CEMENT KILN DUST

- A. Uniformly apply cement kiln dust using dry placement unless otherwise shown on the plans. Add cement kiln dust at the percentage determined in per Mix Design. Apply cement kiln dust only on an area where mixing, compacting, and finishing can be completed during the same working day.
 - 1. Start cement kiln dust 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 Engineer determines that weather conditions are unsuitable.

2. Dry Placement. Before applying cement kiln dust, bring the prepared roadway to approximately optimum moisture content. When necessary, sprinkle in accordance with TxDOT Item 204, "Sprinkling." Distribute the required quantity of dry cement kiln dust with approved equipment. Minimize dust and scattering of cement kiln dust by wind. Do not apply cement kiln dust when wind conditions, in the opinion of the Engineer, cause blowing cement kiln dust to become dangerous to traffic or objectionable to adjacent property owners.
3. Slurry Placement. Mix the required quantity of cement kiln dust with water, as approved. Provide slurry free of objectionable materials and with a uniform consistency that can be easily applied. Agitate the slurry continuously. Apply slurry within 2 hours of adding water and when the roadway is at a moisture content drier than optimum. Distribute slurry uniformly by making successive passes over a measured section of the roadway until the specified cement kiln dust content is reached.

3.05 MIXING

A. Thoroughly mix the material and cement kiln dust 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.

4. 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 02700-2.

Table 02700-2 Gradation Requirements

Sieve Size	Minimum % Passing	
	Base	Subgrade
1-3/4 in.	100	100
3/4 in.	85	85
No. 4	—	60

3.06 Compaction_

A. Compact the mixture in one lift using density control unless otherwise shown on the plans. Unless otherwise shown on the plans, complete compaction of base within 2 hours and subgrade within 6 hours after the application of cement kiln dust.

1. Sprinkle or aerate the treated material in accordance with TxDOT 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-103-E. Adjust operations as required.
2. 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.
3. Remove areas that lose required stability, compaction, or finish. Replace with cement kiln dust-treated mixture at the Contractor's expense.

B. 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 recompacting.

C. Density Control. Compact to at least 95% of the maximum density determined in accordance with Tex-120-E. The Engineer will determine roadway density immediately after completion of compaction in accordance with Test Method Tex-115-E and will verify strength in accordance with Tex-120-E. Remove material that does not meet density requirements. Replace with cement kiln dust-treated mixture and compact and test in accordance with density control methods.

1. 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.

3.07 FINISHING

A. Immediately after completing compaction, clip, skin, or tight-blade the surface of the cement kiln dust treated material with a maintainer or subgrade trimmer to a depth of approximately 1/4 in. 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.

1. In areas where surfacing is to be placed, 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. Remove excess material, reshape, and roll with a pneumatic-tire roller. If material is more than 1/4 in. low, correct as directed. Do not surface-patch.

3.08 CURING

- A. Cure the finished section until the moisture content is at least 2 percentage points below optimum or as directed before applying the next successive course or prime coat. Do not allow equipment or traffic on the finished course during curing, unless otherwise approved. The Engineer may allow traffic on the finished course during curing if proof rolling indicates adequate stability. Proof roll in accordance with TxDOT Item 216, "Proof Rolling." If deformation occurs, do not allow traffic to return to the finished section until the mixed material is firm enough to accommodate traffic without deformation. Apply seals or additional courses within 14 calendar days of final compaction.
- B. When the plans show no specific detour, the Contractor will provide one-way traffic control until proof rolling permits the return of normal traffic to the compacted material.

END SECTION