CITY OF ABILENE

ITEM 265

LIME-FLY ASH (LFA) TREATMENT FOR MATERIALS USED AS SUBGRADE

265.1 DESCRIPTION.

This Item shall govern for treating new or existing subgrade, existing pavement structure or combination thereof to be used as subgrade by pulverizing, adding lime and fly ash, mixing and compacting the mixed material as specified in this Item.

265.2 MATERIALS.

(1) Lime. Lime shall meet the requirements of Item 264, "Lime and Lime Slurry", for the type of lime specified.

The Contractor shall have the option of selecting from the types shown on the Plans the type of lime to be used. The Engineer shall be notified in writing before changing source or type.

All lime slurries used in "Slurry Placing" shall be furnished at or above the minimum "Dry Solids Content" as approved by the Engineer.

(2) Fly Ash. Fly ash may be either Type A or B and shall meet the requirements of "Texas Department of Transportation Departmental Materials Specification: D-9-8900, Fly ash".

265.3 EQUIPMENT.

(1) General. The machinery, tools and equipment necessary for proper prosecution of the work on this Item shall be on the project and approved by the Engineer prior to beginning this Item.

All machinery, tools and equipment used shall be maintained in a satisfactory working condition.

(2) Material Storage. Quicklime, hydrated lime in dry form and fly ash shall be suitably stored in closed, weatherproof containers until immediately before use. Storage bins, when used, shall be completely enclosed. Hydrated lime in bags shall be stored in weatherproof buildings with adequate protection from ground dampness. When Type C Quicklime is permitted, it shall be shipped only in bulk; bagged material will not be acceptable.

(3) Material Weight Verification. When lime and/or fly ash is furnished in trucks, the weight of lime and fly ash shall be determined on certified scales or the Contractor shall provide a set of standard platform truck scales at a location approved by the Engineer. Scales shall conform to the requirements of TxDOT Item 520, "Weighing and Measuring Equipment".

When Type A Hydrated lime or fly ash is furnished in bags, each bag shall bear the manufacturers certified weight. Bags varying more than five (5) percent from that weight may be rejected and the average weight of bags in any shipment, as shown by weighing ten (10) bags taken at random, shall not be less than the manufacturer's certified weight.

(4) Slurry Equipment. Type C Quicklime of Grade "DS" or "S" when used to manufacture slurry on the project or other location approved by the Engineer, shall be slurried in agitated slurry tanks. The slurring of Type C Quicklime must be handled in such a way as to not generate any dust hazardous to job personnel or to the public or be potentially damaging to any adjacent property.

The distributor truck used for slurry placing need not necessarily be equipped with an agitator; however, the slurry at the time of distribution must meet the consistency requirements specified. The Contractor shall, if necessary, use appropriate equipment to achieve compliance with the consistency requirements.

For Type B Commercial Lime Slurry, the distributor truck shall be equipped with a sampling device in accordance with Test Method Tex-600-J, Part I.

265.4 CONSTRUCTION METHODS.

(1) General. The completed course shall be uniformly treated, free from loose or segregated areas, of uniform density and moisture content, well bound for its full depth and shall have a smooth surface.

(2) Preparation of Subgrade or Existing Base. Prior to treating existing material, the subgrade or existing base shall be shaped to conform to the typical sections as shown on the Plans or as established by the Engineer. This work shall be done in accordance with the provisions of applicable bid items. When shown on the Plans, any existing asphaltic concrete pavement shall be removed and will be paid for in accordance with the applicable bid items.

Before pulverizing or scarifying an existing material, when shown on the Plans and when directed by the Engineer, the Contractor shall proof roll the roadbed in accordance with Item 216, "Rolling (Proof)". Soft spots shall be corrected as directed by the Engineer.

When the Contractor elects to use a cutting and pulverizing machine that will process the material to the plan depth, the Contractor will not be required to excavate to the secondary grade or windrow the material. This method will be permitted only if a machine is provided which will insure that the material is cut uniformly to the proper depth and which has cutters that will plane the secondary grade to a uniform surface over the entire width of the cut. The machine shall provide a visible indication of the depth of cut at all times.

In lieu of using the cutting and pulverizing machine, the Contractor shall excavate and windrow the material to expose the secondary grade to the typical sections, lines and grades as shown on the Plans or as established by the Engineer.

(3) Pulverization. The existing pavement or base material shall be pulverized or scarified so that 100 percent shall pass the 2½-inch sieve.

(4) Application and Mixing of Lime and Fly Ash.

(a) General. The percentages by weight or pounds per square yard of lime and fly ash to be added will be shown on the Plans and may be varied by the Engineer if conditions warrant.

Lime or fly ash shall be spread only on that area where the mixing operation can be completed during the same working day, except as required for Quicklime in Section 265.4.(4).(c).

Unless otherwise approved in writing by the Engineer, the LFA operation shall not be started when the air temperature is below 40º F and falling, but may be started when the air temperature is above 35ºF and rising. The temperature will be taken in the shade and away from artificial heat. LFA shall not be placed when weather conditions, in the opinion of the Engineer, are unsuitable.

CAUTION: Use of quicklime can be dangerous. Users should be informed of the recommended precautions in handling, storage and use of quicklime.

(b) Application of Lime. Lime shall be added and mixed first, unless otherwise approved by the Engineer.

The application and mixing of lime with the material shall be accomplished by the methods herein described as "Dry Placing" or "Slurry Placing". Type A Hydrated Lime shall be applied by "Slurry Placing" unless otherwise shown on the Plans or approved by the Engineer. Type B Commercial Lime Slurry shall be applied by "Slurry Placing". Type C Quicklime shall be applied by "Slurry Placing" or "Dry Placing" as shown on the Plans. The method of applying Type C Quicklime may be changed if approved in writing by the Engineer. When Type C Quicklime is used for dry placement, it shall be Grade "DS". When Type C Quicklime is used for slurry placement, it shall be either Grade "DS" or Grade "S". Grade "S" is for use in slurry placement only.

(i) Dry Placing. The lime shall be distributed by a spreader approved by the Engineer or by bag distribution for Type A Hydrated Lime at the rate shown on the Plans or as approved by the Engineer. Distribution rates shall be as shown on the Plans or as directed by the Engineer.

The lime shall be distributed at a uniform rate and in such manner as to reduce the scattering of lime by wind. Lime shall not be applied when wind conditions, in the opinion of the Engineer, are such that blowing lime becomes objectionable to adjacent property owners or dangerous to traffic. A motor grader shall not be used to spread type A Hydrated Lime, but may be used to spread Type C Quicklime of Grade "DS".

(ii) Slurry Placing. Where Type A Hydrated Lime is shown on the Plans and slurry placement is to be used, the Type A hydrate shall be mixed with water to form a slurry with a solids content approved by the Engineer.

Type B Commercial Lime Slurry shall be delivered to the project in slurry form at or above the minimum dry solids content approved by the Engineer. Successive passes shall attain the distribution of lime at the rate(s) shown on the Plans or approved by the Engineer over a measured section of roadway until the proper lime content has been secured.

When Type C Quicklime is applied as slurry, the amount of dry quicklime shall be 80 percent of the amount required by the Plans. The slurry shall contain at least the minimum solids content approved by the Engineer. The residue from the slurring procedure shall be spread uniformly over the length of the roadway currently being processed unless otherwise approved by the Engineer. This residue is primarily inert material with little stabilizing value, but may contain a small amount of quicklime particles that slake slowly. A concentration of these particles could cause the compacted stabilized material to swell during slaking.

Slurry Consistency Requirements

Slurry shall be of such consistency that it can be applied uniformly without difficulty.

When the distributor truck is not equipped with an agitator, the Contractor shall have a stand-by pump available on the project for agitating the lime and water as required by the Engineer in case of undue delays in dispersing the slurry.

(c) Mixing of Lime. The mixing procedure shall be the same for "Dry Placing" or "Slurry Placing" as herein described.

During the interval between application and mixing, hydrated lime that has been exposed to the open air for a period of six (6) hours or more or to excessive loss due to washing or blowing will not be accepted for payment.

The material and lime shall be thoroughly mixed by equipment approved by the Engineer. The material and lime may be brought to the proper moisture content and may be left to cure one to four days as approved by the Engineer or the mixing continued until a homogeneous friable mixture of material and lime is obtained.

Following mixing, a sample of the material at roadway moisture will be obtained for pulverization testing. All non-slaking aggregates retained on the ¾-inch sieve will be removed from the sample. The remainder of the material shall meet the following requirements when tested by TxDOT Test Method Tex-101-E, Part III:

	Percent
Minimum passing 1¾" sieve	100
Minimum passing ¾" sieve	85

When shown on the Plans or approved by the Engineer, this pulverization requirement may be waived when the material contains a substantial quantity of aggregate.

The treated materials shall be sprinkled during the mixing operation as approved by the Engineer to provide optimum mixing moisture.

In addition to the above, when Type C Quicklime, Grade "DS", is used under Dry Placing, the material and lime shall be mixed as thoroughly as possible at the time of the lime application. Sufficient moisture shall be added during the mixing to hydrate the quicklime. After mixing, and prior to compaction, the mixture of the material, quicklime and water shall be moist cured for two (2) to seven (7) days, as approved by the Engineer. After curing, mixing shall continue until the pulverization requirements are met.

(d) Application of Fly Ash. Unless otherwise approved by the Engineer, fly ash shall be distributed in the dry form only by a distributor approved by the Engineer. Application of fly ash shall begin within four (4) calendar days after the lime mixing operation has been completed, unless approved by the Engineer. Fly ash shall not be applied when wind conditions, in the opinion of the Engineer, are such that blowing fly ash becomes objectionable to adjacent property owners or dangerous to traffic. The mixture shall be sprinkled as approved by the Engineer. Fly ash shall be uniformly spread only on that area where the mixing and compacting operations can be completed during the same working day. A motor grader shall not be used to spread fly ash. Initial mixing after the addition of fly ash shall be accomplished dry or with a minimum of water to prevent fly ash balls.

(e) Mixing of Fly Ash. The mixing shall be continued until, in the opinion of the Engineer, a homogeneous mixture of lime, fly ash and material is obtained.

(5) Compaction Methods. Prior to compaction, the material shall be aerated or sprinkled as necessary to provide the optimum moisture. Compaction shall begin immediately after mixing of the last stabilizing agent. All compaction operations shall be completed within six (6) hours.

Compaction shall continue until the entire depth of mixture is uniformly compacted by "Ordinary Compaction" or "Density Control" as shown on the Plans. Throughout this entire operation the shape of the course shall be maintained by blading, and the surface upon completion shall be smooth and in conformity with the typical sections, lines and grades as shown on the Plans or as established by the Engineer.

When shown on the Plans or approved by the Engineer, multiple lifts will be permitted.

(a) Ordinary Compaction. When "Ordinary Compaction" is shown on the Plans, the following provisions shall apply:

The material shall be sprinkled and rolled as directed by the Engineer. All irregularities, depressions or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding or removing material as required and reshaping and recompacting by sprinkling and rolling. The surface of the course shall be maintained in a smooth condition, free from undulations and ruts, until the next course is placed.

Should the material lose the required stability, compaction or finish before the next course is placed, or the project is accepted, it shall be reworked in accordance with Subarticle 265.4.(6). However, compaction shall be in accordance with "Ordinary Compaction".

(b) Density Control. When "Density Control" is shown on the Plans, the following provisions shall apply:

Unless otherwise shown on the Plans, each course shall be sprinkled as required and compacted to the extent necessary to provide not less than 95 percent of the optimum density as determined by Test Method Tex-115-E, Part II. Roadway density testing will be as outlined in Test Method Tex-115-E.

When the material fails to meet the density requirements, or should the material lose the required stability, density or finish before the next course is placed or the project is accepted, it shall be reworked in accordance with Subarticle 265.4.(6).

(6) Reworking a Section. When a section is reworked within 72 hours after placement, the Contractor shall rework the section to provide the required compaction. When a section is reworked more than 72 hours after placement, the Contractor shall add 25 percent of the specified rate of lime and fly ash. Reworking shall include loosening, road mixing as approved by the Engineer, compacting and finishing. When a section is reworked, a new optimum density will be determined from the reworked material in accordance with test Method Tex-121-E, Part II.

(7) Finishing and Curing. After the final layer or course of the LFA treated material has been compacted, it shall be brought to the required lines and grades in accordance with the typical sections, within two (2) hours.

The completed section shall then be finished by rolling with a pneumatic tire or other suitable roller approved by the Engineer. The completed section shall be moist-cured or prevented from drying by addition of an asphalt material at the rate of 0.05 to 0.20 gallons per square yard as determined by the Engineer. This material shall be the type shown on the Plans. Curing shall continue for seven (7) days before further courses are added or traffic is permitted, unless otherwise approved by the Engineer.

However, the LFA treated material may be covered by other courses, the day following finishing, when approved by the Engineer. When the Plans provide for the treated material to be covered by other courses of material, the next course shall be applied within fourteen (14) calendar days after final compaction is completed, unless otherwise approved by the Engineer.

265.5 TOLERANCES.

Tolerances shall conform to the following:

(1) Density tolerances. The Engineer may accept the work providing not more than one out of the most recent five density tests performed is below the specified density, provided the failing test is not more than three pounds per cubic foot below the specified density.

(2) Grade Tolerances. Finished grade tolerances shall be in accordance with Subarticle 132.4.(1).

265.6 MEASUREMENT.

This Item will be measured as follows:

(1) Lime.

(a) Type A.

(i) Hydrated Lime (Dry). When Type A Hydrated Lime is used under "Dry Placing", the quantity of lime will be measured by the ton of 2,000 pounds, dry weight.

(ii) Hydrated Lime (Slurry). When type A Hydrated Lime is used under "Slurry Placing", the quantity of lime will be measured by the ton of 2,000 pounds, dry weight of powdered bulk hydrated lime used to prepare the hydrated lime slurry at the job site.

(b) Type B.

Commercial Lime Slurry. When Type B Commercial Lime Slurry is used, the quantity of lime will be calculated from the minimum percent "Dry Solids Content" of the slurry previously agreed upon for the project by the Contractor and the Engineer. This figure will be multiplied by the weight of the slurry in tons delivered, which must be at or above the required minimum "Dry solids Content".

(c) Type C.

(i) Quicklime (Dry). When Type C Quicklime is used under "Dry Placing", the quantity of lime will be measured by the ton of 2,000 pounds, dry weight of the quicklime actually delivered on the road.

(ii) Quicklime (Slurry). When Type C Quicklime is used under "Slurry Placing", the quantity will be measured by the ton of 2,000 pounds, dry weight of the quicklime used to prepare the hydrated lime slurry at the job site. The measured tonnage of type C quicklime will be multiplied by a conversion factor of 1.28 to give the quantity of equivalent hydrated lime, which will be the basis of payment.

(2) Fly Ash. Fly ash will be measured by the ton of 2,000 pounds, dry weight as delivered on the road.

(3) LFA Treatment. LFA treatment will be measured by the square yard of the depth specified to the line and grades shown on the typical sections.

265.7 PAYMENT.

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for as follows:

(1) Lime. Lime will be paid for at the unit price bid for "Lime" of one of the following specified types, which price will be full compensation for furnishing all lime.

(a) Type A (Dry)

(b) Type A (Slurry)

(c) Type B

(d) Type C (Dry)

(e) Type C (Slurry)

Lime for reworking a section in accordance with Subarticle 265.4.(6) will not be paid for directly but will be subsidiary to this Item.

(2) Fly Ash. Fly ash will be paid for at the unit price bid for "Fly Ash" which price will be full compensation for furnishing all fly ash.

Fly ash for reworking a section in accordance with Subarticle 265.4.(6) will not be paid for directly but will be subsidiary to this Item.

(3) LFA Treatment. "LFA Treated Subgrade" of the compaction method and depth specified will be paid for at the unit price bid per square yard. This price shall be full compensation for shaping existing material, loosening, mixing, pulverizing, spreading, drying, applying lime and fly ash, water content of the slurry, compacting, curing including curing materials, shaping and maintaining, processing, hauling, reworking if required, preparing secondary subgrade and for all mixing water, tools, equipment, labor and incidentals necessary to complete the work.

When proof rolling is shown on the Plans and directed by the Engineer, it will be considered subsidiary to this bid Item.

When "Ordinary Compaction" is shown on the Plans, all sprinkling and rolling, and proof rolling will be considered subsidiary to this Item, unless otherwise shown on the Plans.

When "Density Control" is shown on the Plans, all sprinkling and rolling, and proof rolling will be considered subsidiary to this Item.

When subgrade is constructed under this project, correction of soft spots in the subgrade will be at the Contractor's expense. When subgrade is not constructed under this project, correction of soft spots in the subgrade will be in accordance with Part I General Provisions, Division I *General Requirements and Covenants.*