

ITEM 223

LIME-FLYASH OR FLYASH STABILIZED SUBGRADE

223.1 Description. This item shall consist of treating the subgrade by the pulverizing, addition of lime flyash and/or flyash, mixing and compacting the mixed material to the required density. This item applies to natural ground and embankment and shall be constructed as specified herein and in conformity with the typical sections, lines and grades shown on the plans.

223.2 Materials. Hydrated lime shall meet the requirements of ASTM C977. When Type B, commercial lime slurry is specified, the Contractor shall select, prior to construction, the grade to be used and shall notify the Engineer, in writing, before changing from one grade to another.

Flyash shall meet the requirements of ASTM C618, Class C. Flyash shall also have a minimum CaO content of 20-percent.

Water shall meet the requirements of ASTM Designation C94.

223.3 Equipment. The machinery, tools and equipment necessary for proper prosecution of the work shall be on the project prior to the beginning of construction operations. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

Lime and flyash shall be stored and handled in closed weatherproof containers until immediately before distribution on the road. If storage bins are used, they are to be completely enclosed. Materials in bags are to be stored in weatherproof buildings with adequate protection from ground dampness.

If lime and/or flyash is furnished in trucks, each truck shall have a weigh ticket from a certified scale.

If lime and/or flyash is furnished in bags, each bag shall bear the manufacturer's certified weight. Bags varying more than 5 percent from that weight may be rejected and the average weight of bags in any shipment, as shown by weighing 50 bags taken at random, shall not be less than the manufacturer's certified weight.

223.4 Construction Methods. It is the primary requirement of this specification to secure a completed course of treated material containing a uniform lime-flyash or flyash mixture free from loose or segregated areas, of uniform density and moisture content, well bound for its full depth and with a smooth surface suitable for placing subsequent courses.

It shall be the responsibility of the Contractor to regulate the sequence of his work, to process a sufficient quantity of material to provide full depth as

shown on the plans, to use the proper amounts of lime and flyash, maintain the work and rework the courses as necessary to meet the above requirements.

Before other operations are begun, the roadbed shall be graded, shaped, and compacted as required to construct the lime-flyash or flyash treatment for materials in-place in conformance with the lines, grades, thickness and typical cross-section shown on the plans. Unsuitable soil or material shall be removed and replaced with acceptable material.

The subgrade shall be firm and able to support, without displacement, the construction equipment at the compaction hereinafter specified. Soft or yielding subgrade shall be corrected and made stable by scarifying, and aeration or adding lime and/or flyash and compacting until it is of uniform stability.

The Contractor shall be required to use a cutting and pulverizing machine that will remove the subgrade material accurately to the secondary subgrade and pulverizing the material at the same time, he will not be required to expose the secondary grade nor windrow the material. However, the Contractor shall be required to roll the subgrade, before using the pulverizing machine and correct any soft areas that this rolling may reveal. This method will be permitted only where 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 smooth surface over the entire width of the cut.

The cost of the repair of the secondary subgrade and any materials below the secondary subgrade is incidental to this item.

When lime-flyash stabilization is required, it shall be a two phase operation, with the lime placed and allowed to cure, before the flyash stabilization begins.

Application of the lime and the subsequent curing shall be in accordance with Item 220, titled "Lime Stabilized Subgrade". After the subgrade has cured for the time required by that specification, then flyash stabilization may begin. Flyash stabilization shall be in accordance with this specification.

The machine will be of such design that a visible indication is given at all times that the machine is cutting to the proper depth.

Lime shall be spread only on that area where the first mixing operation can be completed during the same working day.

The sequence of application of lime and flyash, with the material, shall be accomplished by the methods hereinafter described as "Dry Placing", or "Slurry Placing". When Type A, hydrated lime is specified, the Contractor may use either method.

The lime or flyash shall be spread by a spreader or by bag distribution at the rate directed by the Engineer.

For dry placing, the lime or flyash shall be distributed at a uniform rate and in such a manner as to reduce the scattering of lime or flyash by wind to a minimum. Lime or flyash shall not be applied when wind conditions are such that blowing lime or flyash becomes objectionable to traffic or adjacent property owners. A motor grader shall not be used to spread the lime or flyash.

The materials shall be sprinkled until the proper moisture content has been secured. However, initial mixing after the addition of lime or flyash will be accomplished dry or with a minimum of water to prevent lime and/or flyash balls.

For slurry placing, the lime or flyash shall be mixed with water in vehicles with approved distributors and applied as a thin water suspension or slurry.

Type B, commercial lime slurry shall be applied with a lime percentage not less than that applicable for the grade used. The distribution of lime or flyash shall be attained by successive passes over a measured section of roadway until the proper moisture and lime or flyash content has been secured. The distributor vehicle shall be equipped with an agitator which will keep the lime or flyash and water in a uniform mixture.

The mixing procedure shall be the same for "Dry Placing or "Slurry Placing", as hereinafter described.

The material shall be uniformly mixed by approved methods. If the soil binder lime mixture contains clods, they shall be reduced in size by raking, blading, sinking, harrowing, scarifying or the use of other approved pulverization methods so that when all non-slaking aggregates retained on the 3/4" sieve are removed. The remainder of the material shall meet the following requirements when tested at the field moisture condition, or dry by laboratory sieves in accordance with ASTM Method C136.

Minimum Passing 1-3/4 sieve	100 Percent
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Minimum Passing the 3/4" sieve	85 Percent
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It is the intent of this specification that lime and flyash shall be spread as directed by the Engineer.

The amount of lime and flyash used shall be as directed by the Engineer.

During the interval of time between application and mixing, hydrated lime or flyash that has been exposed to excessive loss due to washing or blowing will not be accepted for payment. Spreading, mixing, compaction and finishing for lime-flyash stabilized subgrade should be completed during daylight hours of the same day.

If flyash only is to be used without lime, the following mixing procedures shall apply.

The raw material shall be thoroughly mixed by approved road mixers or other approved equipment, and the mixing continued until a homogeneous, friable mixture is obtained, free from all clods or lumps.

The flyash shall be distributed at a uniform rate and in such manner as to reduce the scattering of flyash by the wind to a minimum. Flyash shall not be applied when wind conditions, are such that blowing flyash becomes objectionable to traffic or adjacent property owners. A motor grader shall not be used to spread flyash.

The material and flyash shall be thoroughly mixed by approved road mixers or other approved equipment and the mixing continued until a homogeneous, friable mixture of material is obtained, free from all clods or lumps. If the soil binder-flyash mixture contains clods, they shall be reduced in size by raking, blading, discing, harrowing, scarifying or the use of other approved pulverization methods so that when all non-slaking aggregates, retained on the 3/4" sieve are removed, the remainder of the material shall meet the following requirements when tested at the field moisture condition or dry by laboratory sieves using ASTM Method C136:

Minimum Passing 1 3/4" sieve	100 Percent
Minimum Passing the 3/4" sieve	85 Percent

Flyash shall be applied only to such an area that all the operations can be continuous and completed in daylight.

During the interval of time between application and mixing, flyash that has been exposed to the open air for a period of 6 hours or more, or to excessive loss due to washing or blowing will not be accepted for payment. It is recommended that the mixing and compaction of flyash stabilized subgrade be completed within 2 hours in order to take advantage of rapid initial set characteristics.

Mixing after the addition of flyash will be accomplished dry or with a minimum of water to prevent flyash balls.

Compaction of the mixture shall begin immediately after adding and mixing of the last stabilizing agent and be completed within 6 hours. The material shall be aerated or sprinkled as necessary to provide a moisture content of

optimum to 3 percent above optimum. Compaction shall begin at the bottom and shall continue until the entire depth of the mixture is uniformly compacted to 95-percent of standard proctor density (ASTM D698), to a minimum depth of 6-inches. In addition to the requirements specified for density, the full depth of the material shall be compacted to the extent necessary to remain firm and stable under the construction equipment. Throughout the 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 section shown on the plans and to the established lines and grades.

After the final layer of the lime-flyash or flyash treated subgrade has been compacted, it shall be brought up to the required lines and grades, and in accordance with the typical sections.

The resulting surface shall be thoroughly rolled with a pneumatic tire roller and "skinned" by a power grader to achieve final grade, removing all loosened stabilized material from the section. The surface shall be thoroughly compacted with the pneumatic roller, adding small increments of moisture as needed during rolling. If aggregate larger than a 3/4" screen is present in the mixture, one complete coverage of the section with the flat wheel roller shall be made immediately after the "skinning" operation. Surface finishing methods may be varied from this procedure provided a dense, uniform surface, free of surface compaction planes is produced. The moisture content of the surface material must be maintained at optimum during all finishing operations. Surface compaction and finishing shall proceed in such a manner as to produce, in not more than 2 hours, a smooth, closely knit surface, free of cracks, ridges or loose material conformity to the crown, grade and line shown on the plans.

After the lime-flyash or flyash treated course has been finished as specified herein, the surface shall be protected against rapid drying by either of the following curing methods for a period of not less than 3 days or as directed by the Engineer.

- A. Maintain in a thorough and continuously moist condition by sprinkling.
- B. Apply an asphalt membrane to the treated course, immediately after same is completed. The asphalt material for the membrane shall be MC-30. Asphaltic material shall meet the requirements of Item 300, Oils, Asphalts and Emulsions, of the Texas Highway Departments' "Standard Specifications for Construction of Highways, Streets and Bridges". The asphalt shall completely cover and seal the total surface of the base and fill all voids. If the Contractor elects to use this method, it shall be his responsibility to protect the asphalt membrane from being picked up by traffic.

The asphalt membrane may remain in place when the proposed surface or other base courses are applied.

Completed sections of lime-flyash or flyash treated material in-place may be opened immediately to local traffic and to construction equipment and to all traffic after the curing period, provided the lime-flyash or flyash treated course has hardened sufficiently to prevent marring or distorting the surface by equipment or traffic, and after the minimum 3 day curing period.

223.5 Quality Assurance. The Testing Laboratory's representative will determine the Moisture-Density Relationship in accordance with ASTM Method D698, on material secured from the roadway. Samples shall be blended with Lime-Fly Ash in the laboratory for each type of material encountered.

The Testing Laboratory's representative will determine the in-place density in accordance with ASTM Methods D2922 or D1556. The minimum level of testing will consist of at least three tests for each 1,000 feet per lane of roadway or 4,000 square feet (500 square yards) of embankment.

223.6 Measurement. Lime-flyash or flyash treatment of the subgrade shall be measured by the **square yard** as shown on the typical sections.

When dry lime or quick lime is used, the quantity of lime will be measured by the **ton** of 2,000 pounds.

When Type B, commercial lime slurry is used, the quantity of lime shall be calculated from the required minimum percent of solids, based upon the use of Grade 2.

Grade 2- The dry solids content shall be at least 35 percent by weight of the slurry and the quantity of lime will be calculated by the ton of 2,000 pounds based on the 35 percent, as delivered on the road.

Flyash will be measured by the **ton** of 2,000 pounds. Flyash may be applied in the dry or in the slurry form. The moisture content in the final mix shall not exceed the desired moisture by more than 2 percent.

223.7 Payment. The work performed and the materials furnished as prescribed by this item and measured under "Measurement" will be paid for as follows:

Lime shall be paid for at the unit price per **ton** of 2,000 pounds for "Lime" of the type specified, which price shall be full compensation for furnishing all lime.

Flyash will be paid for at the unit price bid per **ton** of 2,000 pounds for "Fly Ash", which price shall be full compensation for furnishing all flyash.

Manipulation of Lime-Fly Ash and Fly Ash Treated Subgrade shall be paid for at the unit price bid per **square yard** of the specified thickness shown on the plans.

The unit price bid shall be full compensation for all stabilization of subgrade; for loosening, mixing, pulverizing, spreading, drying, application of flyash and/or application of lime, water content of the slurry, asphalt membrane, shaping, maintaining; for all manipulations and compaction required; for all hauling and freight involved; for all tools, equipment, labor and for all incidentals necessary to complete the work.

END OF ITEM 223