OPTION 1

SECTION 32 11 30

LIME FLY ASH STABILIZED SUBGRADE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This item shall consist of admixing commercial lime and/or lime slurry and fly ash with the existing material, and mixing and compacting the mixed material to the required density. All work performed in this item shall be constructed as specified herein and in conformity with the typical cross-sections, lines and grades as shown on the Plans and as directed by the Engineer.

1.2 MEASUREMENT AND PAYMENT

A. Measurement for Lime Stabilized Subgrade is on a square yard basis. Separate measurement will be made for each different thickness of base course. Limits of measurement shall match actual pavement are, but no greater than the maximum pavement limits shown on Drawings. Limits for measurement will be extended to include installed lime/fly ash stabilized subgrade material that extends 1 foot beyond outside edge of pavement. No payment will be made for lime/fly ash stabilized subgrade in areas beyond these limits.

B. Measurement for hydrated lime and quicklime is by the ton of 2,000 pounds dry-weight basis.

C. Measurement for commercial lime slurry is by the ton of 2,000 pounds of lime calculated on the percentage by weight of dry solids for the grade slurry.

D. Measurement for fly ash is by the ton of 2,000 pounds dry-weight basis.

E. Lime/fly ash stabilized material as described in this section will be paid for at the unit price bid in the Proposal for the lime/fly ash stabilized treatment, which price shall be full compensation for scarifying, preparation below secondary grade, furnishing, distributing, and mixing the lime and for all labor, supplies, water, fuel, tools, equipment and incidentals necessary to mix and compact the stabilized soil to the density specified in these Specifications. Payment will not be made for unauthorized work.

1.3 SUBMITTALS

Lime series Atterburg Limits

Lime series pH test (ASTM C977-83a-Annex Test Method)

Lime type

% Lime

Mix Design

PART 2 – PRODUCTS

2.1 MATERIALS

A. The lime to be used for stabilization shall meet with requirements of TX DOT DMS-6350: "Lime and Lime Slurry" and DMS-6330, "Lime Sources Prequalification of Hydrated Lime and Quicklime". Use commercial lime slurry or pebble grade quicklime. When furnishing quicklime, provide it in bulk. Quicklime can be dangerous – use extreme caution if used for the Work. Contractor shall become informed about recommended precautions in the handling, storage and use of quicklime.

B. The amount of lime required for stabilization will be the percent by weight shown on the Plans, stated in the Special Provisions, or that amount which produces a pH not less than 12.4 and provides for a Plasticity Index less than 18.

C. The fly ash to be used shall conform to the requirements of TXDOT DMS-4615: "Fly Ash for Soil Treatment", Class C. Fly ash to also have a minimum CaO content of 20 percent and contain no lignite ash.

D. Water: clean, clear and free from oil, acids, alkali, or vegetable matter. Water sources other than the local municipal domestic water supply must be approved by the Engineer.

E. Mix Design – The Engineer will determine the target lime/fly ash content and optimum moisture content in accordance with Tex-127-E or prior experience with the project material. The Contractor may propose a mix design developed in accordance with Tex-127-E. The Engineer will use Tex-127-E to verify the Contractor's proposed mix design before acceptance.

2.2 TESTING REQUIREMENTS

A. After final mixing, a pH test, Atterberg Limit test and sieve analysis shall be performed in accordance with Tex-101-E, Part III.

B. Sampling and testing of lime slurry shall be in accordance with Tex-600-J.

C. Soil to be evaluated to establish percent of fly ash and lime slurry to be applied to subgrade material. Sample mixtures of lime slurry will be tested to establish compliance with specifications.

D. Moisture and Density tests shall be taken at each construction station to ensure a density of at least 98% of maximum dry density at a moisture content between optimum and 4% wet of optimum in accordance with Standard Proctor (ASTM D698). All tests meeting these requirements shall be paid by the City. The City will not pay for failing tests.

E. When requested by the Engineer's Inspector, the contractor will proof roll areas in question with a 25 ton pneumatic tired roller or approved equal after lime stabilization is complete.

PART 3 – EXECUTION

3.1. GENERAL:

A. It is the primary requirement of this specification to produce a completed course of treated material containing a uniform lime mixture, free from loose or segregated areas, of uniform density and moisture content, well bound for its full depth as shown on the detail sheet or specified in the Special Provisions 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 use the proper amount of lime and fly ash, maintain the work and rework the courses as necessary to meet the above requirements.

B. The Contractor is required to ensure the existing sub-grade or embankment beneath the course to be lime/fly ash stabilized is of proper density, uniformity and quality. The Contractor may elect to proof roll, replace and/or compact, areas that exhibit instability. If necessary, the Contractor may need to scarify, dry and compact the existing sub-grade prior to addition of lime/fly ash. All work for the preparation of the existing sub-grade will not be paid directly, but will be considered a part of "Lime Fly Ash Stabilization".

3.2. APPLICATION:

A. Mix quicklime and fly ash with water to form a slurry of the solids content specified. Commercial lime slurry shall have dry solids content as specified. Conform to cautionary requirements of Paragraph 2.1A concerning use of quicklime.

B. Apply slurry with a distributer truck equipped with an agitator to keep lime, fly ash, and water in a consistent mixture. Make successive passes over measured section of roadway to attain proper moisture and lime content. Limit spreading to an area where preliminary mixing operations can be completed on the same working day.

C. Apply so that dry subgrade will contain a minimum lime content of 5 percent by weight of dry subgrade unless otherwise instructed by Engineer.

3.3. MIXING:

A. <u>PRELIMINARY MIXING</u>

1. Do not mix and place material when temperature is below 40 degrees F and falling. Base may be placed when temperature taken in the shade and away from artificial heat is above 35 degrees F and rising.
2. Use approved single-pass or multiple-pass rotary speed mixers to mix soil, lime, fly ash, and water to required depth. Obtain a homogeneous friable mixture free of clods and lumps.
3. Contractor shall conduct operations to minimize elapsed time between mixing and compacting fly-ash stabilized subgrade in order to take advantage of rapid initial set characteristics. Complete compaction within 2 hours of commencing compaction and not more than 6 hours after adding and mixing the last stabilizing agent.
4. Shape mixed subgrade to final lines and grades.
5. Eliminate following operations and final mixing if pulverization requirements of Paragraph 3.3.B.3 can be met during preliminary mixing.
   a. Seal subgrade as a precaution against heavy rainfall by rolling lightly with light pneumatic rollers.
   b. Cure soil-lime material for 3 days minimum. Keep subgrade moist during cure.

B. <u>FINAL MIXING</u>

1. Use approved single-pass or multiple-pass rotary speed mixers to uniformly mix cured soil and lime to required depth.
2. Add water to bring moisture content of soil mixture to a minimum of optimum or above.

3. Mix and pulverize until all material passes a 1-3/4 inch sieve; a minimum of 85 percent, excluding nonslacking fractions, passes a ¾ inch sieve; and a minimum of 60 percent excluding nonslaking fractions passes a No. 4 sieve.
4. Shape mixed subgrade to final lines and grades.

3.4. COMPACTION:

A. Compaction of the mixture shall begin immediately after final mixing. Complete all compaction operations within 6 hours of fly ash application. The material shall be aerated or sprinkled as necessary to provide the proper moisture. Compaction shall begin at the bottom and shall continue until the entire depth of mixture is uniformly compacted. Spread and compact in two or more approximately equal layers where total compacted thickness is to be greater than 8 inches. Do not allow stabilized base to mix with underlying material. Correct irregularities or weak spots immediately by replacing material and recompacting.

B. The course shall be sprinkled as required and compacted to the extent necessary to provide no less than ninety-eight (98) percent of the density measured by ASTM D698 at a moisture content between optimum and +4% wet of optimum moisture content. Grades shall be "blue-topped" during the compaction effort and the lime soil mixture shall be compacted to within 0.1 ft in cross-section and 0.1 ft in 16 ft measured longitudinally. In addition to the requirements specified for density, the full depth of the material shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment. Depth tests shall occur every 200 lf and shall be performed after compliance with density requirements. Fill test sections with new compacted lime stabilized subgrade.

C. If the material fails to meet the density requirements, it shall be reworked as necessary to meet these requirements. 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 section shown on the plans and to the established lines and grades. Should the material due to any reason or cause, lose the required stability, density and finish it shall be re-compacted, refinished and retested at the sole expense of the Contractor.

3.5 EQUIPMENT

A. The machine, tools and equipment necessary for the proper prosecution of the work shall be on the project and pre-approved by the Engineer prior to the beginning of construction operations.

B. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

C. Use slurry tanks equipped with agitation devices to keep lime, fly ash, and water in a consistent mixture.

D. To insure thorough mixing of the lime into the material to be stabilized, equipment shall be a pulverizer mixer equivalent to a Seaman Mixer, or soil stabilizing machine shall be used.

E. If lime is furnished in trucks, each truck shall have the weight of lime certified on public scales or the Contractor shall place a set of standard platform truck scales or hopper scales at a location pre-approved by the Engineer. Scales shall be certified as to accuracy by an independent pre-approved testing laboratory.

3.6 FINISHING AND CURING OF LIME-STABILIZED MATERIAL:

A. After the lime/fly ash treated material has been compacted and brought to the required lines and grades in accordance with the typical sections, the completed section shall then be finished by rolling as directed with a pneumatic or other suitable roller sufficiently light to prevent hair line cracking. Complete finishing operations within 2 hours after final compaction. Rework and recompact at areas where hairline cracking develops.

B. The completed section shall be moist-cured for a minimum of three (3) days before further courses are added or any traffic is permitted. During this time period the presence of sulphates should be evident by excessive swelling. If sulphates are found, seek direction from Engineer. Subgrade may be opened to traffic after 2 days if adequate strength has been attained to prevent damage. Restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.

B. Apply seals or additional courses within fourteen (14) calendar days after final compaction, unless otherwise directed by the Engineer.

END OF SECTION