

Black text – from standard FAA spec	Blue text – additions to FAA standard spec
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**I. DESCRIPTION**

**A. NOTES TO ENGINEER:**

- 1. Check soluble sulfate content of soil to ensure it is candidate for lime-treatment.
- 2. Contents as low as 0.5% have caused expansion problems.

**B. ONE OR MORE COURSES:**

- 1. Mixture of soil, lime, water
- 2. To lines, grades, thicknesses, and typical cross sections shown on the plans.

**II. MATERIALS**

**A. HYDRATED LIME**

- 1. Manufactured high-calcium quicklime
- 2. Low-calcium quicklime, or
- 3. Hydrated Lime
- 4. As defined by ASTM C 51
- 5. Conforming to ASTM C 977
- 6. Not permitted:
  - (1) Calcium oxide(CaO),
  - (2) Calcium hydroxide(Ca(OH)2)
  - (3) Magnesium oxide (MgO)
  - (4) Magnesium hydroxide (Mg(OH)2)
  - (5) alone or in combination
  - (6) not directly produced from quicklime produced from calcining limestone

**B. COMMERCIAL LIME SLURRY**

- 1. Pumpable suspension,
- 2. Liquid portion shall not contain dissolved injurious or objectionable material.
- 3. Solids portion shall be principally hydrated lime of sufficient quality and fineness to meet following requirements:
  - a) Chemical composition: 70% by weight of calcium and magnesium oxides.
  - b) Residue: conform to following:
    - (1) Retained on a No. 6 sieve: Max. 0.0%
    - (2) Residue retained on a No. 10 sieve: Max. 1.0%
    - (3) Residue retained on a No. 30 sieve: Max. 2.5%
  - c) Grade: Shall conform to one of the following:
    - (1) Grade 1. Dry solids content shall be at least 31%, by weight, of the slurry.
    - (2) Grade 2. Dry solids content shall be at least 35%, by weight, of the slurry.

**C. WATER**

- 1. Clean – free of oil, salt, acid, alkali, sugar, vegetable, or other injurious substances
- 2. Potable per AASHTO T 26.
- 3. Water known to be potable need not be tested.

**D. SOIL**

- 1. Uniform in Quality and Gradation.
- 2. Free of roots, sod, weeds, and stones larger than 2-1/2 inches.

**III. COMPOSITION**

**A. LIME**

- 1. Contractor to provide Mix Design to determine proper percentage of lime

- a) % should be sufficient to lower LL to <30.
  - b) % should be sufficient to lower PI to 130.
  - c) % should be sufficient to increase CBR (compacted to 93% maximum density as determined by ASTM D 698) to [insert target CBR].
2. Percentage of lime shall not be more than 0.25% above that required to satisfy a) through c) above.

**B. TOLERANCES**

1. At final compaction:
  - a) Lime tolerance: + 0.5%
  - b) Water tolerance: + 2%, -0%

**IV. WEATHER LIMITATIONS**

**A. SUSPEND WORK UNDER THE FOLLOWING CONDITIONS:**

1. Temperature
  - a) below 40 deg F
  - b) may fall below 40 deg F w/l 24 hours
2. Other conditions
  - a) fog
  - b) rain
  - c) frozen subgrade

**V. EQUIPMENT**

**A. REQUIRED EQUIPMENT:**

1. Grading Equipment
2. Scarifying Equipment
3. Spreader For Lime or Lime Slurry
4. Mixing or Pulverizing Equipment
5. Sheepsfoot
6. Pneumatic or Vibrating Rollers
7. Sprinkling Equipment
8. Trucks

**VI. CONSTRUCTION METHODS**

**A. GENERAL**

1. Uniformity of treated subgrade
  - a) uniform lime mixture
  - b) free from loose or segregated areas
  - c) uniform density and moisture content
  - d) well bound for full depth
  - e) smooth surface
2. Contractor's responsibility to:
  - a) use proper amount lime
  - b) maintain the work
  - c) rework courses and necessary
3. Prior to lime treatment:
  - a) Subgrade brought to grade per Section [ ], Earthwork
    - (1) Except that no compaction required within thickness of planned lime-treatment
  - b) Excavate to secondary grade (bottom of lime-treatment)
    - (1) remove
    - (2) windrow
  - c) Correct wet or unsuitable conditions in secondary grade
    - (1) scarify

- (2) add lime
- (3) compact until of uniform stability
- d) Spread excavated material.
- e) May use cutting and pulverizing machine that will accurately cut/pulverize to secondary grade
  - (1) windrowing not required
  - (2) rolling is required to identify, correct soft areas before using pulverizing equipment.
  - (3) machine must give visible indication of proper depth of cutting/pulverizing

B. APPLICATION

- 1. General
  - a) Spread only as far as can be fully worked in same day.
- 2. Dry Placing
  - a) [Dry method not allowed.](#)
- 3. Slurry Placing
  - a) Mixed in water and applied as thin water suspension.
  - b) Commercial slurry with lime percentage not less than the applicable grade.
  - c) Make successive passes until amount of lime required in mix design is placed for the subject layer.
  - d) Distributor trucks shall continually agitate slurry.

C. MIXING

- 1. First Mixing
  - a) Mix full depth with approved mixing machine.
    - (1) Make two coverages with mixing machine.
    - (2) Add water to provide above optimum to ensure chemical reaction.
  - b) Do not leave exposed for more than 6 hours.
    - (1) These areas will not be accepted for payment.
  - c) Lightly roll to seal surface/minimize evaporation.
  - d) Maintain above optimum moisture by sprinkling for:
    - (1) 48 hours or
    - (2) until mixture becomes friable.
- 2. Final Mixing
  - a) After specified curing time, scarify/mix uniformly until clod size meets following:
    - (1) Minimum of clods passing 1-1/2 inch sieve 100 %
    - (2) Minimum of clods passing No. 4 sieve 60%

D. COMPACTION

- 1. Begin immediately after final mixing.
  - a) Do not leave any area undisturbed for more than 30 minutes.
- 2. Aerate/sprinkle to provide optimum moisture as ~~directed by the Engineer~~ [required](#) to meet the following:
  - a) tolerance +/- 2%
  - b) optimum determined by D 698.
  - c) less than amount which will cause instability during compaction/finishing.
- 3. Compact:
  - a) to 93% maximum density
    - (1) as determined by D 698.
    - (2) In-place density determined by D 1556 or D 2922.
  - b) or as necessary to remain firm and stable under construction traffic.
  - c) Rework if density tests fail.
- 4. Maintain surface in smooth condition until acceptance

- a) Irregularities, depressions, weak spots shall be corrected immediately by scarifying, sprinkling, shaping, recompacting.

**E. FINISHING AND CURING**

- 1. After final layer compacted, bring to plan lines and grades and finish by rolling.
  - a) roller to be sufficiently light to prevent hairline cracking
- 2. Smoothness tolerance:
  - a) 3/8 inch in 16 ft.
  - b) tested parallel and perpendicular to centerline
  - c) Contractor to correct areas showing variations outside this limit at his own expense.
- 3. Curing
  - a) Moist cure
    - (1) Minimum 7 days before next course constructed or traffic allowed.
  - b) Apply subsequent course within 14 days.

**F. THICKNESS**

- 1. Determined by depth tests or cores
  - a) Every 300 square yards or less
  - b) If deficiency more than ½ inch Contractor shall correct at his expense.
  - c) Contractor to repair core holes at his expense.

**G. MAINTENANCE**

- 1. Contractor shall maintain condition of treated subgrade until completed, cured, accepted by the Engineer.

**VII. SUBMITTAL REQUIREMENTS**

**A. SLURRY MIX DESIGN**

**VIII. METHOD OF MEASUREMENT**

- A. LIME-TREATED SUBGRADE
  - 1. per square yard
- B. LIME
  - 1. per ton

**IX. BASIS OF PAYMENT**

- A. PAID AT CONTRACT UNIT PRICE UNDER ITEM NUMBER
  - 1. 26.1 Lime -Treated Subgrade – per square yard
  - 2. 26.2 Lime – per ton
  - 3. Is full compensation for all preparation, delivering, placing, mixing, labor, equipment, tools and incidentals
  - 4. [No separate payment for work in areas of night or limited-time construction area.](#)

**X. TESTING REQUIREMENTS**

- A. ASTM D 698 MOISTURE-DENSITY RELATIONS OF SOILS AND SOIL-AGGREGATE MIXTURES USING 5.5 LB (2.49 KG) RAMMER AND 12-IN. (305 MM) DROP
- B. ASTM D 1556 DENSITY OF SOIL IN PLACE BY THE SAND-CONE METHOD
- C. ASTM D 2922 DENSITY OF SOIL IN PLACE BY THE NUCLEAR DENSITY METHOD
- D. AASHTO T 26 QUALITY OF WATER TO BE USED IN CONCRETE

**XI. MATERIAL REQUIREMENTS**

- A. ASTM C 977 QUICKLIME AND HYDRATED LIME FOR SOIL STABILIZATION

**XII. END OF SECTION**