

**KANSAS DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION TO THE
STANDARD SPECIFICATIONS, 1990 EDITION**

NOTE: This special provision is generally written in the imperative mood. The subject, "the *Contractor*" is implied. Also implied in this language are "*shall*", "*shall be*", or similar words and phrases. The word "*will*" generally pertains to decisions or actions of the Kansas Department of Transportation.

Page 215, Section 305. Delete this Section and replace with this:

SECTION 305

LIME TREATED SUBGRADE

305.1 DESCRIPTION.

Mix soil, lime and water; mix the materials either in-place or off-site in a borrow area. Use the mixed materials to construct lime treated subgrade as detailed in the Contract Documents.

BID ITEM

Lime (*)

Manipulation for Lime Treated Subgrade

Water for Lime Treated Subgrade

*Type: Hydrated or Pebble Quicklime

UNIT

megagram

square meter

megagram

305.2 MATERIALS.

If necessary, provide bituminous materials, either emulsified asphalt (SS-1 or CSS-1) or medium cure cutback asphalt (MC-250), that comply with the requirements of **Section 1200**.

Provide the specified type of lime that complies with the requirements of **Section 2000**.

Provide water for lime treated subgrade that complies with the requirements of **Section 2400**.

305.3 CONSTRUCTION REQUIREMENTS.

a. Preparation and Maintenance of the Subgrade or Off-Site Borrow Area. Before the application of the lime treatment, use automatic grade controlled equipment (accomplish control of grade and cross slope by using sensors actuated by a taut reference line) to trim the surface of the subgrade or borrow area. Trim the subgrade to the cross-section shown in the Contract

Documents. Trim borrow areas to the profile established by the Contractor. The trimmed subgrade or borrow area must be uniformly compacted, and trimmed to the required line and grade.

The Engineer may waive the use of automatically controlled equipment on irregular areas. In such cases, trim the subgrade or borrow area by wetting, blading, and rolling.

Maintain the subgrade or borrow area as prepared. Take the necessary measures to provide proper drainage at all times. If they develop, correct defects in the subgrade or borrow area.

b. Application of the Lime.

(1) Application of Pebble Quicklime. Apply the pebble quicklime uniformly across the surface of the prepared subgrade or borrow area. Scarify the prepared area to a minimum depth of 100 mm and a maximum depth of approximately 25 mm less than the specified depth of lime treatment. The specified depth of lime treatment for in-place areas is designated in the Contract Documents. The Contractor will determine the depth of lime treatment for off-site areas.

Perform the scarification with positive depth control equipment. The Engineer may permit the use of a motor grader scarifier on a performance basis. Do not use a plow or disc for the scarification.

Pebble quicklime that is scarified into the soil may be held in that condition overnight only if no additional water is added. Replace any pebble quicklime lost to environmental conditions (wind or rain) while in this state. To determine the amount of pebble quicklime lost, conduct a pH test according to the requirements of ASTM C 977.

(2) Application of Hydrated Lime. Before the lime is applied to the prepared subgrade in-place or off-site borrow area, scarify the prepared area to a minimum depth of 100 mm and a maximum depth of approximately 25 mm less than the specified depth of lime treatment. The specified depth of lime treatment for in-place areas is designated in the Contract Documents. The Contractor will determine the depth of lime treatment for off-site areas.

Perform the scarification with positive depth control equipment. The Engineer may permit the use of a motor grader scarifier on a performance basis. Do not use a plow or disc for the scarification.

Apply hydrated lime to the scarified areas as a slurry, using a pressurized system with spray nozzles. The mixing of the hydrated lime slurry must result in a consistent lime concentration. The concentration of the hydrated lime slurry must allow the application of the correct quantity of lime without adding an undue quantity of excess moisture to the mixture. Apply the hydrated lime slurry the same day it is mixed.

Slaking pebble quicklime at the jobsite to manufacture hydrated lime slurry is allowed according to the requirements of **Section 2000**.

The Engineer may allow the lime slurry (resulting from either hydrated lime or slaked pebble quicklime) be held overnight (no more than 24 hours) in a closed storage container with proper agitation. Measurable settling of the mixture will result in rejection of the material.

c. Adding Water. Add water as necessary to hydrate pebble quicklime or facilitate mixing of the hydrated lime slurry. Add the water uniformly to the mixture. Add water as necessary during the initial mixing operation to provide moisture content above the optimum moisture content of the raw soil being treated of 8 percent for hydrated lime, or 10 percent for dry process pebble quicklime.

Measure the moisture content immediately after the mixing is completed, and before the sealing or compacting.

d. Preliminary Mixing. Mix the lime, soil, and water to the depth and width specified in the Contract Documents (to the depth and width determined by the Contractor for off-site borrow areas). For projects containing more than 16 000 square meters of manipulation, positively control the depth of mixing to maintain the specified depth, ± 12 mm. Use equipment with positive depth control that can maintain cutting or mixing heads in a fixed position relative to the wheels or tracks of the machine carrying the head.

While mixing, do not disturb the roadbed or borrow area beyond the specified limits of the lime treatment.

Continue mixing until 95% of the mixture passes the 50 mm sieve, using the test procedure described in KT-Lime, or a minimum of 2 passes is complete.

e. Aging. Seal the mixture to prevent moisture loss by lightly rolling with a pneumatic-tired roller. Blade the surface to promote shedding of water.

(1) Material Mixed In-Place. Maintain the mixture in this condition for a minimum of 24 hours prior to commencing final mixing.

(2) Material Mixed in a Borrow Area. Maintain the mixture in this condition until the mixture is ready to be used. Keep the surface moist by sprinkling with water.

If the mixture is not used within 14 days of the preliminary mixing, add 1 percent lime by mass of raw soil, in the final mixing operation. If the Contractor knows that his operations will not use the mixture within 14 days, the Contractor may reduce rate of lime applied in the initial application by 1 percent, and add that 1 percent in the final mixing.

f. Final Mixing. After the initial mixing and aging is completed, re-mix the mixture to the specified depth (± 12 mm) and width until 95% of the mixture passes the 37.5 mm sieve and 40% passes the 4.75 mm sieve using the test procedure described in KT-Lime. Periodic mixing over an interval of time is allowed to facilitate the breakdown in particle size. The mixing operations must eliminate all lime pebbles or lime clumps, except for insoluble inert material, before the compaction operation starts.

While mixing, do not disturb the roadbed or borrow area beyond the specified limits of the lime treatment.

Use additional water as necessary during the final mixing to obtain the specified moisture content for the mixture.

g. Compaction of the Mixture. If the material is mixed in-place, compact the material after completing the required mixing.

If the material is mixed off-site, excavate and haul the material to the project site. Place the material on the prepared and trimmed surface, and compact the material.

Compact the mixture to comply with the requirements of Type B compaction, MR-3-3 moisture control, **Section 210**. Blade the mixture as necessary to eliminate irregularities in the surface during the compaction operations. Add water as necessary during the compaction operations to maintain the specified moisture content.

h. Finishing and Curing the Lime Treated Subgrade. After the mixture is compacted, use automatic grade controlled equipment (accomplish control of grade and cross slope by using sensors actuated by a taut reference line) to trim the lime treated subgrade to the specified lines and grades. Where the use of automatic grade control equipment is impractical, use a motor grader to trim the lime treated subgrade to the specified lines and grades. Compact the trimmed surface with a pneumatic-tired roller.

After the compacted mixture is finished, cure the lime treated subgrade for 7 days. Cure the lime treated subgrade by the keeping the finished surface moist with water. Do not allow vehicles or equipment (other than watering equipment) on the finished lime treated subgrade during the curing period.

The Contractor has the option of applying a bituminous prime coat instead of keeping the finished surface moist with water. If this option is chosen, apply either SS-1, CSS-1, or MC-250 at the rate of 1 L per square meter of surface. Multiple light applications may be necessary to obtain the specified rate of application without run-off.

If a base course or subbase is constructed upon the lime treated subgrade, the curing period may be reduced to whatever period of time is necessary for the lime treated subgrade to gain sufficient strength to support the construction and hauling equipment. If a base course or subbase is constructed on the lime treated subgrade, the first lift of the base or subbase is considered the curing medium. Repair any damage to the lime treated subgrade because of the construction of the base course or subbase.

i. Seasonal Limitations. Do not conduct lime treatment operations if the ambient air temperature is below 5°C, or the soil is frozen.

(1) Projects with Rigid Pavement. If possible, cover the finished lime treated subgrade with pavement before it is subjected to freezing. If the lime treated subgrade is not covered by pavement and is subjected to freezing, re-compact the lime treated subgrade before placing any pavement. The Engineer will determine the extent of the re-compaction.

(2) Projects with Flexible Pavement. If possible, cover the finished lime treated subgrade with at least 100 mm (thickness) of pavement before it is subjected to freezing. If lime treated subgrade is not covered with at least 100 mm of pavement and is subjected to freezing, add additional lime, if necessary, and re-compact the lime treated subgrade before placing any pavement. The Engineer will determine (by laboratory or field tests) the additional quantity of lime to add, if any, and the extent of the re-compaction.

305.4 MEASUREMENT AND PAYMENT.

The Engineer will measure the accepted lime by the megagram (to the 0.1 Mg). If bagged lime is used, the Engineer will use the net mass marked on the bag by the manufacturer for the measurement. If certified railroad car or certified truck quantities are used, the Engineer will use the net mass of the lime for the measurement.

The Engineer will measure the completed and accepted manipulation of the lime treated subgrade by the square meter (to the nearest m²). Material placed beyond the neat lines indicated in the Contract Documents is not measured for payment without the Engineer's authorization.

The Engineer will measure the accepted quantity of water used for lime treated subgrade by the megagram (to the nearest 0.1 Mg) by means of calibrated tanks or water meters. The Engineer will measure water used for subgrade preparation, and mixing and compacting the lime treated subgrade. The Engineer will not measure water used for curing the lime treated subgrade, dust control, water wasted through the Contractor's negligence, or water in excess of the quantity required for mixing and compacting the lime treated subgrade.

If the Contractor opts to use bituminous material to cure the lime treated subgrade, the Engineer will not measure the bituminous material for payment.

The Engineer will not measure, for payment, the lime, manipulation, or water used for adding additional lime or re-compaction if:

- the pebble quicklime that is held (in the soil, but not mixed) overnight is lost due to environmental conditions
- the off-site borrow area mixture is not used within 14 days of the preliminary mixing
- the lime treated subgrade is not covered with pavement before it is exposed to freezing temperatures

Payment for "Lime," "Manipulation for Lime Treated Subgrade," and "Water for Lime Treated Subgrade" at the Contract unit prices is full compensation for the specified work.

05-16-01 M&R(SP) (AJG)

ADDENDUM

SIEVE ANALYSIS FOR ACCEPTANCE OF LIME TREATED SOILS (Kansas Test Method KT-Lime)

a. SCOPE.

This method of test covers the procedure for determining the amount of material retained on the 50, 37.5 and 4.75 mm sieves. This test is performed as an acceptance test for lime treated soils.

b. REFERENCED DOCUMENTS.

- b.1.** AASHTO M 92; Wire-Cloth Sieves for Testing Purposes
- b.2.** AASHTO M 231; Balances Used in the Testing of Materials

c. APPARATUS.

- c.1.** The balance shall conform to the requirements of AASHTO M 231 for the class of general purpose balance required for the principal sample mass of the sample being tested.
- c.2.** Sieves meeting AASHTO M 92 of specified sizes for the aggregate being tested. A nest of sieves shall include the 50 mm, 37.5 mm, 12.5 mm, 9.5 mm and 4.75 mm. The 12.5 mm and 9.5 mm sieves are used only to protect the 4.75 mm from overloading.

d. TEST SAMPLES.

Obtain samples of road mixed material from the subgrade or borrow area. The original sample before splitting shall weigh approximately 35 kg.

Reduce sample by quartering or splitting to a mass of not less than 15 000 g. Exercise extreme care to prevent segregation and/or degradation during the splitting operation.

e. TEST PROCEDURE.

The sample prepared as above shall be accurately weighed and sieved through the sieve series in the applicable specification. Conduct the sieving operation by means of a lateral and vertical motion accompanied by a jarring action to keep the sample moving continuously over the surface of the sieve. (In no case shall fragments in the sample be turned or manipulated through the sieve by hand nor shall a coin or other foreign object be placed in the sieve along with the sample to aid in the sieving operation.) Continue sieving until no more than 1 percent by mass of the residue passes any sieve during one minute. When mechanical sieving is used, the thoroughness of sieving shall be tested by using the hand method of sieving as described above. Before using a mechanical shaker, in addition to hand shaking, for production control, comparison tests should be run to check the results against hand shaking only. The time on the mechanical shaker should be adjusted so that the same results are obtained as by the hand method.

In no case shall the fraction retained on any sieve at the completion of the sieving operation weigh more than 6 kg/m^2 of sieving surface. (This amounts to 200 grams on the 200 mm diameter sieve.) This may be accomplished by removing excess material from the screen, placing it in a suitable container, sieving the material remaining on the screen, then sieving the material retained in the container.

f. CALCULATIONS.

The percent retained on the 50, 37.5 and 4.75 mm sieves* is calculated as follows:

$$\text{Percent Retained} = \frac{100(A)}{B}$$

Where: A = Mass of the retained fraction of the original sample determined to within 0.1 percent of the original sample mass as obtained by sieving over the specified sieve.

B = Original mass of sample.

* - Be sure to include the quantities found on the 12.5 mm and 9.5 mm sieves to the 4.75 mm sieve mass when calculating percent retained.