

**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 (Set Price)

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. 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.

If pebble quicklime is used, slaking pebble quicklime at the jobsite to manufacture hydrated lime slurry is required according to the requirements of **Section 2000**.

Apply hydrated lime to the scarified areas as 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.

Check the application rate by blading a flat area in the path of the liming application; placing a planar surface with a minimum surface area of 0.09 m² (e.g. a straight-sided pan) on the prepared area, and allowing the liming train to pass over the surface. Weigh the test surface before and after the lime application and calculate the application rate. Other methods to check the lime application rate must be approved by the Field Engineer. Apply the hydrated lime slurry the same day it is produced.

Verify the concentration of the lime suspension at the minimum rate of 1 per day or 1 per mixed batch, whichever is greater; with the use of the attached Table I: Strength of Lime Suspensions; and a volume measuring device and scale. Alternatively, the use of KT-62, Percent Solids of Lime Slurry, may be used.

The Engineer may allow the hydrated 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 facilitate mixing of the hydrated lime slurry and soil. 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.

Measure the moisture content (using KT-11) 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 m² 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-42, and 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-42. 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 m^2 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 40°F, or the soil is frozen.

(1) Projects with Rigid Pavment. 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, mixing, compacting and curing the lime treated subgrade. The Engineer will not measure water used for 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 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" and "Manipulation for Lime Treated Subgrade," at the Contract unit prices and for "Water for Lime Treated Subgrade" at the Contract set price is full compensation for the specified work.

Table I: Strength of Lime Suspensions

Lb. per gal. of suspension	Grams per liter, suspension	Grams Ca (OH) ₂ per liter, suspension	Lb. Ca (OH) ₂ per gallon, suspension
8.41	1,010	15.46	.135
8.50	1,020	32.24	.272
8.58	1,030	49.02	.412
8.66	1,040	65.81	.546
8.75	1,050	82.59	.691
8.83	1,060	99.37	.830
8.91	1,070	116.15	.962
8.99	1,080	132.14	1.106
9.08	1,090	149.32	1.244
9.16	1,100	166.50	1.392
9.25	1,110	182.35	1.517
9.33	1,120	200.85	1.679
9.41	1,130	216.71	1.816
9.50	1,140	233.89	1.948
9.58	1,150	251.07	2.09
9.66	1,160	268.24	2.23
9.75	1,170	285.42	2.38
9.85	1,180	302.60	2.52
9.91	1,190	319.78	2.68
10.00	1,200	336.96	2.80
10.08	1,210	354.14	2.94
10.16	1,220	371.31	3.09
10.24	1,230	388.49	3.24
10.33	1,240	405.67	3.39
10.41	1,250	424.17	3.52
10.49	1,260	437.38	3.71
10.58	1,270	453.24	3.86
10.66	1,280	470.42	4.00
10.74	1,290	488.92	4.15
10.83	1,300	504.77	4.29
10.91	1,310	523.27	4.45
11.00	1,320	541.77	4.60
11.08	1,330	557.63	4.73
11.16	1,340	574.81	4.90
11.25	1,350	591.99	5.04
11.33	1,360	607.84	5.18
11.41	1,370	623.70	5.32
11.50	1,380	639.56	5.49
11.58	1,390	655.41	5.62
11.66	1,400	673.91	5.78
11.75	1,410	692.41	5.95
11.83	1,420	710.91	6.09
11.91	1,430	726.77	6.22
12.00	1,440	742.63	6.37
12.08	1,450	759.81	6.51