

2014 Q1 – PWD Proposed Rule Changes

PROPOSED VERSION for 1st Quarter 2014 Posting

Standard Specifications Criteria Manual – NEW Spec 277S

Earliest Possible Adoption: February 2014

Item No. 277S

Lime-Cement Treatment (Road-Mixed)

277.1 Description

Mix and compact water, lime, cement and subgrade or base (with or without pulverized reclaimed asphalt concrete pavement) in the roadway.

277.2 Submittals

The submittal requirements of this specification item may include:

- A. Mix design information (Transportation Criteria Manual Section **3.2.1C Lime-Cement Stabilization**).
- B. Type of lime and rate of application, type of cement and rate of application,
- C. Equipment proposed for use in proof rolling, pulverizing, mixing, placement and compaction operations

277.3 Materials

Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of proposed material sources and of changes in material sources. The Engineer will verify that the specification requirements are met before the sources can be used. The Engineer may sample and test project materials at any time before compaction.

- A. Soil shall consist of approved material, free from vegetation or other objectionable matter, encountered in the existing roadway and/or other acceptable embankment or borrow material selected for use in preparation of the roadway in accordance with this specification.

Lime. The lime shall meet the requirements of the most current TXDOT Department Materials List.(DMS)**Cement.** The cement shall meet the requirements of the most current TXDOT Department Materials List.(DMS) The Contractor, at his option, may use bag or bulk cement.**B. Flexible Base.** When required, furnish base material that meets the requirements of Item 210, "Flexible Base," for the type and grade shown on the plans, before the addition of lime or cement.

Water. Mixing water shall conform to the requirements of Item 403S.3.B, "Mixing Water."

Asphalt. When permitted for curing purposes, furnish asphalt or emulsion in accordance with Item 301S.3, "Asphalts, Oils, and Emulsions," as shown on the plans or as directed.

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277.4 Mix Design

The Engineer will determine the target lime-cement content and optimum moisture content in accordance with the most current TXDOT test procedures. The mix design will produce a stabilized mixture that meets the minimum average 7-day compressive strength of 160 pounds per square inch (1100 kilopascals) and no more than 400 pounds per square inch (2750 kilopascals) using the unconfined compression testing procedures described in the most current TXDOT test procedures. . Subsequent mix designs or partial designs necessitated by changes in the material will be at project expense, Mix design changes requested by the Contractor will be entirely at the Contractor's expense.

277.5 Equipment

Provide machinery, tools, and equipment necessary for proper execution of the work. Provide rollers in accordance with Item 234S, "Rolling." Provide proof rollers in accordance with Item 236S, "Proof Rolling," when directed.

- A. Storage Facility.** Store quicklime, dry hydrated lime, and cement in closed, weatherproof containers.
- B. Lime Slurry Equipment.** Use slurry tanks equipped with agitation devices to slurry hydrated lime, quicklime, or cement on the project or other approved location. The Engineer may approve other slurring methods.
- C. Pump.** Provide a pump for agitating the slurry when the distributor truck is not equipped with an agitator. Equip the distributor truck with a sampling device in accordance with the most current TXDOT test procedures, when using commercial lime slurry.
- D. Pulverization Equipment.** Provide pulverization equipment that:
 - cuts and pulverizes material uniformly to the proper depth with cutters that will plane to a uniform surface over the entire width of the cut,
 - provides a visible indication of the depth of cut at all times, and
 - uniformly mixes the materials

277.6 Construction

Construct each layer uniformly, free of loose or segregated areas and with the required density and moisture content. Provide a smooth surface that conforms to the typical sections, lines, and grades shown on the plans or as directed.

- A. Preparation of Subgrade or Existing Base for Treatment.** Before treating, remove existing asphalt concrete pavement in accordance with pertinent Items and the plans or as directed. Shape existing material in accordance with applicable bid items to conform to typical sections shown on the plans and as directed.

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When shown on the plans or directed, proof-roll the roadbed in accordance with Item 236S, "Proof Rolling," before pulverizing or scarifying existing material. Correct soft spots as directed.

When new base material is required to be mixed with existing base, deliver, place, and spread the new material in the required amount per station. Manipulate and thoroughly mix new base with existing material to provide a uniform mixture to the specified depth before the addition of lime or cement.

- B. Pulverization.** Pulverize or scarify existing material after shaping so that 100% passes a 2-1/2-in. sieve. If the material cannot be uniformly processed to the required depth in a single pass, excavate and windrow the material to expose a secondary grade to achieve processing to plan depth.
- C. Application and Mixing of Lime–Cement.** When treating with Lime-Cement, apply, mix, and cure lime first unless otherwise directed.

Start treatment operations only when the air temperature is at least 35°F and rising or is at least 40°F. The temperature will be taken in the shade and away from artificial heat. Suspend operations when the Engineer determines that weather conditions are unsuitable.

Minimize dust and scattering by wind. Do not apply lime or cement when wind conditions, in the opinion of the Engineer, cause blowing lime or cement to become dangerous to traffic or objectionable to adjacent property owners.

During the interval between application and mixing, sections treated with hydrated lime or cement that have been exposed to the open air for a period of 6 hr. or more, or that experience excessive loss due to washing or blowing, will not be accepted for payment.

After mixing and required curing, the Engineer will sample the mixture at roadway moisture and test in accordance with the most current TXDOT test procedures, to determine compliance with the gradation requirements in Table 1.

Table 1
Gradation Requirements (Minimum %Passing)

Sieve Size	Base	Subgrade
1-3/4 in.	100	100
3/4 in.	85	85
No. 4	-	60

- 1. Application of Lime.** Uniformly apply lime using dry or slurry placement as shown on the plans or as directed. Add lime at the percentage determined in the

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most current TXDOT test procedures Apply lime only on an area where mixing can be completed during the same working day. When pebble grade quicklime is placed dry, mix the material and lime thoroughly at the time of lime application. *Use of quicklime can be dangerous. Inform users of the recommended precautions for handling and storage.*

- a. **Dry Placement.** Before applying lime, bring the prepared roadway to optimum moisture content. Distribute the required quantity of hydrated lime or pebble-grade quicklime with approved equipment. Only hydrated lime may be distributed by bag. Do not use a motor grader to spread hydrated lime.
- b. **Slurry Placement.** Provide slurry free of objectionable materials, at or above the approved minimum dry solids content, and with a uniform consistency that will allow ease of handling and uniform application. Deliver commercial lime slurry to the jobsite or prepare lime slurry at the jobsite or other approved location by using hydrated lime or quicklime, as specified.

Distribute slurry uniformly by making successive passes over a measured section of roadway until the specified lime content is reached. Uniformly spread the residue from quicklime slurry over the length of the roadway being processed unless otherwise directed.

2. **Mixing of Lime.** Begin mixing within 6 hr. of lime application. Thoroughly mix the material and lime using approved equipment. Allow the mixture to mellow for 1 to 4 days as directed. When pebble-grade quicklime is used, allow the mixture to mellow for 2 to 4 days as directed. Sprinkle the treated materials during the mixing and mellowing operation, as directed, to achieve adequate hydration and proper moisture content. After mellowing, resume mixing until a homogeneous, friable mixture is obtained.
3. **Application of Cement.** Uniformly apply cement in dry form unless otherwise approved. Apply at the percentage determined in the most current TXDOT test procedures

It shall be the responsibility of the Contractor to (1) regulate the sequence of his work, (2) process a sufficient quantity of material to provide full depth as indicated on the Drawings, (3) use the proper amount of Portland cement, that is established by the approved job mix design or approved by the Engineer or designated representative and (4) maintain the work and rework the courses as necessary to meet the design strength requirements.

The cement shall be spread by an approved spreader or by bag distribution. It shall be distributed at a uniform rate and in such a manner as to reduce to a minimum the scattering of cement by wind. Cement treatment shall not be mixed or placed when the

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wind velocity exceeds 15 miles (25 kilometers) per hour or when the air temperature is below 40°F (4°C) and falling, but may be mixed or placed when the air temperature is above 35°F (2°C) and rising. The temperature shall be taken in the shade and away from artificial heat. In any event cement treatment shall be mixed or placed only when weather conditions, in the opinion of the Engineer or designated representative, are suitable. If a bulk cement spreader is used, it shall be positioned with string lines or other approved method during spreading to insure a uniform distribution of cement. Do not use a motor grader to spread cement.

Cement shall be applied only in that area where the mixing, compacting and finishing operations can be continuous and completed in daylight within 6 hours of such application.

The percentage of moisture in the soil at the time of cement application shall not exceed the quantity that will permit uniform and intimate mixture of material and cement during dry mixing operations. The percentage of moisture in the soil at the time of cement application shall not exceed the optimum moisture content for the cement-stabilized mixture.

No equipment, except that used in spreading and mixing, will be allowed to pass over the freshly spread cement until it is mixed.

For lime-cement treatment, begin cement application within 4 days after the lime mixing operation has been completed unless otherwise approved.

- 4. Mixing of Cement.** Thoroughly dry-mix the material and cement using approved equipment until a loose, homogeneous mixture is obtained. After any required mixing of the material(s), the cement shall be dry mixed with the material(s) prior to the addition of water. Immediately after dry mixing, water shall be uniformly applied. After mixing, the mixture shall be in a loose, evenly spread state ready for compaction. The mixture shall be mixed and compacted in one (1) lift.

Add water as directed, to achieve adequate mixing and hydration moisture. The mixer shall be provided with means for the visible and accurate gauging of the water application. The water shall be uniformly applied through a pressure spray bar.

After the cement is spread, the mixing operation shall proceed as follows:

- a.** The mixer shall in one continuous operation: mix the air-dry material and cement to the full depth indicated on the Drawings, provide for the addition of water uniformly, thoroughly moist-mix the material, cement and water, spread the completed cement mixture evenly over the machine processed width of the subgrade, and leave it in a loose condition ready for immediate compaction.

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b. The stabilized cement mixture shall be compacted within 30 minutes of mixing.

D. Compaction. Compact immediately after mixing the last stabilizing agent. Use density control unless otherwise shown on the plans. Complete all compaction operations of each lift within 2 hr. of cement application.

E. Multiple lifts are permitted when shown on the plans or approved by the Engineer. Add water or aerate to bring each layer to the moisture content directed. Determine the moisture content of the mixture at the beginning and during compaction in accordance with the most current TXDOT test procedures.

Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least 1/2 the width of the roller unit. On super-elevated curves, begin rolling at the low side and progress toward the high side. Offset alternate trips of the roller. Operate rollers at a speed between 2 to 6 MPH as directed.

Rework, re-compact, and refinish material that fails to meet or that loses required moisture, density, stability, or finish before the next course is placed or the project is accepted. Continue work until specification requirements are met. Perform the work at no additional expense to the Department.

1. **Ordinary Compaction.** Roll with approved compaction equipment as directed. Correct irregularities, depressions, and weak spots immediately by scarifying the areas affected, adding or removing treated material as required, reshaping, and re-compacting.
2. **Density Control.** The Engineer will determine optimum roadway density for compaction control of completed sections in accordance with the most current TXDOT test procedures.

a. **Subgrade.** Compact to at least 95% of the maximum density determined in accordance with the most current TXDOT test procedures unless otherwise shown on the plans.

b. **Base.** Compact the bottom course to at least 95% of the maximum density determined in accordance with the most current TXDOT test procedures unless otherwise shown on the plans.

F. Reworking a Section. Reworking includes loosening, adding material or removing unacceptable material if necessary, mixing as directed, compacting, and finishing. The Contractor has the option of removing failing material and replacing it with acceptable material. Add lime and cement when reworking lime–cement treated sections, at the rate of at least 25% of the percentage determined in the most current TXDOT test procedures as directed. When re-pulverization of the failing section is not achievable, remove failing material and replace with acceptable treated material.

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When density control is specified, determine a new maximum density of the reworked material in accordance with the most current TXDOT test procedures, Compact as directed.

- G. Finishing.** Immediately after completing compaction of the final course, clip, skin, or tight-blade the surface with a maintainer or subgrade trimmer to a depth of approximately 1/4 in. Remove loosened material and dispose of it at an approved location. Seal the clipped surface immediately by rolling with a pneumatic tire roller until a smooth surface is attained. When finishing treated base, use a steel wheel roller before rolling with the pneumatic tire roller. Add small increments of water as needed during rolling. Shape and maintain the course and surface in conformity with the typical sections, lines, and grades. Complete finishing operations within 2 hr. after final compaction.
- G. Curing.** Cure by maintaining in a thorough and continuously moist condition by sprinkling or cure with an asphalt material applied at a rate of 0.05 to 0.20 gal. per square yard as approved. Do not allow equipment on the finished course during curing except as required for sprinkling, unless otherwise approved.

Apply subsequent courses within 14 calendar days of completion of final compaction of the underlying treated course unless otherwise approved.

277.7 Sampling and Testing

The lime-cement conditioned mixture shall be tested daily at the Project site for conformance to specification requirements. The Engineer or designated representative shall determine sample locations based on the Contractor's anticipated production. Each day's anticipated production shall be sectioned into three (3) equal, single-pass, sub-area lots. Each day's sample locations shall be equally distributed over the three (3) sub-areas. Also, no more than one location of the three (3) sub-areas is to be located in an irregular shaped area such as a cul-de-sac.

When, in the opinion of the Engineer or designated representative, test results appear unrepresentative, additional testing may be authorized. Retesting due to failures or to resolve unrepresentative results will be at the expense of the Contractor and the results of the retesting shall be averaged with the results of the original testing. If the results of retesting indicate that the original testing was erroneous, the original test results will be discarded.

The Engineer will obtain samples of completed work to conduct the tests from the most current TXDOT test procedures:

The contractor shall repair areas disturbed while obtaining samples.

Measurement ^{ALime}. When lime is furnished in trucks, the weight of lime will be determined on certified scales, or the Contractor must provide a set of standard platform truck scales at a location approved by the Engineer. Scales must conform to the requirements of the most

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current TXDOT specification. When lime is furnished in bags, each bag must indicate the manufacturer's certified weight. Bags varying more than 5% from that weight may be rejected. The average weight of bags in any shipment, as determined by weighing 10 bags taken at random, must be at least the manufacturer's certified weight.

1. Hydrated Lime.

- a. **Dry.** Lime will be measured by the ton (dry weight).
- b. **Slurry.** Lime will be measured by the ton (dry weight) of the hydrated lime used to prepare the lime slurry at the jobsite.

2. Commercial Lime Slurry. Lime slurry will be measured by the ton (dry weight) as calculated from the minimum percent dry solids content of the slurry, multiplied by the weight of the slurry in tons delivered.

3. Quicklime.

- a. **Dry.** Lime will be measured by the ton (dry weight).
- b. **Slurry.** Lime slurry will be measured by the ton (dry weight) of the quicklime used to prepare the slurry, multiplied by a conversion factor of 1.28 to give the quantity of equivalent hydrated lime, which will be the basis of payment.

BCement. Cement will be measured by the ton (dry weight). When cement is furnished in trucks, the weight of cement will be determined on certified scales, or the Contractor must provide a set of standard platform truck scales at a location approved by the Engineer. Scales must conform to the requirements of the most current TXDOT specification.

When cement is furnished in bags, each bag must indicate the manufacturer's certified weight. Bags varying more than 5% from that weight may be rejected. The average weight of bags in any shipment, as determined by weighing 10 bags taken at random, must be at least the manufacturer's certified weight.

Cement slurry will be measured by the ton (dry weight) of the cement used to prepare the slurry at the job site or from the minimum percent dry solids content of the slurry, multiplied by the weight of the slurry in tons delivered.

C. Lime-Cement Treatment. Lime-Cement treatment will be measured by the square yard of surface area. The dimensions for determining the surface area is established by the widths shown on the plans and the lengths measured at placement.

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277.9 Payment

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid in accordance with Section 277.8.A, "Lime"; Section 277.8.B, "Cement"; or Section 277.8.C, "Lime-Cement Treatment."

Furnishing and delivering new base will be paid for in accordance with Section 210S, "Flexible Base" Mixing, spreading, blading, shaping, compacting, and finishing new or existing base material will be paid for under Section 277.8.C, "Lime-Cement Treatment." Removal and disposal of existing asphalt concrete pavement will be paid for in accordance with pertinent Items.

Asphalt used solely for curing will not be paid for directly, but will be subsidiary to this Item. Asphalt placed for curing and priming will be paid for under Item 301S "Asphalts, Oils and Emulsions"

Lime and cement used for reworking a section in accordance with Section 277.6.F, "Reworking a Section," will not be paid for directly but will be subsidiary to this Item.

Sprinkling and rolling, except proof rolling, will not be paid for directly but will be subsidiary to this Item unless otherwise shown on the plans. When proof rolling is shown on the plans or directed by the Engineer, it will be paid for in accordance with Item 236S, "Proof Rolling."

Where subgrade is constructed under this Contract, correction of soft spots in the subgrade or existing base will be at the Contractor's expense. Where subgrade is not constructed under this Contract, correction of soft spots in the subgrade or existing base will be in accordance with pertinent Items.

- A. **Lime.** Lime will be paid for at the unit price bid for "Lime" of one of the following types:
- **Hydrated Lime (Dry)**
 - **Hydrated Lime (Slurry)**
 - **Commercial Lime Slurry**
 - **Quicklime (Dry)**
 - **Quicklime (Slurry)**
- B. **Cement.** Cement will be paid for at the unit price bid for "Cement" of the type specified. This price is full compensation for furnishing cement.
- C. **Lime-Cement Treatment.** Lime - Cement treatment will be paid for at the unit price bid for "Lime-Cement Treatment," "and for the depth specified. No payment will be made for thickness or width exceeding that shown on the plans. This price is full compensation for shaping existing material, loosening, mixing, pulverizing, spreading, applying lime and cement, compacting, finishing, curing including curing materials, water, drying, blading, shaping and maintaining, replacing, disposing of loosened materials, processing, hauling, reworking if required, preparing secondary subgrade,

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equipment, labor, tools, and incidentals.

The placement of Lime-Cement Treatment as prescribed above will be measured by the square yard of processed, approved quantities completed based on the inspected, validated dimensions from the Documentation submitted. Dimensions include the length(s) (feet) and the width(s) (feet) and weights of materials include the tons of lime and cement placed in dry weight for the corresponding areas. The stabilized area(s) are to be stated in Square Yard (sq-yd) units at the designated thickness in inches as follows:

Payment will be made under:

Pay Item No. 227-A:	Lime for Lime-Cement Treatment	Per Ton
Pay Item No. 227-B:	Cement for Lime-Cement Treatment	Per Ton
Pay Item No. 227-C:	Lime-Cement Treatment, (___ in. Thick)	Per Square Yard

End

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RELATED CROSS REFERENCE MATERIALS - Continued

Special Specification Item SS277, "Removal of Portland Cement Concrete"

City of Austin Standard Contract Documents

<u>Designation</u>	<u>Description</u>
01500	Temporary Facilities
01550	Public Safety and Convenience

The Code of the City of Austin, Code of Ordinances, Volume 1

<u>Designation</u>	<u>Description</u>
Article 15-12-166	Permit Required
Article 15-12-173	Conditions for Permit Issuance
Article 15-12-174	Permit Term

City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 130S	Borrow
Item No. 203S	Lime Treatment for Materials in Place
Item No. 210S	Flexible Base