

SECTION 512 - PRESSURE GROUTING CONCRETE PAVEMENT

512.01--Description. This work consists of locating unstable concrete pavement, drilling of holes and the pumping of a slurry type grout mixture to stabilize and underseal the pavement. The grout mixture shall form a hard and insoluble mass that will effectively fill the voids. Pavement that remains unstable after an initial undersealing and stabilizing attempt shall be re-grouted as directed by the Engineer.

When a hot mix asphalt overlay is required, it shall be the Contractor's responsibility to schedule operations in such a manner that the first course of overlay will be placed at the earliest practicable time and no later than fourteen days after the pavement has been stabilized.

When designated on the plans, this work shall also consist of drilling holes in the shoulder adjacent to cracks at the edge of the pavement and the pumping of a slurry type grout mixture to fill the cracks to the surface of the cement treated shoulder. Unless otherwise specified, Type 1 grout shall be used. If in the

Engineer's opinion, the type of grout being used proves to be unsatisfactory, the Contractor shall switch to a Type 5 grout at no change in contract price.

512.02--Materials. shall meet the follows requirements:

Materials used in the work shall meet the requirements specified in the following sections or subsections:

Portland Cement Types I or III	701
Calcium Chloride, Type I	714.02*
Fly Ash, Class C or F	714.05
Water	714.01.1 and 714.01.2
Fine Aggregate	703.18**
Limestone Dust	512.02.1

* The Materials Engineer may approve other commercially available accelerators which may be substituted for calcium chloride.

** Fine aggregate shall meet the requirements of Subsection 703.18 except that mortar making properties are not required.

512.02.1--Limestone Dust. The source of the material shall be approved by the Engineer and meet the following gradation requirements:

SIEVE	PERCENT PASSING
No. 30	95-100
No. 200	20-100

512.02.2--Proportioning Grout Mixture. The bid item will designate the type or types of grout mixture which shall consist of proportions listed in the table below. The mixing water shall be that quantity which will produce a grout of such consistency that the time of efflux from the flow cone will be a minimum of 16 seconds and a maximum of 22 seconds. Upon approval of the Engineer, a wetting agent may be added to the water to reduce surface tension and increase flowability of the grout mixture.

The consistency will be determined by Mississippi Test Method MT-56. Cement, fly ash, limestone dust, and/or fine aggregate may be added in the proper proportions to a mixed batch to produce the required consistency provided the cement factor is not reduced to less than specified.

**GROUT MIXTURES
PERCENT BY WEIGHT OF DRY MATERIALS**

DRY MATERIALS	TYPES					
	1	2	3	4	5	6
Cement	25	25	25	25	30	25
Limestone Dust	25	75	50			
Fly Ash	25		25	70		
Fine Sand	50	50				75
Calcium Chloride	*	*	*	*	*	

* As prescribed in Subsection 512.03.1

It shall be the Contractor's responsibility to have the grout mixture in its final position within one hour after adding the mixing water.

512.03--Construction Requirements.

512.03.1--Weather Limitations. Pressure grouting shall not be performed when the subgrade contains an abnormal amount of moisture as evidenced by standing water on the pavement or in joints or cracks. The air temperature shall be above 40°F in the shade or 35°F and rising before starting any grout pumping operation.

The following temperature ranges shall control the quantity of calcium chloride to be included in the grout mixture:

ATMOSPHERIC TEMPERATURE	PERCENT CALCIUM CHLORIDE BY WEIGHT OF CEMENT
35 - 55°F	5
56 - 69°F	4
70 - 79°F	3
80 - 89°F	2
90°F and above	1

The quantity shall be as prescribed unless otherwise directed by the Engineer. Upon approval of the Engineer, the calcium chloride may be reduced in quantity or eliminated as required with the use of Class "C" fly ash. The calcium chloride shall be thoroughly pre-mixed in the mixing water.

512.03.2--Equipment. The equipment shall be that customarily used in pressure grouting of earthen embankments or mud-jacking of concrete pavement. It shall consist of no less than the following:

- (a) Air compressors of sufficient capacity for operating pneumatic equipment.
- (b) Pneumatic equipment with a drill size that is compatible with the size of

the pump discharge nozzle. The equipment shall be in satisfactory operating condition and operated in such a manner as to prevent unnecessary damage to the pavement.

- (c) Equipment for accurately measuring and proportioning by volume or weight the component materials of the grout.
- (d) A mixer capable of thoroughly mixing the grout in an approved manner. A batch type and concrete mixing trucks may be used for types 2 and 3 grout mixtures. A colloidal mixer must be used for Types 1, 4 and 5 grout mixtures.
- (e) A positive action pump capable of forcing grout into voids and cavities beneath the pavement. The pump shall be capable of producing a discharge pressure range of 50 to 200 pounds per square inch of the end of the discharge pipe. The pumping system shall be equipped with a pressure gauge so that any instantaneous change in pressure can be detected by the inspector.
- (f) A stop watch and flow cone conforming to the dimensions and other requirements set out in the Department's SOP for Mississippi Test Method: MT 56.
- (g) Testing equipment shall consist of a tandem axle truck with dual wheels and the rear axles shall be loaded to 50 kips evenly distributed. The measuring equipment shall consist of no less than two gauges mounted on a measuring device that is capable of detecting movement of 0.001 of an inch. A driver and sufficient personnel to assist in preliminary testing, when required by the contract, and stability testing.
- (h) Equipment to measure pavement lift shall consist of no less than four gauges mounted on a measuring device or devices that is capable of detecting movement on each side of a joint or crack and the adjoining shoulder simultaneously. The equipment shall make such measurements to 0.001 of an inch.

512.03.3--Testing.

512.03.3.1--General. When testing is required, it is intended to locate all pavement having a deflection exceeding 0.030 of an inch. Testing may begin as early as 4:00 A.M. and continue as long as the surface temperature of the pavement remains below 85°F.

512.03.3.2--Preliminary Testing by the Department. When the pavement has been tested and marked by the Department, preliminary testing will not be required by the Contractor.

512.03.3.3--Preliminary Testing by the Contractor. When the contract includes a unit bid price for testing and it has not been performed by the Department, all of the project or designated areas shall be tested by the Contractor. Testing shall be performed as follows:

One set of gauges will be positioned on each side of a joint or crack near the pavement edge. The gauges will be zeroed with no load on either side of the joint or crack. The test truck will then be moved into position and stopped with the center of the nearest test axle about one foot from the joint or crack and the outside test wheel about one foot from the pavement edge. The gauges will be read and the test truck will then be moved across the joint or crack to a similar position for a second reading of the gauges. This operation will be repeated for each joint or crack to be tested. The inspector will be responsible for reading the gauges and subsequent recording. All locations with movement of more than 0.030 of an inch will require pressure grouting.

When testing shoulders, gauge positioning and testing shall be the same as indicated above for roadway pavement. The Engineer may adjust the position of the gauges to meet field conditions.

512.03.3.4--Stability Testing. After the designated areas have been pressure grouted in accordance with these specifications, they shall be retested in accordance with Subsection 512.03.3.3 when the contract includes a unit bid price for testing.

Any undersealed pavement with movement of 0.030 of an inch or more shall be re-grouted and tested as directed.

Any pavement which continues to show movement in excess of that specified after two properly performed groutings may be accepted, or the slab may be removed and replaced as directed by the Engineer.

512.03.4--Drilling Holes. The hole pattern and pumping sequence shown on the plans shall be used, except when modified to use drilling holes made from previous undersealing work. The Contractor may alter the hole pattern with the Engineer's approval. However, only the actual number of holes drilled will be measured for payment.

The holes shall be of a size and shape that best provide a positive seal for the pumping nozzle. The holes shall be drilled to a depth of approximately eight inches below the bottom of the concrete for the initial undersealing unless the Engineer approves an alternate depth. The number, depth and location of holes for undersealing after the initial operation shall be approved by the Engineer.

When pressure grouting cracks located in the shoulders at the edge of the pavement, the holes in the shoulders shall be located as shown on the plans or as

directed by the Engineer. These holes are to be drilled below the treated base.

512.03.5--Cleaning Holes. Prior to pumping the grout, compressed air shall be used to remove debris and to help provide a passage for the grout.

512.03.6--Pumping the Grout. The nozzle of the discharge hose shall be secured in the hole in a manner that provides a seal adequate to maintain the grout pressure underneath the slab. The nozzle end shall not extend below the bottom of the concrete. Pumping will continue until a clear flow of grout protrudes from an adjacent hole, joint or crack, or until the pavement begins to lift. This procedure will be repeated in other holes until all voids are supposedly filled. Plugging of holes during grouting operations will not be permitted.

Additional evidence that grouting should cease is a rapid rise of the pavement, or a rise of the adjacent shoulder. A minimum lifting of the pavement will generally be required to move grout into the cavities and voids, however, the lifting shall not exceed 0.050 of an inch. Movement of the pavement and adjacent shoulder will be monitored by the Contractor with equipment as required by Subsection 512.03.2(h). Care shall be taken not to crack the pavement by differential lifting. During pumping, very close attention shall be given to the lift measuring device to prevent excessive pumping pressures.

Moderate to major pavement cracks or pavement broken during the pumping operation due to the Contractor's negligence will be repaired or removed and replaced at the Contractor's expense.

512.03.7--Clean Up and Opening to Traffic. Deposits of mud and/or grout on the pavement or shoulders shall be removed and the surface cleaned before traffic is permitted on the section. Other debris, bags, spillage, etc., shall be removed from the right-of-way each day.

Traffic shall not use the undersealed pavement for at least three hours after grouting. Grouting operations shall cease at least three hours before sundown or earlier as necessary to permit the grout to harden at least three hours.

512.03.8--Permanently Sealing Holes. When pavement is not to be overlaid all grout shall be removed from the holes to the bottom surface of the concrete pavement and filled with a stiff sand-cement mixture or an approved quick setting patching material. Filled holes that ravel out or become damaged shall be repaired. All holes from previous undersealing work that were used by the Contractor shall also be similarly repaired at no cost to the Department.

512.03.9--Stability Tests. The test shall not be conducted until the undersealed pavement has been open to traffic for at least twelve hours. These tests shall be conducted in accordance with Subsection 512.03.3.4. Based upon these test results the pavement will be accepted or designated for further undersealing or

replaced as directed by the Engineer.

512.04--Method of Measurement. Holes drilled at locations and to the depths shown on the plans or directed by the Engineer will be measured per each. Additional holes required for subsequent undersealing operations will be measured per each.

Portland Cement incorporated into the grout mixture will be measured by the pound.

Calcium chloride incorporated into the completed work in accordance with the provisions of the contract will be measured by the pound.

When required, preliminary testing in accordance with Subsection 512.03.3.3 will be measured by the mile, linear horizontal measure, for each lane of roadway.

Stability testing at each joint or crack in accordance with Subsection 512.03.3.4 will be measured per each lane joint or each lane crack, up to a maximum of three tests.

512.05--Basis of Payment. Holes will be paid for at the contract unit price per each, which price shall be full compensation for drilling and sealing the hole.

The portland cement and calcium chloride incorporated into the grout mixture will be paid for at the contract unit price per pound, which price shall be full compensation for furnishing materials to be incorporated into the specified type of grout mixture, for all hauling, mixing, pumping and clean-up required to stabilize the pavement.

Preliminary testing will be paid for at the contract unit price per mile, which price shall be full compensation for furnishing all testing equipment, the load test truck and necessary personnel to assist in the testing.

Stability testing will be paid for at the contract unit price per each test and shall be full compensation for furnishing all testing equipment, the load test truck and necessary personnel to assist in the testing.

Cost for maintenance of traffic and individual traffic control devices as required by the Department's Traffic Control Plan shall be included in the unit prices for pressure grouting and will not be measured for separate payment under the provisions of Sections 618 and 619.

Payment will be made under:

512-A: Holes *

- per each

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512-B: Portland Cement Pressure Grout Slurry, Type _____

512-C: Calcium Chloride

512-D: Preliminary Testing

512-E: Stability Testing, Lane Joint

512-F: Stability Testing, Lane Crack

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- per pound

- per pound

- per mile

- per each

- per each

* Indicate "In Shoulders" when holes are required in shoulders