

# ALABAMA DEPARTMENT OF TRANSPORTATION

## General Application Special Provision

DATE: October 27, 2022

GASP No. 22-GA0023

EFFECTIVE DATE: May 1, 2023

SUBJECT: Pressure Grouting and Repair of Portland Cement Concrete Pavement.

Alabama Standard Specifications, 2022 Edition, SECTION 453 shall be amended as follows:

## SECTION 453 PRESSURE GROUTING AND REPAIR OF PORTLAND CEMENT CONCRETE PAVEMENT

### 453.02 Materials.

*Article 453.02 shall be replaced by the following:*

### 453.02 Materials.

#### (a) General.

Materials furnished for use shall conform to the appropriate requirements of Division 800, Materials, and the requirements noted in this Article.

#### (b) Grout.

The grout used in pressure grouting shall consist of one of the mixtures shown in Table I with the materials complying with the following:

Type I, III, IL, IP, or IS Cement - Section 815

Calcium Chloride - Section 805 Type I

Fly Ash- Section 806 modified to waive the Loss on Ignition requirement

Water - Section 807

Admixtures - Section 808 and 809

Limestone Dust - Limestone dust shall be thoroughly dry, free of lumps, meeting the following gradation requirements:

Size	% Passing by Weight {Mass}
No. 30 {600 $\mu$ m} Sieve	100
No. 100 {150 $\mu$ m} Sieve	90 - 100
No. 200 {75 $\mu$ m} Sieve	65 - 100

#### Fine Sand

Fine sand shall comply with the appropriate requirements of Section 802 allowing the use of manufactured sand from limestone, sandstone or granite, or natural silica fine sand meeting the following gradation requirements:

Size	% Passing by Weight {Mass}
No. 10 {2.00 mm} Sieve	95 - 100
No. 60 {250 $\mu$ m} Sieve	40 - 90
No. 200 {75 $\mu$ m} Sieve	0 - 50
Percent Silt	0 - 25
Percent Clay	0 - 12
Percent Organic Material	0 - 3

Sand shall be non-plastic as determined by AASHTO T 89 and T 90.

**(c) Concrete.**

Concrete for Portland Cement concrete pavement replacement shall meet the requirements of Section 450 utilizing either Type III cement or Type I, Type IL, Type IP or Type IS cement containing a non-chloride accelerator. The use of an accelerator will not be required when the ambient air temperature is above 85 °F {29 °C}.

**(d) Adhesives.**

Adhesives furnished for anchoring tie bars and dowel bars shall meet the requirements of Article 870.04.

**453.03 Construction Requirements.****(b) Pressure Grouting of Pavement Slabs.**

*Subarticle 453.03(b) shall be replaced by the following:*

**(b) Pressure Grouting of Pavement Slabs.****1. Weather Limitations.**

Unless approved otherwise by the Engineer in writing, all pressure grouting shall be performed between the dates of April 1 and November 1.

Pressure grouting operations may not be started unless the air temperature, in the shade and away from artificial heat, is at least 35 °F {2 °C} and rising. Pressure grouting shall stop if the temperature is 40 °F {4 °C} and falling or when the subgrade contains an abnormal amount of moisture as evidenced by standing water on the pavement or in joints or cracks.

To accelerate setting and provide early strength to mixes utilizing Type I, Type IL, Type IP or Type IS cement, calcium chloride shall be used in the proportions tabulated below for respective temperature ranges. Normal traffic flow may be resumed three hours after grouting.

Atmospheric Temperature	% Calcium Chloride by Weight {Mass} Of Type I, IL, IP or IS Cement
35 - 55 °F {2 - 12 °C}	5
56 - 69 °F {13 - 20 °C}	4
70 - 79 °F {21 - 26 °C}	3
80 - 89 °F {27 - 31 °C}	2
90 °F {32 °C} and above	1

When Type III cement is used, 0-2% calcium chloride may be required as needed to accelerate setting in cold weather. Grouted slabs may be opened to traffic in accordance with Subarticle 453.03(d).

**2. Preparation of Grout Mixture.**

The mixtures used in pressure grouting shall consist of the proportions tabulated in Table I. The consistency may be varied by the addition of water and/or other additives. The quantity by weight {mass} of equivalent 100% pure calcium chloride to be included in the mixture shall be in accordance with Item 1 above. The calcium chloride, when required, shall be thoroughly pre-mixed in the approximate quantity of mixing water required for a predetermined batch size before combining with the other ingredients. The consistency of the grout shall be determined in accordance with ALDOT-338. The quantity of mixing water used shall be that which will produce a grout of such consistency that the time of efflux from the flow cone will be a minimum of 14 seconds and a maximum of 22 seconds for undersealing. After the initial introduction of a sufficient amount of water into the mixture to obtain the necessary consistency, no additional water shall be added. The grout shall be used within 90 minutes after introduction of water into the mixture.

Dry ingredients may be added to a mixed batch only in the amounts necessary to bring a too thin mixture to the required consistency. In this case the added dry ingredients shall be in the specified ratio. Grout which fails to meet the flow requirements specified above shall not be used in grouting operations.

A grout mixture shall be selected by the Contractor from the mixtures shown in Table I below. The Engineer reserves the right to specify a different mixture if the one chosen by the Contractor fails to produce the desired results.

TABLE I GROUT MIXTURES						
	Mix Proportions, Percent by Volume of Dry Ingredients					
	Grout Type					
	1	2	3	4	5	6
Fine Sand				30	50	50
Limestone Dust		50	80			30
Fly Ash	80	30		50	30	
Cement	20	20	20	20	20	20

### 3. Construction.

Selected slabs designated by the Department for pressure grouting shall be drilled as indicated on the plans or designated by the Engineer. For holes nearest the edges of the slab, the joints, or a major crack, a maximum of 3 inches {75 mm} from the precise marked location is considered to be reasonable. For other holes, a maximum 6 inch {150 mm} tolerance is considered to be reasonable. Should it become necessary or desirable to drill holes at locations other than those shown on the plans, such holes shall be drilled only as approved by the Engineer. In no instance shall holes be drilled in the wheel paths of a lane. The drills shall be rotated to avoid cracking the pavement and to provide satisfactory holes of the proper diameter for effective operations in pressure grouting. When drilling holes, the drills shall be held as nearly perpendicular to the pavement surface as possible. Holes which cannot be satisfactorily used in pressure grouting shall be filled with grout and not measured for pay; new holes shall be drilled.

After the holes are drilled, and just prior to pressure grouting, a high pressure air pipe may be required to clean the hole, if deemed necessary by the Engineer, to facilitate introduction of the grout.

After the holes are cleaned, the discharge hose on the pressure grout pump shall be connected to the hole in a manner that will provide adequate seal to maintain pressure past the connection. The discharge end of the pipe shall not extend below the lower surface of the concrete pavement.

To fill all voids, pumping of grout will be required in holes designated by the Engineer. The maximum pressure allowed during the grouting operation will be 200 psi {1.5 Mpa}. A gage shall be located on the discharge side of the pump to measure the pumping pressure. Normally, indication that grout is flowing out of an adjacent hole or joint or the edge of the slab is sufficient evidence that all cavities or voids are filled within the range of the hole being grouted and pumping in such hole shall cease. Additional evidence that grouting should cease is a rapid rise of the slab, or indications of a rise of the adjacent shoulder. A minimal lifting of the slab will be allowed but not to exceed 0.05 of an inch {1 mm} per grouting pass. Care shall be taken not to crack slabs by differential lifting. Any slab or portion of slab or shoulder which is raised more than 0.05 of an inch {1 mm} each grouting will require corrective action, without payment, by the Contractor. Such corrective action shall consist of grinding or other methods approved by the Engineer.

After grouting has been completed in a drill hole, the discharge pipe shall be withdrawn and latent grout removed. The hole shall not be plugged unless authorized otherwise by the Construction Engineer. Patching of the hole shall begin after the grout has taken an initial set. The grout shall be removed to a minimum depth of 4 inches {100 mm} below the pavement surface. A low slump concrete mix consisting of 1-part Type I, Type II, Type IP, Type IS or Type III cement and 2-parts No. 100 concrete sand by volume shall then be placed in the hole, rodded and leveled with the pavement surface. Filled holes that later shrink below the finished surface, ravel out, or otherwise become damaged before project completion shall be repaired.

Corrective measures shall be taken in case stooiling occurs by making proper adjustment in the stiffness of the grout being used. In case stooiling does occur, additional holes shall be provided as directed and a more fluid grout shall be pumped through these new holes to fill the voids between the stools.

At least 24 hours, but no later than 5 days, after a slab has been grouted, it shall be tested for movement between the hours of 3:00 a.m. and 7:00 a.m. On cool, cloudy days, this time frame may be extended if approved by the Engineer. The test rolling equipment shall be rubber-tired and of

sufficient weight {mass} to give a 20,000 pounds {90 kN} single axle load with a minimum of 10,000 pounds {45 kN} per side (a properly loaded dump truck may be used).

Each slab shall be tested by making one or more passes over it with the test roller. The rolling shall be slow enough to allow an observer to measure the movement and mark the slab if regrouting is needed. If the slab moves 0.03 of an inch {0.8 mm} or more during the test rolling, new holes shall be drilled and the slab regrouted. All slabs which have been regrouted shall be retested as outlined above for the initial testing.

After two returns for regrouting, should the slab fail the test rolling, the Engineer will make the decision to leave the slab as is, continue regrouting, or remove and replace the slab. Payment will be made under the appropriate pay items for the additional drill holes and grout used in the regrouting operation. The cost of test rolling shall be absorbed in other items of work.

The construction methods outlined above may be modified by the Engineer as field conditions indicate.

Pressure grouting operations shall cease at least three hours before sundown, except that on cloudy days pressure grouting operations shall cease earlier as necessary to permit grout to harden at least three hours prior to allowing traffic back on the grouted slab before first darkness. First darkness shall be defined as that time of day the average traveling public vehicle would first begin to use its headlights.

### **(c) Removal and Replacement of Pavement Slabs.**

*Subarticle 453.03(c) shall be replaced by the following:*

### **(c) Removal and Replacement of Pavement Slabs.**

#### **1. Removal.**

The extent of removal shall be as shown on the plans or directed by the Engineer. The slab section designated for removal shall be sawed as shown on the plans. The Contractor shall not oversaw the slab within 2 feet {600 mm} of another oversaw or within 2 feet {600 mm} of any type of joint. Transverse cuts for removal and the placing of new steel tie bars shall be performed as shown by plan details. The sections of pavement to be removed may be removed in any manner approved by the Engineer which does not damage the underlying base layer, adjacent concrete slabs, or the joint steel. Any damage to the underlying base or adjacent slabs shall be repaired to the satisfaction of the Engineer. Joint steel shall be cleaned and reconditioned to provide the same load transfer and/or tie as in the original pavement design. Any damaged or destroyed steel, which in the opinion of the Engineer would not function properly, shall be replaced in kind and retied to the old pavement by drilling an appropriate size hole of the proper depth and anchoring the new bar with an approved adhesive material. This replacement also includes steel damaged or destroyed previous to the removal operation. All tie bars and dowel bars tied to the old pavement shall be anchored into place with an approved adhesive material in such a manner as to meet a 7200 pound {32 kN}, minimum, pull-out requirement. The Department will perform the pull-out tests in accordance with ALDOT-366. The Contractor shall supply the equipment necessary to perform the pull-out test.

Slabs shall be removed and replaced during the same day. Preparation for removal, including sawing the slab into smaller pieces, may be done the day prior to removal, but traffic shall be maintained on the slab the night before removal.

#### **2. Concrete Pavement Replacement.**

After completion of removal operation, the joint steel and/or reinforcing steel shall be reconditioned or replaced (reconditioned means the cleaning and straightening of the steel bars and the cleaning, painting, greasing, replacement, etc. of the dowels), new tie bars placed as detailed by the plans, and the base cleaned and repaired as directed, and then the slab shall be poured.

The Contractor shall provide gang drills or templates that will provide the proper alignment for holes drilled for dowels or tie bars. The size of the drilled hole shall be 1/8 of an inch {3 mm} greater in diameter than the diameter of the dowel or tie bar being installed therein. The drill used shall not cause any spalling of the existing concrete around the face of the drill hole.

The Contractor shall provide a device that will place the adhesive in the back of the drilled hole first and then proceed toward the front. After the dowels or tie bars are anchored in place, the

Contractor shall allow time for the adhesive to set and then allow sufficient time for any required pull-out tests to be performed prior to pouring the replacement slab.

The concrete paving slab shall be poured in accordance with the provisions of Section 450 except that Structural Portland Cement Concrete meeting the requirements of Section 501 for a Class A concrete utilizing either Type III cement or Type I, Type IL, Type IP or Type IS cement with a non-chloride accelerator, shall be used and a full paving train will not be required. Unless shown otherwise by the plans, the surface finish and slope of the new pavement shall be the same as the adjoining pavement slabs. If the pavement is to be covered by a bituminous overlay, a wood float finish and straight slope will be acceptable. All joints, except expansion joints, with adjacent pavement shall be butt type tied construction joints. Expansion joints shall be reconstructed so that the continuity of existing expansion joints are retained utilizing similar joint filler and sealed with the type sealer specified on the plans. Other reconstructed joints which require sealing shall be sealed with the specified type sealer. When a joint is completely removed, new materials shall be used throughout the joint. All materials necessary to repair or reconstruct the joints in or adjacent to the concrete pavement replacement is considered incidental to said replacement.

All joints shall be constructed in accordance with the provisions of Subarticle 450.03(j) except as noted herein. Due to the requirement for the use of either an accelerator or Type III cement in the concrete mix, extreme care shall be taken to see that joints are saw cut before uncontrolled shrinkage cracking begins.

Slabs that have been removed shall be replaced the same day they are removed.

The Contractor shall use such approved methods as necessary to keep all pavement surfaces adjacent to this operation reasonably clean of excess grout or other materials at all times.