



## SECTION 625

### UNDERSEALING PAVEMENT

**625.1 Description.** This work shall consist of stabilizing portland cement concrete pavement by furnishing, hauling and pumping a grout mixture of cement, fly ash and water under the concrete slab. This work shall be completed after any required pavement repair and prior to the placement of any new overlay material.

#### 625.2 Material.

**625.2.1** The materials used in grouting shall consist of a mixture of portland cement, fly ash and water proportioned as specified or directed by the engineer. Materials shall meet the following requirements:

Item	Section
Fly Ash	1018
Cement, Type I, II or III	1019
Water	1070

**625.2.2** Cement and fly ash shall be stored in suitable weather-proof buildings, silos or by other approved methods which will protect the materials from dampness.

#### 625.3 Construction Requirements.

**625.3.1 Weather Limitation.** Grouting shall not be performed when the air temperature is below 40 F (5 C), when the subgrade is frozen, when the subgrade contains an abnormal amount of moisture from recent rainfall as evidenced by standing water on the pavement or in joints or cracks, or when in the judgment of the engineer satisfactory results are not being obtained.

**625.3.2 Grout.** Grout for filling voids beneath the pavement shall be composed of cement, fly ash, water and, if necessary, admixtures. Grout shall meet the following minimum requirements: (1) Flow cone efflux time shall be 10 to 16 seconds as determined in accordance with ASTM C 939. (2) The grout shall consist of not less than one part cement by volume to three parts fly ash by volume and shall have a minimum design strength at minimum efflux time of 600 psi (4.1 MPa) at seven days as determined in accordance with the applicable portions of ASTM C 942, with the exception that storage of compressive specimens after 24 hours shall be placed in a 100 percent humidity cabinet. Preparation of grout shall be performed in accordance with ASTM C 938 with the following exceptions: (a) Mixing shall be performed with a commercial type blender operating at approximately 15,000 revolutions per minute (rpm), (b) molding of specimens shall be delayed by the time designated in the contractor's mix design submittal. At least three weeks prior to the beginning of this work, the contractor shall submit to the engineer the proposed mixture. The submittal shall include the mix design, source and type of all materials, and independent laboratory testing of the grout showing one day, three day and seven day compressive strengths, efflux time, time of initial and final set by Gilmore needle in accordance with ASTM C 266 and time delayed to molding specimens after mixing grout. The time delayed between mixing and molding will be the maximum holding time allowed in the field and in no case shall exceed 60 minutes.

Accompanying the mix design submittal shall be sufficient quantities of all mixture components to permit laboratory verification of the grout properties listed herein. Approximately 10 pounds (5 kg) of portland cement and 30 pounds (14 kg) of fly ash are required.

**625.3.3 Measurement of Materials.** The cement and fly ash for underseal grout shall be measured by weight (mass) or volume. The quantity of cement and fly ash to be used shall be calculated from the proportions specified by the engineer. Batches which do not contain the proper quantities of materials shall be wasted at the contractor's expense. Personnel, scales and equipment necessary for calibrating the proportioning devices and for verifying the accuracy of proportions shall be furnished by the contractor and shall be available at all times. The equipment shall include standard 50-pound (20 kg) test weights equivalent to 20 percent of the net load capacity of the scales, to the nearest greater 50-pound (20 kg) increment. However, not more than 20 weights will be required. All equipment shall be calibrated by the contractor in the presence of and subject to the approval of the engineer. Verification of the accuracy of the scales and other dispensing methods may be required at any time deemed necessary by the engineer, but will be performed at least once each day of operation.

**625.3.3.1** Any admixtures used shall be incorporated and mixed in the grout mixture in accordance with the admixture manufacturer's recommendations and as approved by the engineer. Admixtures may be added by hand methods. Admixtures shall be measured within a tolerance of plus or minus three percent of the required quantity.

**625.3.3.2** Weight proportioning (Mass determination) equipment, accuracy, calibration and verification shall meet [Sec 501.3](#). Volume proportioning equipment, accuracy, calibration and verification shall meet [Sec 501.6](#).

**625.3.4 Grout Mixer.** The grout plant shall consist of a high-speed colloidal-mixing machine. The colloidal-mixing machine shall operated at a minimum speed of 800 rpm, maximum speed to 2000 rpm, creating a high shearing action and subsequent pressure release to make a homogeneous mixture. Mixed material shall not be held for more than the period designated in the contractor's mix design submittal. The mix design period shall not exceed 60 minutes. With permission of the engineer, grout that has lost fluidity may be re-tempered with water one time. Water used to wash the drum of the mixer shall not be used as mixing water.

**625.3.5 Deflection Testing.** When required, deflection testing shall be performed in accordance with MoDOT Test Method T64.

**625.3.5.1** All testing shall be performed between the hours of 4:00 a.m. and 9:00 a.m., unless otherwise directed by the engineer. The contractor shall stop testing if the slabs are beginning to lock-up. Tests shall not be performed during spring thaw conditions or when the subgrade is frozen.

**625.3.5.2** The contractor shall furnish and maintain four gauges on two gauge mounts, two gauges per mount, that are capable of detecting slab movement of 0.001 inches (0.025 mm). Gauges and mounts must be approved by the engineer prior to use. The contractor shall also furnish and maintain a vehicle having a dual-tire single axle with an 18,000 pound (8 Mg) single axle load. The contractor shall furnish a truck operator and necessary personnel to place and assist in operating the gauges.

**625.3.6 Grouting Operations.** In general, the hole pattern shall be as shown in the plans. The drilled holes shall be a maximum of 1 1/2 inches (38 mm) in diameter, drilled vertically and round. Holes shall be drilled with a minimum of break out at the bottom of the pavement. Break out in excess of 1 1/2 inches (38 mm) outside the hole diameter shall constitute a non-

acceptable hole and will not be counted for payment. After the hole is drilled, it shall be blown clean with air pressure. The engineer reserves the right to modify the hole pattern, but in no case shall there be less than two holes.

**625.3.6.1** The grout efflux time will be determined by the engineer, but shall be between ten to sixteen seconds. The grout efflux time shall be measured by performing flow cone tests in accordance with ASTM C 939. Seven day comprehensive strengths of the grout material shall be determined from 6 x 12 inch (152.4 x 304.8 mm) cylinders molded daily from the grout material being used. Grout material failing to meet specifications shall be rejected.

**625.3.6.2** The contractor shall furnish equipment and personnel necessary to measure pavement lift during grouting. The equipment shall be capable of detecting the lift of the pavement edge relative to the adjoining shoulder or the adjacent slab. The equipment shall have the capability of measuring movement to the nearest 0.001 inches (0.025 mm). The equipment shall measure lift relative to the reference points and be of a design satisfactory to the engineer. The lift gauge will be read and recorded by the engineer. Pavement raised in excess of 0.20 inch (5 mm) and cracked shall be replaced at the contractor's expense to such limits as directed by the engineer.

**625.3.6.3** A positive action pump capable of forcing grout through a drilled hole into voids and cavities beneath the pavement slab or treated base shall be provided. The injection pump shall have pressure capability of 50 to 250 psi (345 to 1725 kPa) when pumping a grout slurry mixed to a twelve second flow cone time. The injection pump shall be capable of continuous pumping at rates as low as 1 1/2 gallons (6 L) per minute or the system modified by adding a recirculating hose and by-pass valve at the discharge end of the system.

**625.3.6.4** The grout shall be injected under the pavement progressively through the previously drilled holes by means of a pressure distributor. The distributor unit shall be equipped with the necessary hoses, fittings and valves, including a satisfactory nozzle for injecting the grout under the pavement without undue leakage at the point of injection.

**625.3.6.5** Grouting shall begin at a low pumping rate and pressure. However, a short surge up to 200 psi (1380 kPa) can be allowed at the start, but this shall quickly drop below 100 psi (690 kPa) to a range of 30 to 50 psi (205 to 345 kPa). Pumping shall be stopped if the initial pressure does not drop, the pumping pressure increases, grout appears at any adjacent hole or longitudinal or transverse joint or crack, the pavement is raised 0.125 inches (3 mm) or more, or when a negative reading occurs.

**625.3.6.6** All drill tailings, spilled grout and other debris shall be cleaned up at the end of each working day or before the lane is opened to traffic. When adjacent lanes are open to traffic, provisions shall be made to prevent grout from encroaching onto the open lane or squirting onto passing vehicles.

**625.3.7 Placing of Permanent Plugs.** The permanent plug shall not be placed until grout material injected beneath the pavement achieves initial set (grout material in the injection hole has resistance when pressed with finger). If the pavement is not to be resurfaced, the drill holes shall be filled flush with the surface of the pavement using a fast setting sand and cement mixture approved by the engineer. The mortar for filling the holes shall be composed of one part cement and two parts fine aggregate, by volume, and only enough water to permit placing and packing of the mortar in the holes or an approved commercial pre-mixed rapid set mortar or concrete may be used. If the pavement is to be resurfaced, the drill holes may be plugged with mortar as described above or by using an approved square or cylindrical wood plug, 4 to 5 inches (100 to 125 mm) in length, pointed at the lower end, with the top drive flush with the existing pavement surface.

**625.3.8 Handling Traffic.** The contractor may use one lane of the pavement for the equipment necessary to perform the work. At least one-way traffic shall be maintained at all times.

**625.3.9 Opening to Traffic.** No traffic shall be allowed on the undersealed pavement until three hours after the end of pumping operations and after all drill holes have been plugged. Grout ejection caused by traffic will be cause for further delaying opening to traffic.

**625.4 Method of Measurement.**

**625.4.1** Holes drilled through the concrete slabs, at the locations shown on the plans or as directed by the engineer, and properly filled after undersealing will be counted.

**625.4.2** Cement will be measured to the nearest 1/10 ton (0.1 Mg).

**625.4.3** Fly ash will be measured to the nearest 1/10 ton (0.1 Mg).

**625.4.4** Measurement of testing for deflection will be per joint, crack or pavement repair patch per traffic lane in which testing is performed. Testing prior to undersealing and testing after undersealing will be measured separately.

**625.5 Basis of Payment.** The accepted quantities of drilled holes, portland cement, fly ash and deflection tests will be paid for at the unit price for each of the pay items included in the contract. No direct payment will be made for water or any admixtures used in the grout.