

STATE

OF

TENNESSEE

March 1, 2006

SPECIAL PROVISION

REGARDING

UNDERSEALING OF CONCRETE PAVEMENT

This work shall consist of undersealing existing Portland Cement Concrete Pavement slabs by pumping hot asphalt cement or a specified mixture of Portland Cement, fly ash, and water, under the concrete slab. The purpose of this operation is to fill voids beneath the slabs with a substance that will form an incompressible, nonsoluble, and nonerodable mass.

Due to the character of the work to be performed under this section, the Engineer will determine it's effectiveness in producing the desired results. Should the operation be determined to be ineffective, the Engineer may order all work under this section to be discontinued. In such case, the contractor will be paid for all work performed. No claims will be considered because of the elimination of work under this section.

MATERIALS

Cement-Fly Ash:

<u>Component</u>	<u>Requirement</u>
Portland Cement, Type I	AASHTO M-85
Fly ash, Type F or Type C	ASTM C-618
Water	Subsection 918.01

In addition, the cement-fly ash grout when mixed as indicated in this specification shall attain a seven (7) day compressive strength of at least 700 psi. This shall be evidenced by certified test results submitted by the contractor prior to any undersealing operations for the materials that will be utilized.

Asphalt:

Asphalt cement for undersealing material shall meet the requirements of AASHTO M-238.

Grout for drill holes:

Non-shrinking grout for filling drill holes shall meet the requirements of **Subsection 918.21,**

PROPORTIONING
(Cement-fly ash grout)

The cement-fly ash grout shall consist of one part Portland Cement by volume, and three parts fly ash by volume, mixed with sufficient water to produce a grout of such consistency that the time of efflux from the flow cone, when tested in accordance with the U.S. Corps of Engineers Method CRD-C611-80, shall be in the range of 12 to 18 seconds. (See attachment "B").

WEATHER LIMITATIONS

Grouting shall not be performed unless the free air temperature is at least thirty-five degrees (35 F) and rising or forty degrees (40 F) if falling or 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.

TIME LIMITATIONS

Any grout which has not been placed under the pavement within one hour after mixing shall be wasted. Material wasted due to expiration of the allotted time will not be measured for payment.

EQUIPMENT

Equipment and tools necessary for handling materials and performing all parts of the work shall be approved by the Engineer. The equipment shall be at the jobsite and in sound mechanical condition sufficiently ahead of the start of construction operations to be examined thoroughly and approved.

General.

- (1) Roller - The roller shall consist of an approved single axle trailer type roller or a loaded truck having a single rear axle. In either case, the single axle shall be loaded, as directed, to a gross weight equal to or more than the maximum legal load for a tandem axle on the highway on which the project is located, except that the gross weight on such a single axle shall not exceed 25 tons. If a trailer type roller is used it shall be towed by a rubber tired prime mover capable of maintaining a speed of two miles per hour.

The wheels shall be equipped with pneumatic tires capable of satisfactory operation at a minimum inflation pressure of 100 psi. The tires may contain liquid if the contractor desires. The contractor shall provide the Engineer with acceptable verification of the gross axle weight and tire pressure.

- (2) Air compressors - Air compressors shall be of sufficient capacity to operate pneumatic rotary percussion drills.

- (3) Pneumatic rotary percussion drills - Pneumatically operated rotary percussion drills shall be capable of cutting 1-1/2 inch diameter or other approved diameter holes through the rigid pavement. The equipment shall be in satisfactory operating condition and operated in such a manner as to prevent unnecessary damage to the slab.
- (4) Slab Deflection - Four gauges on two gauge mounts, two gauges per mount, capable of detecting slab movement under load to the thousandth of an inch with an instantaneous readout shall be required.
- (5) Slab Uplift - A slab uplift measuring device capable of measuring slab uplift during pumping operations shall be required. The equipment shall be capable of measuring slab movement in the thousandths of an inch with an instantaneous readout. The fulcrum for the arm of the measuring device shall be located on the shoulder a minimum of five feet from the edge of the pavement during monitoring of movement. See attachment "A" for a typical approved measuring device with proper operating instructions. One of equal or better quality measuring capabilities shall be required.

Cement-Fly Ash Grouting:

The following items of equipment are required:

- (1) Equipment for accurately measuring and proportioning by volume or weight the various materials composing the Portland Cement grout.
- (2) Mixer - A high speed, colloidal batch type mixer capable of thorough homogeneous mixing of the various components of the grout.
- (3) Pump - A positive action pump capable of forcing cement-fly ash grout through a drilled hole into voids and cavities beneath the pavement slab.

The pump shall be capable of supplying a varying pressure up to a maximum of at least 50 pounds per square inch at the end of the discharge pipe. A pressure gauge to measure grout pressure at the pump discharge is required. The injection apparatus shall be equipped with a grout packer to prevent the extrusion of grout around the drill hole during grouting operations as well as by-pass lines or other means to insure continuous circulation and/or agitation of the grout during interruptions of pumping operations.

- (4) Flow Measuring - A stop watch and flow cone conforming to the dimensions and other requirements of the U.S. Army Corp of Engineers Test Method No. CRD-C611-80 as modified by this Special Provision.

Asphalt Undersealing:

- (1) Asphalt distributor - A pressure asphalt distributor capable of handling asphalt at a temperature range of 350 F - 500 F. shall be required. The distributor unit shall be equipped with the necessary hoses, fittings, valves, etc., including a satisfactory nozzle

for pumping the asphalt under the pavement without undue leakage at the point of injection, a pressure gauge to measure pumping pressure, and a recirculating system.

CONSTRUCTION REQUIREMENTS

Prior to undersealing operations the contractor shall pre-roll the concrete pavement with the roller mentioned above to determine where the undersealing operations are needed. A roller coverage is defined as a single pass over a single traffic lane. The contractor shall furnish the roller and necessary personnel to place, move, and operate the roller and the slab movement measuring devices.

All pre-rolling shall be performed between the hours of daylight and 9:00 A.M. unless otherwise directed by the Engineer. The contractor is to stop the testing if the slabs are beginning to "lock-up". In hot weather, the contractor may be required to test between 4:00 A.M. and 7:00 A.M. to avoid "lock-up" of the slabs, if so directed by the Engineer.

During pre-rolling a set of gauges will be positioned with one gauge referenced to the corner of each slab on both sides of the joint near the pavement edges. The gauges will then be zeroed with no load on the slab on either side of the joint. The roller will then be moved into position and stopped with the center of the test axle about one foot behind the joint and the outside test wheel about one foot from the pavement edge. The back gauge will then be read. The roller will then be moved across the joint to a similar position about one foot forward of the joint and stopped. The forward gauge will then be read. This operation will be repeated for each joint to be tested. The inspector will be responsible for reading and recording the gauges.

All slabs showing deflections of 0.030 inches or more when tested according to the above procedure are to be undersealed. In addition, slabs showing signs of distress along with deflections less than 0.030 inches may be undersealed at the sole discretion of the Engineer.

A minimum of twenty-four hours after the designated slabs have been undersealed in accordance with these specifications, they shall be retested. Retesting will be accomplished in a manner similar to the procedures for pre-rolling as detailed above. Slabs which still deflect 0.030 inches or more shall be regouted and retested as directed. Any slab which continues to show movement in excess of that specified after two properly performed groutings may be removed and replaced or regouted and retested as directed by the Engineer.

The plans designate the location of holes to be drilled for the purpose of undersealing. The drilling work shall begin using the hole pattern and pumping sequence shown on the plans. The hole pattern may be revised either increasing or decreasing the number of holes to be drilled, dependent upon undersealing results, only at the discretion of the Engineer.

The holes, one and one-half (1-1/2) inches in diameter or other approved diameter, shall be to a depth of approximately eight inches beneath the bottom of the concrete slab unless directed otherwise by the Engineer. For holes nearest the edges of the slab, the joints or a major crack, a maximum of 3" from the precise marked location is considered to be reasonable. For other holes a maximum of 6" tolerance is considered reasonable. When drilling holes, the drills shall be held as nearly perpendicular as possible to the pavement surface. The drills shall be rotated to avoid cracking the pavement and to provide satisfactory holes of the proper diameter for effective operations in pressure undersealing. Irregular or unsatisfactory holes which cannot be utilized in undersealing shall be filled with grout, and new holes drilled. No more holes shall be drilled

during a day's operations than can be undersealed during the same day unless approved by the Engineer.

After the holes are drilled and immediately prior to undersealing, a pipe with sufficient air pressure to remove debris and provide a passage for the underseal material will be inserted in each hole.

To underseal, a pipe connected to the discharge hose on the pressure asphalt distributor or Portland Cement grout pump shall be lowered into the hole. The discharge hoses are to be so constructed to prevent extrusion of material from the hole once pumping operations have begun. The discharge end of the pipe shall not extend below the lower surface of the concrete pavement. Pumping shall be required in the holes designated by the Engineer in order to fill all voids. Normally, when underseal begins to flow out of an adjacent hole, joint, or edge of slab, sufficient evidence exists that all cavities or voids have been filled within the range of the hole being undersealed and pumping shall cease. Additional evidence that pumping should cease is the rapid rise of the slab or indications of a rise of the adjacent shoulder. A minimal lifting of the slab will generally be required to move underseal into the existing cavities and voids but this lift should not exceed 0.100 inch total accumulative movement for the slab measured at the outside corner, by the approved slab uplift measuring device. Very close attention shall be given to the slab lift measuring device to prevent excessive pumping pressures, rapid lift of the slab, or substantial rising of the adjacent shoulders. Care shall be taken not to crack slabs by differential lifting. Slabs determined to be cracked or broken during undersealing operations due to the contractor's negligence will be repaired at his expense.

The contractor shall provide all personnel and equipment necessary to satisfactorily measure and control lift on every slab that is undersealed. The inspector will be responsible for reading and recording the amount of movement.

Precautions shall be taken by the contractor to insure that the minimum amount possible of underseal is pumped into the edge drain system located near the shoulder/pavement interface, if one exists. These precautions shall include but are not limited to drilling one or more "observation holes" in the asphaltic concrete shoulder as close as possible to the shoulder/pavement interface and "timing" of the grouting operation to prevent and stop "excess grouting" in any hole insuring that grout does not flow into the edge drain system. Upon completion of the grouting operation, any "observation holes" are to be filled with non-shrinking grout. No separate payment will be made for this work and the cost thereof is to be included in the bid submitted for other items. All precautions used will require the approval of the Engineer.

When asphalt cement is the undersealing agent, immediately after the undersealing through a drill hole has been completed the hole shall be temporarily plugged with an approved type plug to prevent back flow onto the pavement. The plug shall be removed when undersealing through an adjacent hole begins. Drill holes shall not be plugged when cement-fly ash is the undersealing agent.

Deposits of underseal on the pavement and/or shoulders shall be removed and the surface cleaned before traffic is permitted on the section. Other debris such as bags, spillage, etc. shall be removed from the right-of-way each day.

Deposits of underseal material shall be removed from each drill hole and the hole shall be filled with a non-shrinking, sand-cement grout or an approved quick setting patching material on

the same day that the undersealing in the hole is completed. Filled holes that ravel out or become damaged shall be repaired.

No traffic shall be allowed on the undersealed pavement until three hours after the end of pumping operations and all drill holes have been grouted. Pressure undersealing operations shall cease at least three (3) hours before sundown, except that on cloudy days pressure undersealing operations shall cease earlier as necessary to permit underseal to harden at least three (3) hours prior to allowing traffic back on the pavement before darkness.

METHOD OF MEASUREMENT

Pre-rolling, performed as set out herein, completed and accepted will be measured by the square yard. The area of pre-rolling will be computed by using the horizontal length(s) measured or computed along the centerline of the roadway(s) and the width(s), unless specified, will be the width of the concrete pavement in or under the traffic lane being pre-rolled. Test rolling after the grouting operations will not be measured for payment, but the cost included in the price bid for other items.

Holes drilled through the concrete slabs in accordance with these Specifications at the locations shown on the Plans or directed by the Engineer and properly filled after satisfactory use will be measured complete-in-place and each completed and accepted hole will be counted.

Asphalt cement incorporated into the work as Asphalt Underseal in accordance with the provisions of the contract will be measured by the gallon.

Cement-fly ash grout incorporated into the work will be measured by the cubic foot. One bag of cement will be considered to produce 3.5 cubic feet of grout.

Water and grout used to fill drill holes will not be measured for payment and payment for this work will be included in the price bid for other items.

BASIS OF PAYMENT

Work performed and materials furnished and used as specified in the contract and measured as provided herein will be paid for as follows: Pre-rolling will be paid for at the contract unit price bid per square yard; Holes will be paid for at the contract unit price bid per each; Asphalt Underseal will be paid for at the contract unit price bid per gallon; Cement-fly ash grout will be paid for at the contract unit price bid per cubic foot. The prices thus paid shall be full compensation for furnishing all materials; for proportioning and mixing of the materials to produce the grout; for all drilling; for all pumping and repumping, for all protection and maintenance; for all test rolling; and for all equipment, tools, labor and incidentals necessary to complete the work.