

SECTION 03100

PORTLAND CEMENT PERVIOUS CONCRETE PAVEMENT

Part 1 – Description

- A. The work to be performed under this specification will be in conformance with the appropriate referenced plans and drawings for the construction of the proposed pervious concrete pavement. Included in the performance of work is the furnishing of all labor, materials, and necessary equipment.
- B. Traditional Portland cement pavement testing procedures based on strength, air content and slump control are not applicable to this type of pavement material. As continued testing of this product yields test methods that are reproducible in the field, these recommended specifications will be modified.
- C. Pervious concrete contractors must demonstrate their qualifications and experience by submitting a list of at least three completed projects performed according to the job's owner, engineers' or architects' satisfaction at that time, or completion of the Pervious Concrete Sales and Installation Training course at Tennessee Ready Mix Concrete Association (TRMCA). Upon request, any applicable test results shall be provided.
- D. Contractor without prior experience is to place, joint and cure a small trial placement of no less than 200 sq. ft. so all parties get familiar with producing and placing the product. He must demonstrate to all parties concerned that he can meet the specifications for pavement thickness and in-place weight and satisfactory pavement can be installed at the site location.
 1. The test panel or panels may be placed at any of the specified Portland cement pervious locations. The test panel or panels shall be tested for thickness in accordance with ASTM C42; void structure in accordance with ASTM C138; and for core unit weight, in accordance with ASTM C 140, paragraph 6.3.
 2. Satisfactory performance of the test panel or panels will be determined by:
 - a. Compacted thickness to be not less than 1/4" below specified thickness
 - b. Void Structure: 20% +/- 5% for low porosity, normal strength
30% +/- 5% for high porosity, low strength
 - c. Unit weight +/- 5 pcf of the design unit weight
 3. If the requirements in item 2 are not met, the test panel shall be removed at the contractor's expense and disposed of in the proper manner.
 4. If the test panel or panels meet the above mentioned requirements, it can be

left in place and included in the completed work.

5. The color and texture of the test panel or panels should not be used as a guide for the remaining portion of the job.

Part 2 - Materials

- A. This specification references the following American Society For Testing and Materials (ASTM) standards, which are made a part hereof by such reference and shall be the latest applicable edition and revision thereof:

ASTM C 29, Test for Unit Weight and Voids in Aggregate

ASTM C 33, Specifications for Concrete Aggregates

ASTM C 42, Test Methods for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

ASTM C 117, Test Method for Material Finer than 75µm (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C 150, Specifications for Portland Cement (Types I or II only)

ASTM C 494, Specification for Chemical Admixtures for Concrete

ASTM C 595, Specifications for Blended Hydraulic Cements (Types IP or IS only)

ASTM C 618, Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

ASTM C 989, Specification for Ground Granulated Blast Furnace Slag for Use in Concrete and Mortars

ASTM C 1077, Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation

ASTM C 1116, Standard Specification for Fiber-Reinforced Concrete and Shot Crete

ASTM C 1157, Performance Specification for Hydraulic Cement

ASTM D 448, Specification for Standard Sizes of Coarse Aggregates for Highway Construction

ASTM D 1557, Tests for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10 Pound Rammer and 18-inch Drop

ASTM E 329, Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction

ACI 211.3R-97, Guide for Selecting Proportions for No-Slump Concrete

ACI 305R-99, Hot Weather Concrete

ACI 396R-88, Cold Weather Concrete

American Association of State Highway and Transportation Officials (AASHTO)
AASHTO T-180, Moisture-Density Relations of Soils Using a 10-Pound (454 kg) Rammer and an 18-inch (457 mm) Drop

Tennessee Department of Transportation (TDOT), Standard Specifications for Road and Bridge Construction

- B. Cement shall be Portland cement conforming to ASTM C 150 (Type I or II) or ASTM C 595 (Type IP, IS). For pavement being used by vehicular traffic, the total cementitious material shall not be less than 600 lbs/cu. yd.
- C. Fly Ash shall conform to ASTM C 618. Fly ash conforming to ASTM C 618 may be used in amounts not exceeding twenty percent (20%) by weight of the total cementitious material.
- D. Ground Granulated Blast Furnace Slag shall conform to ASTM C 989. Ground Granulated Blast Furnace Slag conforming to ASTM C 989 may be used in amounts not exceeding 50 percent by weight of the total cementitious material.
- E. Aggregates shall be furnished in sizes: No. 7, No. 8 or No. 89, as described in Section 903.03, TDOT Standard Specifications or ASTM C 33. Other sizes of aggregates may be used upon approval of engineer, architect, or owner's representative.
- F. The volume of aggregate specified above shall be equal to approximately 27 cu. ft. per cu. yd. when calculated as a function of the unit weight determined in accordance with ASTM C 29 dry rodded procedure. If fine aggregate is used, its volume should not exceed 3 cu. ft. and should also be included in the total aggregate volume. Final aggregate content will depend upon the specific gravity of the aggregate to be used and the desired void content to be obtained in the hardened pervious concrete. Please see the table below for a calculation example.

Table 1. Aggregate Content Example

	Bulk Density as per ASTM C20 Rodding Procedure	Multiply Bulk Density by 27	Weight of Aggregate per Cubic Yard
Sample 1	96 lbs	x27	2592
Sample 2	98 lbs	x27	2646
Sample 3	100 lbs	x27	2700

- G. Water shall be potable or shall be in accordance with Section 918.01 of the TDOT Standard Specifications. Water quantity shall be such that the cement past displays a wet metallic sheen without causing the cement past to flow from the aggregates. A dull-dry appearance mix may be produced if insufficient mix water has been used.
- H. Admixtures shall be of the following types:
 - Type A Water Reducing Admixtures shall comply with ASTM C 494.
 - Type B Retardation Admixtures shall comply with ASTM C 494.
 - Type D Water reducing/retarding admixtures shall comply with ASTM C 494.
 - Hydration stabilizers may be used but must meet ASTM C 494, Type B or D.
- I. Fibers must conform to ASTM C 1116. Fibers shall be added at a rate of not less than 0.75 lbs. per cubic yard or as recommended by the manufacturer.

Part 3 – Execution

3.01 Subgrade Preparation and Formwork

- A. Trenches shall be excavated to the detailed depth and width as shown on the plans. The sides and bottom of the trenches shall be prepared to a relatively smooth condition free of sharp objects, obstructions, depressions, and debris which might damage the filter cloth during installation.
- B. The filter cloth shall be placed with the long dimension parallel to the centerline of the channel and shall be laid loosely without wrinkles or creases. When more than one width of filter cloth is necessary, the joints shall be overlapped a minimum of twelve inches (12”). The cloth shall be placed such that the downstream edges overlap the upstream edges. Securing pins with washers shall be inserted through both strips of overlapped material and into the material beneath, until the washer bears against the cloth and secures it firmly to the base material. These securing pins shall be inserted through the overlapped cloth at not greater than two foot (2’) intervals along a line through the midpoint of the overlap.
- C. The cloth shall be protected at all times during construction from contamination by surface runoff and any cloth so contaminated shall be removed and replaced with uncontaminated cloth at the Contractor’s expense.

- D. Any damage to the cloth during its installation shall be replaced by the Contractor at his own expense. To repair a torn, punctured, or otherwise damaged section, a piece of filter cloth shall be cut large enough to cover the damaged area and overlap all around the damaged area a minimum of twelve inches (12”).
- E. Stone overlaying the cloth shall not be dropped on the cloth from a height greater than three feet (3ft).
- F. The aggregate shall be placed in six inch (6”) layers and each layer compacted by the use of a vibratory compactor to the satisfaction of the Engineer.
- G. Forms shall be made of wood or steel. Forms shall be of ample strength and stability to withstand loads during concrete placement operations. They should be set accurately to the required grade and alignment.

3.02 Mixing and Transportation

- A. The pervious concrete can be transported by either a ready-mix truck or a dump truck. The truck mixer shall be operated at the drum speed recommended by the manufacturer and shall not be less than seventy (70) nor more than three hundred (300) revolutions. The time elapsing from the time water is added to the mix until the concrete is deposited in place at the site of the work shall not exceed ninety (90) minutes, unless otherwise approved by an engineer. This time may be increased to one hundred twenty (120) minutes when utilizing an approved retarding admixture or the hydration stabilizer specified in Section 2.H.
- B. The pervious concrete contractor or his qualified agent will inspect each batch for appearance of concrete uniformity according to Section 2.G. This person will be determined at the pre-construction meeting. A slight adjustment of water may then be required at the work site to achieve the proper consistency. A minimum of twenty (20) revolutions at the manufacturer’s designated mixing speed shall be required following any such adjustment. Mixture discharge shall be rapid and continuous as possible. Concrete shall be deposited as close to its final position as practicable and at a point so that fresh concrete enters and adheres to the mass of previously placed unhardened concrete. As deposited, the mixture shall be placed where it will require as little rehandling as possible.
- C. Conventional paving equipment or manual and vibrating screeds may be used for the strike off operation. It is recommended to allow for one-half ($\frac{1}{2}$) to one-fourth ($\frac{1}{4}$) inch additional thickness above the forms to eliminate surface raveling after compaction. A full width heavy roller or other full width compaction devices that provide five (5) to ten (10) psi vertical force shall be used, immediately following the strike off operation and removal of the additional thickness. The pervious concrete pavement cross section shall not deviate more than $\pm 3/8$ ” in ten (10) feet from the required grade. No other finishing operation is required after mechanical or other approved strike off and compaction operations. Placement width should not exceed

fifteen (15) feet unless a contractor has sufficient mechanical consolidating equipment.

- D. The pavement surface shall be covered with a minimum four (4) mil thick polyethylene sheeting **immediately** following compactive rolling. If adverse ambient conditions (temperature, wind and humidity) exist, a fog or light mist shall be sprayed above the surface prior to covering. Sheeting must be secured during cure time and must cover all edges of the placed pavement. Sand or dirt should not be used to hold down sheeting. No traffic shall be allowed during cure time.
- E. Recommended cure times:
 - 1. Portland Cement Type I, II, IS – 7 days minimum.
 - 2. Portland Cement Type I or II with Class F or C Fly-ash or Type IP – 10 days minimum.
- F. Joints shall be constructed of the type and dimensions and at the locations required by the plans and in accordance with the provisions of these specifications. Control (contraction) joints shall be spaced at twenty (20) foot centers, and they shall be at a depth of one-fourth ($\frac{1}{4}$) of the thickness of the pavement. Longitudinal control joints shall be installed at the mid-point of the constructed pavement if the pavement width exceeds fifteen (15) feet. Both types of joints can be installed in the plastic concrete or saw cut after the pavement has hardened sufficiently (normally after curing). Installation of saw cut joints may be delayed until the completion of the recommended curing period. Transverse construction joints shall be constructed when placing is interrupted a sufficient length of time so that concrete begins to harden. A bonding agent suitable for bonding fresh concrete to existing concrete shall be brushed, rolled or sprayed on the existing pavement surface edge. Expansion joints shall be formed when pavement is abutting slabs or other adjoining structures by the use of premolded joint filler.

3.03 Testing, Inspection, and Acceptance

- A. The General Contractor shall retain an independent testing laboratory and licensed surveyor upon concurrence with Owner. The laboratory must provide evidence of conforming to the requirements of ASTM E-329 “Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials used in Construction,” and ASTM C 1077 “Standard Practice for Testing Concrete and Concrete Aggregates for Use in Construction, and Criteria for Laboratory Evaluation”. All samples shall be identified by date and batch mix or truckload. Laboratory testing shall be done expeditiously, and results communicated to all concerned in a timely manner. Licensed surveyor shall be licensed in Tennessee.
- B. The contractor shall be responsible to require pervious concrete material supplier to provide a mix compliance statement on each shipping document. No deviation of the approved mix design will be accepted without the concurrence of the owner’s

engineer or agent. At owner's request, if batch certification is not adequate, a minimum frequency of one (1) test for each day of placement shall be conducted in accordance with ASTM C172 and C-29. Mix shall be within \pm five percent (5%) of the design unit weight.

- C. After a minimum of seven (7) days following each placement, three (3) samples should be core drilled. The cores shall be measured for thickness, void structure, and unit weight. Untrimmed, hardened core samples shall be used to determine placement thickness in accordance with ASTM C 42. The average of all cores shall not be less than the required thickness with any core being more than one-half ($\frac{1}{2}$) inch less than the required thickness. After thickness determination, core ends shall be trimmed to facilitate void structure determination in accordance with ASTM C 138. The void content of 20% \pm 5% for low porosity, normal strength pervious and 30% \pm 5% for high porosity, low strength pervious should be met.
- D. Unit weight determination in the saturated condition shall be in accordance with ASTM C-140, paragraph 6.3. Ranges of satisfactory and weight values are \pm 5 pcf of the design unit weight.

END OF SECTION