

SECTION 03300

PORTLAND CEMENT PERVIOUS PAVEMENT

PART 1 - GENERAL PROVISIONS

1.1 SCOPE OF WORK

- A. *The work to be completed under this contract includes the furnishing of all labor, materials, and equipment necessary for construction of the proposed improvements in conformance with the plans and specifications.*

1.2 REFERENCES

A. *American Society of Testing and Materials*

1. *ASTM C 29, Test for Unit Weight and Voids in Aggregate*
2. *ASTM C 33, Specifications for Concrete Aggregates*
3. *ASTM C 42, Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete*
4. *ASTM C 117, Test Method for Material Finer than 75 μm (No. 200) Sieve in Mineral Aggregates by Washing*
5. *ASTM C 138, Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete*
6. *ASTM C 140, Methods of Sampling and Testing Concrete Masonry Units*
7. *ASTM C 150, Specifications for Portland Cement (Types I or II only)*
8. *ASTM C 172, Practice of Sampling Fresh Concrete*
9. *ASTM C 260, Specification for Air-Entraining Admixtures for Concrete*
10. *ASTM C 494, Specification for Chemical Admixtures for Concrete*
11. *ASTM C 595, Specifications for Blended Hydraulic Cements (Types IP or IS only)*
12. *ASTM C 618, Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete*
13. *ASTM C 989, Specification for Ground Granulated Blast Furnace Slag for Use in Concrete and Mortars*
14. *ASTM C 1077, Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation*
15. *ASTM D 448, Specification for Standard Sizes of Coarse Aggregates for Highway Construction*
16. *ASTM D 1557, Tests for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10 Pound Rammer and 18-inch Drop*
17. *ASTM E 329, Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction*

B. *American Association of State Highway and Transportation Officials (AASHTO)*

1. *AASHTO T-180, Moisture-Density Relations of Soils Using a 10 Pound (454kg) Rammer and an 18 inch (457mm) Drop*

C. *Tennessee Department of Transportation (TDOT) Standard Specifications for Construction of Roads and Bridges*

1.3 CONTRACTOR QUALIFICATIONS

A. *General*

1. The use of an ACI Concrete Flatwork Certified Finisher is strongly recommended. Prior to award of the contract, the placing contractor shall furnish Owner/Engineer a statement attesting to qualifications and experience.
2. If the placing contractor and concrete producer have insufficient experience with Portland Cement Pervious Concrete Pavement, the placing contractor shall retain an experienced consultant to monitor production, handling, and placement operations at the contractor's expense.

B. *Test Panels.* Regardless of qualification, contractor is to place, joint and cure one test panel, to be a minimum of 200 sq. ft. at the required project thickness to demonstrate to the Engineer's satisfaction that in-place unit weights can be achieved and a satisfactory pavement can be installed at the site location.

1. Test panels may be placed at any of the specified portland cement pervious pavement placement locations (or at other location with prior approval from the Owner). Test panels shall be tested for thickness in accordance with ASTM C 42; void structure in accordance with ASTM C 138; and for core unit weight in accordance with ASTM C 140, Paragraph 6.3.
2. Satisfactory performance of the test panels will be determined by:
 - a. Compacted thickness no less than 1/4" of specified thickness
 - b. Void Structure: 15% minimum, 21% maximum
 - c. Unit weight \pm five (5) pcf of the design unit weight
3. If measured void structure falls below 15% or if measured thickness is greater than 1/4" less than the specified thickness or if measured weight falls less than five (5) pcf below design unit weight, the test panel shall be removed at the contractor's expense and disposed of in an approved landfill.
4. If the test panel meets the above-mentioned requirements, it can be left in-place and included in the completed work.

1.4 CONCRETE MIX DESIGN

- A. *Contractor shall furnish* a proposed mix design with proportions of materials to Owner or agent prior to commencement of work. The data shall include unit weights determined in accordance with ASTM C 29 Paragraph 11, Jigging Procedure.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. *General.* Use locally available material having a record of satisfactory performance.
- B. *Cement.* Portland Cement Type I or II conforming to ASTM C 150 or Portland Cement Type IP or IS conforming to ASTM C 595.
- C. *Aggregate.* Use Tennessee Department of Transportation (TDOT) No. 89 coarse aggregate (3/8 to No. 50) per ASTM D 448. If other gradation of aggregate is to be used, submit data on proposed material to Owner for approval.
- D. *Air entraining agent* shall comply with ASTM C 260.
- E. *Admixtures:*
 - 1. Type A Water Reducing Admixtures ASTM C 494
 - 2. Type B Retarding ASTM C 494
 - 3. Type D Water Reducing/Retarding ASTM C 494

Also, a hydration stabilizer can be utilized and is recommended in the design and production of pervious concrete. This stabilizer suspends cement hydration by forming a protective barrier around the cementitious particles, which delays the particles from achieving initial set. The admixture's primary function should be as a hydration stabilizer; however, it must also meet the requirements of ASTM C 494 Type B Retarding or Type D Water Reducing/Retarding Admixtures.

- F. *Water.* Potable shall be used.

2.2 PROPORTIONS

- A. *Cement Content.* For pavements subjected to vehicular traffic loading, the total cementitious material shall not be less than 600 lbs. per cu. yd.
- B. *Aggregate Content.* The volume of aggregate per cu. yd. shall be equal to 27 cu. ft. when calculated as a function of the unit weight determined in accordance with ASTM C 29 jigging procedure. Fine aggregate, if used, should not exceed three (3) cu. ft. and shall be included in the total aggregate volume.
- C. *Admixtures* shall be used in accordance with the manufacturer's instructions and recommendations.
- D. *Mix Water.* Mix water shall be such that the cement paste displays a wet metallic sheen without causing the paste to flow from the aggregate. (Mix water yielding a cement paste with a dull-dry appearance has insufficient water for hydration.)

1. Insufficient water results in inconsistency in the mix and poor bond strength.
2. High water content results in the paste sealing the void system primarily at the bottom and poor surface bond.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION AND FORMWORK

- A. *Subgrade Support.* When applicable, the subgrade shall be compacted by a mechanical vibratory compactor to a minimum density of 95% of a maximum dry density as established by ASTM D 698.
- B. *Subgrade Moisture.* When applicable, the subgrade shall be in a moist condition (within $\pm 3\%$ of the optimum moisture content as determined by compaction test ASTM D 698).
- C. *Forms.* Forms may be of wood or steel and shall be the depth of the pavement. Forms shall be of sufficient strength and stability to support mechanical equipment without deformation of plan profiles following spreading, strike-off and compaction operations.

3.2 MIXING, HAULING AND PLACING

- A. *Mix Time.* Truck mixers shall be operated at the speed designated as mixing speed by the manufacturer for 75 to 100 revolutions of the drum.
- B. *Transportation.* The portland cement aggregate mixture may be transported or mixed on site and should be used within one (1) hour of the introduction of mix water, unless otherwise approved by the Engineer. This time can be increased to 90 minutes when utilizing the hydration stabilizer specified in Section 205.
- C. *Discharge.* Each mixer truck will be inspected for appearance of concrete uniformity according to Section 304. Water may be added to obtain the required mix consistency. A minimum of 20 revolutions at the manufacturer's designated mixing speed shall be required following any addition of water to the mix. Discharge shall be a continuous operation and shall be completed as quickly as possible. Concrete shall be deposited as close to its final position as practicable and such that fresh concrete enters the mass of previously placed concrete. The practice of discharging onto subgrade and pulling or shoveling to final placement is not allowed.
- D. *Placing and Finishing Equipment.* Unless otherwise approved by the Owner and Engineer in writing, the Contractor, shall provide mechanical equipment of either slipform or form riding with a following compactive unit that will provide a minimum of 10 psi vertical force. The pervious concrete pavement will be placed to the required cross section and shall not deviate more than $\pm 3/8$ inch in 10 feet from profile grade. If placing equipment does not provide the minimum specified vertical force, a full width roller or other full width compaction device that provides sufficient compactive effort shall be used immediately following the strike-off operation. After mechanical or other approved strike-off and compaction operation, no other finishing operation will be allowed. If vibration, internal or surface applied, is used, it shall be shut off immediately when forward progress is halted for any reason. The contractor will be restricted to pavement placement widths of a maximum of fifteen (15) feet unless the contractor can demonstrate competence to provide pavement placement widths greater than the maximum specified to the satisfaction of the Engineer.

E. *Curing*

1. *Curing procedures* shall begin within 20 minutes after the final placement operations. The pavement surface shall be covered with a minimum six (6) mil thick polyethylene sheet or other approved covering material. Prior to covering, a fog or light mist shall be sprayed above the surface when required due to ambient conditions (temperature, wind, and humidity). The cover shall overlap all exposed edges and shall be secured (without using dirt or stone) to prevent dislocation due to winds or adjacent traffic conditions.
2. *Cure Time*
 - a. Portland Cement Type I, II or IS - 7 days minimum
 - b. Portland Cement Type I or II with Class F Flyash (as part of the 600 lbs./cy minimum cementitious) or Type IP - 10 days minimum
 - c. No truck traffic shall be allowed for 10 days (no passenger car/light trucks for seven (7) days)

- F. *Jointing*. Transverse control (contraction) joints shall be installed at 8 foot intervals. They shall be installed at a depth of 1/4 the thickness of the pavement. Longitudinal control joints shall be installed at the midpoint if the constructed lane width exceeds 15 feet. These joints can be installed in the plastic concrete. Transverse construction joints shall be installed whenever placing is suspended a sufficient length of time that concrete may begin to harden. In order to assure aggregate bond at construction joints, a bonding agent suitable for bonding fresh concrete to existing concrete shall be brushed, rolled, or sprayed on the existing pavement surface edge. Isolation (expansion) joints will not be used except when pavement is abutting slabs or other adjoining structures.

3.3 TESTING, INSPECTION AND ACCEPTANCE

A. *Laboratory Testing*

1. The Owner will retain an independent testing laboratory. The testing laboratory shall conform to the applicable requirements of ASTM E 329, *Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction*, and ASTM C 1077, *Standard Practice for Testing Concrete and Concrete Aggregates for Use in Construction, and Criteria for Laboratory Evaluation*, and shall be inspected and accredited by the Concrete Advisory Board of Georgia, Inc. or by an equivalent recognized national authority.
2. The agent of the testing laboratory performing field sampling and testing for concrete shall be certified by the American Concrete Institute as a Concrete Field Testing Technician Grade I, or by a recognized state or national authority of an equivalent level of competence.

B. *Testing and Acceptance*

1. A minimum of one gradation test of the subgrade is required every 5000 square feet to determine percent passing the No. 200 sieve per ASTM C 117.
2. A minimum of one test for each day's placement of pervious concrete in accordance with ASTM C 172 and ASTM C 29 to verify unit weight shall be conducted. Delivered unit weights are to be determined in accordance with ASTM C 29 using a 0.25 cubic foot cylindrical metal measure. The measure is to be filled and compacted in accordance with ASTM C 29 paragraph 11, jiggling procedure. The unit weight of the delivered concrete shall be \pm five (5) pcf of the design unit weight.
3. Test panels shall have two cores taken from each panel in accordance with ASTM C 42 at a minimum of seven (7) days after placement of the pervious concrete. The cores shall be measured for thickness, void structure, and unit weight. Untrimmed, hardened core samples shall be used to determine placement thickness. The average of all production cores shall not be less than the specified thickness with no individual core being more than $\frac{1}{2}$ inch less than the specified thickness. After thickness determination, the cores shall be trimmed and measured for unit weight in the saturated condition as described in Paragraph 6.3.1 "Saturation" of ASTM C 140, *Standard Methods of Sampling and Testing Concrete Masonry Units*. The trimmed cores shall be immersed in water for 24 hours, allowed to drain for one (1) minute, surface water removed with a damp cloth, then weighed immediately. Range of satisfactory unit weight values are \pm five (5) pcf of the design unit weight.
4. After a minimum of seven (7) days following each placement, three cores shall be taken in accordance with ASTM C 42. The cores shall be measured for thickness and unit weight determined as described above for test panels. Core holes shall be filled with concrete meeting the pervious mix design.

END OF SECTION