DrainScape® Pervious Concrete Pavement Specification

This suggested Specification for Pervious Concrete Pavement is provided as a guideline only. Each project and geographical area has circumstances particular to it, such as soil conditions or available local aggregate, which may require modifications. Published 8/15/14.

DrainScape® Pervious Concrete is a product that helps protect the environment. It can aid in the process of qualifying for Leadership in Energy and Environmental Design (LEED) points as set by the United States Green Building Council (USGBC). Some of the points DrainScape® may help projects qualify for are:

- LEED SS Credit C6.1 Stormwater – Quantity Control.
- LEED SS Credit C6.2 Stormwater – Quality Control.
- LEED WE Credit C1.1 Water Efficient Landscaping.
- LEED MR Credit 4.1 AND 4.2 Recycled Content.
- LEED MR Credit 5.1 AND 5.2 Regional Materials.

DrainScape® Pervious Concrete Pavement does not look or behave like typical asphalt or concrete pavements. The finished surface is not tight and uniform, but is open and varied. Minor surface irregularities and small amounts of surface raveling are normal. Owners, Architects and Engineers are strongly encouraged to set up an appointment to visit some of our previously installed DrainScape® pervious concrete projects.

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Notes:
1) A specifier is within his rights to issue a proprietary specification that names only one brand. If in the informed and professional judgment of the specifier, his client's needs will be best served by naming a particular brand, then he has the responsibility to limit his specification to one source. This practice is even acceptable on publicly funded projects. This principle of proprietary specification has found legal support in the case of Whitten Corp. v. Paddock Pool Builders, Inc., a Federal District Court case from Massachusetts (376 F. Supp. 125). Further support came in 1975 when the U.S. Supreme Court rejected further appeal and review.

SPECIFICATION:

Section 1 - General requirements

Section 2—Products

Section 3—Execution

SECTION 1—GENERAL REQUIREMENTS

1.1—Scope

1.1.1 This specification provides requirements for the construction of pervious concrete pavement.

1.1.2 In case the requirements of this specification conflict with the contract documents, this document shall govern.

1.2—Definitions

Architect/Engineer—the architect, engineer, architectural firm, or engineering firm issuing project drawings, project specifications or administering the work under the contract documents.

construction joint —a joint constructed from two separate concrete placements where the first has undergone final setting before the next placement.

contraction joint— formed, sawed, or tooled groove in a concrete structure to create a weakened plane to control the location of cracking resulting from the dimensional change of different parts of the structure or pavement.

contractor— the person, firm, or entity under contract for construction of the work.

contract documents—documents including project drawings and specifications covering the required work.

early-entry dry-cut saw— a saw designed to produce joints in concrete commencing 1 to 4 hours after finishing and without raveling the cut edges.

exposure condition, moderate— an environment, normally in temperate climate regions, in which concrete will only occasionally be exposed to moisture and will not be saturated before freezing and where no deicing agents or other aggressive chemicals are used.

exposure condition, severe— an environment, normally in cold climate regions, in which concrete may be saturated or in almost continuous contact with moisture before freezing, and where deicing agents are used.

isolation joint—a normally vertical interface allowing relative movement without transferring sufficient tension, compression, or traction forces to negatively affect the performance of a structure or pavement.

Owner—the corporation, association, partnership, individual, public body or authority for whom the work is constructed.

panel—an individual concrete slab bordered by joints or slab edges.

pavement (pervious concrete)—a pavement comprising material with sufficient continuous voids to allow water to pass from the surface to the underlying layers.

permitted—accepted or acceptable to the architect/engineer.

project drawings—graphic presentation of project requirements.

project specifications—the written documents that detail requirements for the work in accordance with service parameters and other specific criteria.

reference standards—standardized mandatory language documents of a technical society, organization, or association, including the building codes of local or state authorities, which are referenced in the Contract Documents.

subbase—a layer in a pavement system between the subgrade and the base course, or between the subgrade and a portland-cement concrete pavement.

subgrade—the soil prepared and compacted to support a structure or pavement system.

submittal—documents or material provided to the Architect/Engineer for review or acceptance.

Work—the entire construction of separately identifiable parts thereof required to be furnished under the Contract Documents.

1.3—Referenced standards

1.3.1 Standards of ACI and ASTM referred to in this specification are listed with serial designation including year of adoption or revision, and are part of this specification.

1.3.1.1 *ACI standards—*

522.1-08	Specifications for Pervious Concrete Pavement
522R-10	Report on Pervious Concrete
306.1-90	Standard Specification for Cold Weather Concreting

1.3.1.2 *ASTM standards—*

C1688/C1688-12	Standard Test Method for Density and Void Content of Freshly Mixed Pervious Concrete.
C1754/C1754M-12	Standard Test Method for Density of Void Content of Hardened Pervious Concrete.
C1747/C1747M-11	Standard Test Method for Determining Potential Resistance to Degradation of Pervious Concrete by Impact and Abrasion.
C1701/C 1701M-09	Standard Test Method for Infiltration Rate of In Place Pervious Concrete.
C94/C94M-06	Standard Specification for Ready-Mixed Concrete
C172-04	Practice for Sampling Freshly Mixed Concrete
C42/C42M-12	Standard Test Method for Obtaining Test Drilled Cores and Sawed Beams of Concrete.
C174/C 174M-12	Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores. Note – The support pins should have a rounded radius of ½" inch. Make 9 measurements 1 at the center and 8 along the circumference.
C979-05	Standard Specification for Pigments for Integrally Colored Concrete
C1077-06	Practice for Laboratories Testing Concrete and Concrete Aggregates for the Use in Construction and Criteria for Laboratory Evaluation
D994-98 (2003)	Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
D1751-04	Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
D1752-04a	Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
D 3385-03	Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer
D 3665-06	Practice for Random Sampling of Construction Materials
E 329-06a	Specification for Agencies Engaged in Construction Inspection and/or Testing

1.4—Standards-producing organizations

Abbreviations for and complete names of organizations issuing documents referred to in this specification are listed:

American Concrete Institute (ACI)
ASTM International (ASTM)
National Ready Mixed Concrete Association (NRMCA)

1.5—Submittals

1.5.1 Contractor shall submit documentation as required in this specification for acceptance by the architect/engineer.

1.5.2 Obtain written acceptance of submittals before using the materials or methods requiring acceptance.

1.5.3 Responsibility of Contractor – Before construction, submit to Architect/Engineer:

1.5.3.1 Data on pervious contractor qualifications.

1.5.3.2 Proposed concrete mixture proportions and unit weight.

1.5.3.3 Two test panels, as described in 1.6.2, placed, jointed, and cured; each a minimum of 225sf and having the required thickness defined by Contract Documents.

1.5.4.1 Mandatory Qualifications for Pervious Concrete Contractor.

Pre-Bid Requirements

1.5.4.1.a Provide a list of 5 successfully installed DrainScape® pervious concrete projects within the Southwestern United States that when combined total over 350,000 SF. Include the address and the square footage for each project, date of the installation, the point of contact for the project and their phone number and two photos of each project. Provide copies of NRMCA certificates for at least one NRMCA Pervious Concrete Craftsman & two additional Installers or Craftsman that will be on site during placement. (Note - NRMCA Pervious Concrete Technicians will not be acceptable for this requirement). Failure to provide this information prior to bid, or the submittal of incomplete or inaccurate information, shall give cause to reject, the entire bid as non responsive and incomplete.

Preapproved Contractors

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1.6—Quality control

1.6.1 ***Contractor qualification*** – The contractor installing the DrainScape® pervious concrete must have successfully installed a minimum of 350,000 SF on 5 projects

within the Southwestern United States. The contractor shall employ no less than one NRMCA certified Pervious Concrete Craftsman and two additional NRMCA certified Pervious Concrete Installers or Craftsman who must be on site working as members of the crew during all concrete placement. (Note - NRMCA Pervious Concrete Technicians will not be acceptable for this requirement).

1.6.2 Test panels— Test panels may be placed at any of the final pervious concrete pavement placement locations. Test density and void content of freshly mixed pervious concrete for the test panels in accordance with ASTM C1688-12. Remove cores not less than 14 days after placement in accordance with ASTM C42-12 Obtaining Test Drilled Cores and Sawed Beams of Concrete. Test thickness in accordance with ASTM C 174-12. The support pins should have a rounded radius of ½" inch. Make 9 measurements 1 at the center and 8 along the circumference.

1.6.2.1 The acceptable fresh density shall be within ± 10 pcf of the specified density.

1.6.2.2 Tolerance for thickness, and unit weight, reported as the average of three cores of each test panel shall be as follows:

1.6.2.2.a The average compacted thickness shall not be more than 1/2 in. less than the specified thickness, with no single core exceeding 1 in. less than the specified thickness; nor shall the average compacted thickness be 1-1/2 in. more than the specified thickness.

1.6.2.2.b The acceptable hardened density shall be within ± 10 pcf of the specified density

1.6.2.3 When a test panel is outside one or more of the limits of 1.6.2.1 and 1.6.2.2, the test panel shall be rejected, removed, and replaced at the Contractor's expense.

1.6.2.4 When the test panel complies with 1.6.2.1 and 1.6.2.2, the panel may be left in place and included in the completed Work.

1.6.3 ***Testing agencies***—Agencies that perform testing services on concrete materials shall meet the requirements of ASTM C1077. Agencies inspecting the Work shall meet the requirements of ASTM E329. Testing agencies performing the testing shall be accepted by Architect/Engineer before performing any Work.

1.6.3.1 Field tests of concrete required shall be performed by an individual certified as an NRMCA Certified Pervious Concrete Technician or equivalent and an ACI Concrete Field Testing Technician—Grade 1 or equivalent.

1.6.4 ***Testing responsibilities of contractor—***

1.6.4.1 Advise the owner or general contractor at least 48 hours before concrete placement. (Owner or General Contractor shall be responsible for scheduling and payment of all testing as well as advising the architect/engineer of the schedule.)

1.6.5 ***Testing***

1.6.5.1 Conduct a minimum of one density and void unit weight test during each day's placement. Test density and void content of freshly mixed pervious concrete for the test panels in accordance with ASTM C1688-12.

1.6.5.1a The acceptable fresh density shall be within ± 10 pcf of the specified density.

1.6.5.2 Remove three cores from each lot of 5,000 square feet not less than 14 days after placement in accordance with ASTM C42-12 Obtaining Test Drilled Cores and Sawed Beams of Concrete. Select three locations in accordance with ASTM D 3665-06. Test thickness in accordance with ASTM C174-12. The support pins should have a rounded radius of ½" inch. Make 9 measurements 1 at the center and 8 along the circumference. After thickness determination, measure the cores for Density and Void content in accordance with ASTM C1754-12 Standard Test Method for Density of Void Content of Hardened Pervious Concrete.

1.6.5.3.1 Tolerance for thickness, and unit weight, reported as the average of three cores of each lot shall be as follows:

1.6.5.3.1.a The average compacted thickness shall not exceed 1/2" less than the specified thickness, with no single core exceeding 1" less than the specified thickness.

1.6.5.3.1.b The acceptable hardened density shall be within ±10 pcf of the specified density.

1.6.5.3.2 When a lot is outside one or more of the limits of 1.6.5.3.1, the lot shall be subject to rejection, removed, and replaced at the contractor's expense unless accepted by the owner.

1.6.5.3 Core holes shall be filled with concrete or preblended grout.

1.6.5.4 Pervious Concrete Pavement does not look or behave like typical asphalt or concrete pavements. The finished surface is not tight and uniform, but is open and varied. Minor color, surface irregularities and moderate amounts of surface raveling are normal. The raveling should be considerably reduced after the first few weeks of vehicular use.

1.6.5.5 Compressive or Flexural Strength Tests shall not be used for Pervious Concrete.

SECTION 2— PRODUCTS

2.1—Subbase

When required specify coarse aggregate size and grading requirements. Coarse aggregates shall meet the durability requirements of ASTM C 33.

2.2—Pervious Concrete

Comply with ASTM C 94/C 94M and the following requirements:

2.2.1 *Aggregates* - Aggregate size is typically 3/8" but shall not exceed ½".

2.2.2 *Admixtures* – Chemical admixtures that facilitate the production and placement of pervious concrete shall be permitted.

2.2.3 *Fibers* – The use of fibers in pervious concrete mixtures is permitted when approved by the Architect/Engineer.

2.2.*4 Pigments*—Use pigments complying with ASTM C979 if specified in Contract Documents.

2.3—Isolation joint material

2.3.1 For isolation joint materials, comply with ASTM D 994, D1751, or D1752.

2.4—Forms

2.4.1 Make forms with steel, wood, or other material that is sufficiently rigid to maintain specified tolerances, and capable of supporting concrete and mechanical concrete placing equipment.

2.4.2 Forms shall be clean and free of debris of any kind, rust, and hardened concrete.

SECTION 3—EXECUTION

3.1—Subgrade preparation

3.1.1 Prepare subgrade as specified in the contract documents.

3.1.2 Construct subgrade to ensure that the required pavement thickness is obtained in all locations.

3.1.3 Keep all traffic off of the subgrade during construction to the maximum extent practical. Regrade subgrade disturbed by concrete delivery vehicles or other construction traffic, as needed.

3.2—Subbase

3.2.1 Use only when specified in contract documents. Where used, prepare subbase in accordance with contract documents. (Note to the specifier – Usually the layer of subbase is installed over a Geotextile Mirafi 140NL)

3.3—Setting formwork

3.3.1 Set, align, and brace forms so that the hardened pavement meets the tolerances specified in 3.7.

3.3.2 Apply form release agent to the form face which will be in contact with concrete, immediately before placing concrete.

3.3.3 The vertical face of previously placed concrete may be used as a form.

3.3.4 Placement width shall be as specified in Contract Documents. Concrete placement width shall not exceed 20 ft.

3.4—Batching, mixing, and delivery

3.4.1 Batch and mix in compliance with ASTM C 94/C 94M except that discharge shall be completed within 60 minutes of the introduction of mixture water to the cement. Increase time to 90 minutes when utilizing an extended set control admixture. Water addition is permitted at the point of discharge.

3.5—Placing and finishing pavement

3.5.1 Deposit concrete either directly from the transporting equipment or by conveyor onto the prewetted subgrade or subbase.

3.5.2 Do not place concrete on frozen subgrade or subbase.

3.5.3 Deposit concrete between the forms to an approximately uniform height.

3.5.4 Spread the concrete using a come-along, short-handle, square-ended shovel or rake.

3.5.5 Strike off concrete between forms using a Bunyan Striker. laser screeds, vibrating screeds, or slip form pavers shall not be used.

3.5.6 Do not use steel trowels or power finishing equipment.

3.5.7 Finish the pavement to the elevations and thickness specified in Contract Documents.

3.6—Final surface texture

3.6.1 Compact the fresh concrete with the Bunyan Striker.

3.6.2 Compact the concrete to a dense, pervious surface.

3.6.3 Edging is not required.

3.6.4 Pervious Concrete Pavement does not look or behave like typical asphalt or concrete pavements. The finished surface is not tight and uniform, but is open and varied. Minor surface irregularities and moderate amounts of surface raveling, and color variations are normal.

3.7—Tolerances

3.7.1 Construct pavement to comply with the following tolerances:

Elevation: +3/4 in., –3/4 in.

Thickness: +1-1/2 in., –1-0 in.

3.7.1.1 General contractor or owner shall mechanically sweep pavement before testing for compliance with tolerances.

3.8—Curing

3.8.1 Begin curing within 20 minutes of concrete discharge unless longer working time is accepted by the Architect/Engineer.

3.8.2 Completely cover the pavement surface with a minimum 6 mil thick polyethylene sheet. Cut sheeting to a minimum of a full placement width.

3.8.3 Cover all exposed edges of pavement with polyethylene sheet.

3.8.4 Secure curing cover material without using dirt.

3.8.5 Cure pavement for a minimum of 7 uninterrupted days, unless otherwise specified.

3.9—Hot and cold-weather construction

3.9.1 When hot weather is anticipated, submit detailed procedures for the production, transportation, placement, protection, curing, and temperature monitoring of concrete during hot weather. Temperature of concrete shall be 95 degrees or less, unless a higher temperature is approved by the Architect/Engineer.

3.9.2 In cold weather, comply with ACI 306.1-90.

3.10—Jointing

3.10.1 Construct joints at the locations, depths, and with horizontal dimensions indicated on the Contract Documents.

3.10.2 When jointing requirements are not indicated on the project drawings, submit drawings describing proposed jointing in accordance with 1.5 and the requirements of 3.10.2.1 through 3.10.3.2.

3.10.2.1 Indicate locations of contraction joints, construction joints, and isolation joints. Spacing between contraction joints shall not exceed 20 ft.

3.10.2.2 The larger horizontal dimension of a slab panel shall not exceed 125% of the smaller dimension.

3.10.2.3 The angle between two intersecting joints shall be between 80 and 100 degrees, as specified in Contract Documents.

3.10.2.4 Joints shall intersect pavement free edges at 90-degree angles and shall extend straight for a minimum of 1-1/2 ft from the pavement edge where possible.

3.10.2.5 Contraction joint depth shall be ¼ of the pavement thickness. This shall be done with a roller jointer. If the depth of the joint exceeds 1 ½" the joint shall be cut with a rolling jointer during placement, after 7 to 14 days the remaining depth of the joint shall be cut with a concrete saw.

3.10.2.6 Use isolation joints only where pavement abuts fixed objects, such as buildings, foundations, and manholes.

3.10.2.7 Extend isolation joints through the full depth of the pavement. Fill the entire isolation joint with expansion joint material.

3.10.3 Create contraction joints by one of the following methods:

3.10.3.1 Tool contraction joints to the specified depth and width in fresh concrete immediately after the concrete is compacted.

3.10.3.2 Saw-cut concrete after concrete has hardened sufficiently to prevent aggregate from being dislodged and soon enough to control pavement cracking. To minimize drying, ensure that curing materials are removed only as needed to make cuts.

3.11—Opening to traffic

3.11.1 Do not open the pavement to light vehicular traffic until the concrete has cured for at least 14 days (28 days for heavy traffic), and not until the pervious pavement has been accepted by the architect/engineer for opening to traffic.

3.11.2 Owner/General contractor shall be responsible for protecting the pervious concrete from other trades.

3.11.3 General contractor or owner shall mechanically sweep pavement before it is opened to vehicular traffic.