



# Guideline Specifications for Portland Cement Pervious Concrete Pavements

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## FORWARD

This sample specification for Portland Cement Pervious Concrete Pavement is provided as a guideline only. Specific projects will have conditions that may require modifications to this document. It is recommended that an accompanying 'Guideline Specification for Compaction and Subgrade for Portland Cement Pervious Concrete Pavement' also be referenced. An additional resource from PSCA entitled 'Recognized Procedures for Achieving Quality Pervious Concrete' can be a helpful tool for placement and inspection.

Pervious concrete pavement does not look or behave like typical concrete pavements. The finished surface is not tight and uniform, but is open and varied. Surface irregularities and minor amounts of surface raveling are normal. Traditional concrete testing procedures for strength and slump are not applicable. Pervious Concrete is tested instead for consistency, void content and thickness; methods which are outlined in this document to help assure a long life, drainable pavement.

Owners, architects and engineers are strongly encouraged to visit locations where pervious concrete pavement has been installed before making the decision to use the material and to use an experienced installer and finisher.

Technical assistance and installation training is available from your local cement and concrete associations. Planning, design, materials and construction information can be provided. The concrete industries of California and Nevada offer you these choices:

- **California Nevada Cement Association**
  - Southern California and Southern Nevada:  
David Akers (858) 437-1445 [david.akers@cncement.org](mailto:david.akers@cncement.org)
  - Northern California and Northern Nevada:  
Paulette Salisbury (925) 918-0982 [paulette.salisbury@cncement.org](mailto:paulette.salisbury@cncement.org)
- **Concrete Promotion Council of Northern California**
  - Rob Wallace (888) 633-0393 [rob@cpcnc.org](mailto:rob@cpcnc.org)
- **Southern California Concrete Producers**
  - Larry Maes (626) 441-3107 [lmaes@sccpconcrete.com](mailto:lmaes@sccpconcrete.com)
- **Sierra Nevada Concrete Association - Reno**
  - Contact Paulette Salisbury (925) 918-0982 [paulette.salisbury@cncement.org](mailto:paulette.salisbury@cncement.org)
- **Southern Nevada Concrete and Aggregate Association – Las Vegas**
  - Contact David Akers (858) 437-1445 [david.akers@cncement.org](mailto:david.akers@cncement.org)

**SECTION 033729**  
**PORTLAND CEMENT PERVIOUS CONCRETE PAVEMENT**

**PART 1        GENERAL**

**1.01 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 Portland Cement Pervious Concrete Pavement for streets, parking and pedestrian areas in conformance with the plans and specifications.
  
- B.**        Work in other sections:  
Formwork: see "Concrete Formwork" in Division 03  
Other Paving: see other sections in Division 33  
Inserts of landscape accessories into concrete pavement: see Division 32  
Drains in concrete pavement: see Division 32  
Subgrades and Compaction: see Division 31

**1.02 References:**

- A.**        American Concrete Institute
  - 1.**        Concrete Field Testing Technician Grade I
  
- B.**        American Society for Testing and Materials
  - 1.**        ASTM C 29 "Test for Bulk Density (Unit Weight) and Voids in Aggregate ASTM C33 "Specification for Concrete Aggregates"
  - 2.**        ASTM C 33 "Specification for Concrete Aggregates"
  - 3.**        ASTM C 94 "Specification for Ready-Mixed Concrete"
  - 4.**        ASTM C 150 "Specification for Portland Cement"
  - 5.**        ASTM C 260 "Specification for Air-Entraining Admixtures for Concrete"
  - 6.**        ASTM C 494 "Specification for Chemical Admixtures for Concrete"
  - 7.**        ASTM C 595 "Specification for Blended Hydraulic Cements"
  - 8.**        ASTM C 618 "Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete."
  - 9.**        ASTM C 685 "Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing"
  - 10.**      ASTM C 989 "Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars."
  - 11.**      ASTM C 1438 "Standard Specification for Latex and Powder Modifiers for Hydraulic Cement Concrete and Mortar."

12. ASTM C 1602 “Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete”
  13. ASTM C 1688 “Standard Test Method for Density and Void Content of Freshly Mixed Pervious Concrete”
  14. ASTM C 1701/C1701M “Standard Test Method for Infiltration Rate of In Place Pervious Concrete”
  15. ASTM C 1751 “Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
  16. ASTM C 1752 “Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.”
  17. ASTM D 994 “Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)”
  18. ASTM E 329 “Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.”
- C. National Ready Mixed Concrete Association
1. Text Reference for Pervious Concrete Contractor Certification

### 1.03 Quality Assurance:

**A. The Pervious Concrete Subcontractor:**

1. Shall submit:
  - a. Evidence of two successful pervious concrete pavement projects including: the project name and address, owner’s name, contact information and size of each project.
  - b. Verification of current NRMCA Certification requirements described below:
2. Shall meet, at the time of bidding: **one** of the following criteria for the minimum certification for each placement crew and submit verification of NRMCA Pervious Concrete Certification with the bid. ([http://www.nrmca.org/Education/Certifications/Pervious\\_Contractor.htm](http://www.nrmca.org/Education/Certifications/Pervious_Contractor.htm))
  - a. The pervious concrete subcontractor shall employ no less than one (1) NRMCA Certified Pervious Concrete Craftsman who must be onsite, actively guiding and working with each placement crew during all pervious concrete placement.
  - b. The pervious concrete subcontractor shall employ no less than three (3) NRMCA Certified Pervious Concrete Installers who must be onsite, actively guiding and working with pervious concrete for projects.
  - c. The pervious concrete subcontractor shall employ no less than three (3) NRMCA Pervious Concrete technicians and one (1) Pervious Installer who shall be onsite, actively guiding and working with each placement crew during all pervious concrete placement.

- B. Performance:** Upon completion of the initial curing, the pervious concrete shall be tested for initial baseline infiltration in accordance with ASTM C1701. The rate shall be a minimum of 100 inches per hour.

**1.04 Submittals:** Before starting work, submit the following:

**A. Concrete materials:**

1. Proposed concrete mixture proportions including all material weights, volumes, density (unit weight), water / cementitious ratio, and void content. The mix design shall not specify a compressive or flexural strength.
2. Aggregate type, source and gradation.
3. Cement, fly ash, ground granulated blast-furnace slag and admixture manufacturer certifications

**B. Qualifications:** Evidence of qualifications listed under Quality Assurance.

**C. Project details:** Specific plans, details, schedule, construction procedures and quality control plan.

**D. Test Panel:**

1. Construct Test panel(s) to meet requirements of contract documents. Place a minimum one 225 sq. ft panel. Provide joints and curing using materials, equipment, and personnel proposed for the project as described in Section 1.02.B. Coordinate location of test panels with Owner and Architect/Engineer.
2. The test panel shall be tested for acceptance in accordance with section 3.08 Quality Control.
3. An approved test panel will be used as quality control for the project and may be incorporated into the project if of acceptable quality.
4. Remove and legally dispose of all materials used for test panels not approved and all excess materials.

## **PART 2 MATERIALS**

**2.01 Materials:**

**A. Cement:** Portland cement Type II or V conforming to ASTM C150 or Portland cement Type IP or IS conforming to ASTM C595.

**B. Supplementary Cementitious Materials:**

1. Class F Fly Ash: ASTM C618
2. Ground Granulated Blast-Furnace Slag: ASTM C989

**C. Chemical Admixtures:**

1. Air entraining agents shall comply with ASTM C260.
2. Chemical Admixtures shall comply with ASTM C494.
3. Latex bonding agents shall comply with ASTM C1438.

**D. Aggregates:** Coarse Aggregate: ASTM C33. The maximum size and gradation shall meet the project criteria for surface appearance and void content.

**E. Water:** ASTM C 1602.

**F. Isolation Joint Material:** Shall comply with ASTM D994, D1751, or D1752.

**2.02 Mixture Proportions:** The composition of the proposed concrete mixtures shall be submitted to the owner's representative for review and shall comply with the following provisions unless an alternative composition is demonstrated to comply with the project requirements. Conform with all requirements of Authorities Having Jurisdiction (AHJ) for pavements and walkways.

- A. Cementitious Content:** Comply with the approved mix design.
  - 1. Supplementary cementitious content:**
    - a. Fly ash:** 25% maximum of the total cementitious material or in accordance with approved mix design.
    - b. Slag:** 40% maximum of the total cementitious material or in accordance with approved mix design.
- B. Water / Cementitious Ratio** Shall range between 0.27 lb/lb and 0.31 lb/lb. or in accordance with approved mix design.
- C. Aggregate Content:** As appropriate for approved mix design.
- D. Admixtures:** Use in accordance with approved mix design.
- E. Mix Water:** as appropriate for approved mix design.
- F. Color:** Pigments to be selected by the architect.

### **PART 3 EXECUTION**

**3.01 Subgrade:** Verify subgrade preparation, grade, and conduct permeability and density tests for conformance to project requirements and is acceptable for installation of pervious concrete. (See PSCA 'Section 31 Subgrade Guidelines for Pervious Concrete' that accompanies this document.)

**3.02 Recharge Basin (Detention Basin):** When base material is used under pervious concrete for water recharge, it shall be composed of uniform sized aggregate conforming to ASTM C33, minimum size 6. For minimum void content, refer to civil or geotechnical contract documents.

**3.03 Formwork:** Form materials: any material permitted by AHJ and of sufficient strength and stability to support mechanical equipment without deformation of plan profiles following spreading, strike-off and compaction operations.

#### **3.04 Mixing and Hauling:**

- A. Production:** Pervious concrete shall be manufactured and delivered in accordance with applicable sections of ASTM C 94 or ASTM C 685.
- B. Mixing:** Pervious concrete shall be produced in central mixers, transit mixers or in volumetric mixers.
- C. Delivery:** Deliver pervious concrete directly from the mixer by means of conveyer as close as possible to final position.

- D. **Discharge:** Each truckload will be visually inspected for consistency of concrete mixture. Job site water additions are permitted to obtain and maintain the required mix consistency throughout the discharge. Discharge shall be a continuous operation. Concrete shall be deposited as close to its final position as practical and such that discharged concrete is incorporated into previously placed plastic concrete.

**3.05 Placing and Finishing:** Shall comply with the content of the National Ready Mixed Concrete Association's *'Text Reference for Pervious Concrete Contractor Certification'* with the following provisions:

- A. Internal vibration shall not be permitted. Use mechanical screed equipment. Do not use hand screeds except in confined and small areas. Cross roll compacted concrete to remove any screeding and compaction marks on the concrete surface.
- B. Compact to the required cross-section and shall not deviate more than  $\pm 3/8$  inch in 10 feet from profile grade.

**3.06 Jointing**

- A. Joints shall be installed at locations and to depths shown on the project plans.
- B. Control (contraction) joints shall be installed at regular intervals not to exceed 1.5 times the width of the placement or 20 feet, or in accordance with approved joint placement plan. The control joints shall be installed at  $1/4$  the thickness of the pavement but not to exceed 1-1/2". These joints can be installed in the plastic concrete or saw cut after the concrete has hardened. New joints in plastic concrete or recently hardened concrete shall align with joints in older concrete. Joints abutting curbs and other fixed concrete shall be installed within 10 degrees of perpendicular to the older concrete as possible.
- C. Install joints to match approved sample.
- D. Transverse construction joints: Install whenever placing is suspended for 20 minutes or whenever concrete is no longer workable.
- E. Do not dowel longitudinal joints between successive placements.
- F. Isolation joints: Use when abutting fixed vertical structures. Place isolation material before concrete is placed and to the depth of the pavement section.

**3.07 Curing:**

- A. Final curing procedures shall begin no later than 20 minutes after the concrete has been discharged from the mixer. The pavement surface shall be covered with a minimum of six (6) mil thick white or clear polyethylene sheet or other approved covering material. In cold weather black plastic may be used to aid in heat retention. The cover shall prevent air infiltration to the fresh concrete and shall overlap all exposed edges and shall be secured to prevent dislocation due to winds or adjacent traffic conditions.
- B. The curing cover shall remain securely in place for a minimum of 7 days. No vehicular traffic shall be permitted on the pavement until curing is complete and no truck traffic shall be permitted for at least 14 days.

**3.08 Quality Control:**

- A.** The owner shall employ a testing laboratory that conforms to the requirements of ASTM E329 and ASTM C1077. All personnel engaged in testing shall be certified by the American Concrete Institute as ACI Concrete Field Technicians or equivalent and shall be certified by NRMCA as a Pervious Concrete Technician.
- B.** Prior to each placement, the formed thickness shall be at least the design thickness testing within -0" to +3/4".
- C.** Plastic concrete shall be sampled in accordance with ASTM C 172 and density (unit weight) measured in accordance with ASTM C 1688. The density (unit weight) of the delivered concrete shall be +/- 5 pcf of the design density (unit weight).
- D.** Plastic void content shall be calculated as per ASTM C1688 Gravimetric Air Determination and compared to the void percentage required by the hydraulic design.
- E.** Upon completion of initial curing, the pervious concrete shall be tested for a baseline infiltration rate using ASTM C1701.

**END OF SECTION**

*"This guideline specification is intended solely for use by professional personnel who are competent to evaluate the significance and limitations of the information provided and who will accept responsibility for the application of this information. The Pacific Southwest Concrete Alliance, its members firms and employees disclaim any and all responsibility and liability for the accuracy and the application of the information contained in this publication to the full extent permitted by law."*