

## ENVIRONMENTAL CRITERIA FOR EVALUATION OF PERVIOUS AND PERMEABLE PAVING MATERIALS AND ASSEMBLIES

### EC116

Effective date: October 1, 2012

#### PREFACE

ICC-ES issues Environmental Criteria (ECs) to provide interested parties with information on the requirements for obtaining an ICC-ES Verification of Attributes Report (VAR). An ICC-ES VAR provides independent verification of a manufacturer's environmental claims and product attributes. ECs address the production stage of the report subject, beginning with raw material acquisition through final manufacturing and packaging, and may also include information on projections for installation, use, reuse, and end-of-life, where specifically stated therein. This EC is effective as of the date referenced above and may be amended from time to time.

All VARs must comply with the EC in effect on the date of issuance or reissuance of the report. Any technical changes to the EC will be marked within the EC. A solid vertical line (|) shall be placed in the margin within the EC to indicate a change, addition, or deletion from the previous edition. A deletion indicator (➔) shall be placed in the margin where wording has been deleted.

ICC-ES may consider alternate approaches to those contained in this EC, provided the applicant submits valid data demonstrating that the alternate approach is at least equivalent to the requirements set forth in this EC, subject to approval by ICC-ES staff. Notwithstanding that a product, material, or type or method of construction meets the requirements set forth in this EC, or that it can be demonstrated that valid alternate ECs are equivalent to the requirements in this document, ICC-ES retains the right to refuse to issue or renew a VAR, if the product, material, or type or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or malfunctioning is apt to cause unreasonable property damage or personal injury or sickness relative to the benefits to be achieved by the use of the product, material, or type or method of construction.

The EC is limited to the scope statement in Section 1.2 and is not intended to construe a comprehensive environmental claim where considerations are given to other environmental trade-offs, impacts or full life cycle assessment.

**Note: The Preface of ICC-ES environmental criteria was revised in February 2012 to reflect changes in policy .**

**Environmental Criteria are developed for use solely by ICC-ES for purpose of issuing ICC-ES VARs.**

# ENVIRONMENTAL CRITERIA FOR EVALUATION OF PERVIOUS AND PERMEABLE PAVING MATERIALS AND ASSEMBLIES (EC116)

## 1.0 INTRODUCTION

**1.1 Purpose:** This document provides a procedure for determination of physical properties of pervious and permeable paving materials and assemblies of materials, either field-mixed or prefabricated, for recognition in an ICC-ES Environmental Programs, Verification of Attributes Report (VAR).

**1.2 Scope:** Reports issued under this environmental criteria address raw material acquisition and production stages. Life cycle assessment considerations are outside the scope of this EC. Report users are responsible for determining compliance with applicable codes, standards and environmental regulations.

**1.3 Applicability:** Pervious and permeable paving materials shall be based on the criteria in the following:

**1.3.1** IgCC Sections 403.1, 408.2.1, 408.2.4, 903.1 and 904.3

**1.3.2** CALGreen Section A4.106.4 and A5.106.3(5)

**1.3.3** ICC 700 Section 403.5

**1.3.4** ASHRAE Standard 189.1 Section 5.4.1.1

**1.3.5** ANSI/GBI 01 Sections 7.3.1.1 and 7.4.1.8.7

**1.3.6** LEED Credit SS6.1 and SS6.2

**1.3.7** LEED Homes Credit SS4

### 1.4 Referenced Documents:

**1.4.1** 2012 *International Green Construction Code*<sup>™</sup> (IgCC), International Code Council.

**1.4.2** 2010 *California Green Building Standards Code* (CALGreen), California Building Standards Commission.

**1.4.3** 2008 National Green Building Standard<sup>™</sup> (ICC 700), National Association of Homebuilders.

**1.4.4** ANSI/ASHRAE/USGBC/IES Standard 189.1-2009, – Standard for the Design of High-Performance Buildings (Except Low-Rise Residential Buildings), American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

**1.4.5** ANSI/GBI 01-2010, Green Building Assessment Protocol, Green Building Initiative, Inc.

**1.4.6** LEED<sup>®</sup> 2009 for New Construction and Major Renovations, U.S. Green Building Council, Inc.

**1.4.7** LEED<sup>®</sup> 2009 for Schools New Construction and Major Renovations, U.S. Green Building Council, Inc.

**1.4.8** LEED<sup>®</sup> for Homes Rating System, Version 2008, U.S. Green Building Council, Inc.

**1.4.9** ASTM C39/C39M-10, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens, ASTM International.

**1.4.10** ASTM C140-12, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units, ASTM International.

**1.4.11** ASTM C936/C936M-11, Standard Specification for Solid Concrete Interlocking Paving Units, ASTM International.

**1.4.12** ASTM C1319/C1319M-11, Standard Specification for Concrete Grid Paving Units, ASTM International.

**1.4.13** ASTM C1688/C1688M-10a, Standard Test Method for Density and Void Content of Freshly Mixed Pervious Concrete, ASTM International.

**1.4.14** ASTM C1701/C1701M-09, Standard Test Method for Infiltration Rate of In Place Pervious Concrete, ASTM International.

**1.4.15** Environmental Criteria for Determination of Radiative Properties of Roof Coverings and Solar Reflectance of Hardscape Materials (EC103), ICC Evaluation Service, LLC.

### 1.5 Terms and Definitions:

**1.5.1 Concrete Grid Paving Units:** Manufactured solid hydraulic cement concrete paving units with openings filled with aggregates and that when assembled allow passage of water through the assembly. The units are assembled into a pattern consisting of a minimum 20 percent open surface area.

**1.5.2 Pervious Concrete:** Hydraulic cement concrete with distributed, interconnected macroscopic voids that allows water to pass through the material with little resistance. (IgCC Section 202).

**1.5.3 Interlocking Concrete Pavers:** Manufactured solid hydraulic cement concrete paving units with joints and/or openings between units that are filled with aggregates and that allow passage of water through the assembly. The units are assembled into a pattern that has an open surface area ranging from 5 to 19 percent.

**1.5.4 Permeable Paving:** Paving, composed of material other than concrete, that permits the passage of water vapor and/or liquid.

## 2.0 REQUIRED DATA

**2.1 Product Description:** Information on the paving products or systems to be evaluated. The information shall include the product name, style, part or model number (as applicable), physical description of the paving product or system, and a production flowchart identifying all of the components used in the production of pervious and permeable paving materials with respect to the overall manufacturing process, whether the process consists of field-mixing and placing or factory prefabrication. Additionally, all relevant specifications for the product must be provided along with the components and/or constituents used to manufacture the product, and the components used with the product in the final in-place configuration on-site. Specifications must be consistent with the product as described in the submitted test reports and quality documentation. As an example, for mixed materials (wet and dry), the following must be provided:

- i. Specifications of incoming materials, or the date of the signed, controlled document that describes each constituent and its specification.
- ii. Mix ratios of the constituents, or the date of the signed, controlled document that describes the mix ratio.

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- iii. Finished product specifications (for example, for wet products, specific gravity and viscosity; for formed products, weight, compressive strength, etc.).

When agreed to by ICC-ES, in lieu of providing the actual specifications, the applicant may identify the controlled document that describes the product specifications, provided the document is identified by a revision level and/or date.

When the product specifications are not provided to ICC-ES except through reference to a controlled document as described in the preceding paragraph, the controlled document describing the product specifications shall be made available to the inspection agency for their review and their verification, during the qualifying inspection described in Section 3.3, that the product specifications are consistent with the product described in the original qualifying data.

**2.2 Packaging and Identification:** A description of the method to allow for field identification of the material shall be submitted. Identification shall include the ICC-ES VAR number.

**2.3 Installation and Field Inspection Requirements:** Specifications for the installation and inspections required to determine the installed paving will meet minimum performance requirements. For *interlocking concrete pavers* and *concrete grid paving units*, the unit manufacturer's specifications, installation instructions or other technical literature must be provided that specifies the minimum percent of open surface area and the type and/or size of permeable aggregate necessary for the assembly to achieve the infiltration rate established by testing in accordance with Section 2.4.3.

**2.4 Pervious and Permeable Paving Materials or Systems:** The following data must be submitted for the applicable material or system that is of materials to be evaluated:

**2.4.1 Pervious Concrete and Permeable Paving:** Data demonstrating compliance with the requirements of Sections 2.4.1.1, 2.4.1.2 and 2.4.3.

**2.4.1.1 Density and Void Content:** Results of testing in accordance with ASTM C1688 to establish the minimum requirements necessary to achieve the infiltration rate established by the testing specified in Section 2.4.3.

**2.4.1.2 Compressive Strength:** Results of testing in accordance with ASTM C39 to establish the minimum compressive strength for each paving mix for which evaluation is sought.

**2.4.2 Interlocking Concrete Pavers and Concrete Grid Paving Units:** Data demonstrating compliance with the requirements of Sections 2.4.2.1, 2.4.2.2 and 2.4.3.

**2.4.2.1 Physical Properties:** Results of testing in accordance with ASTM C936 for interlocking concrete pavers, and in accordance with ASTM C1319 for concrete grid paving units.

**2.4.2.2 Compressive Strength:** Results of testing in accordance with ASTM C140 to establish the

minimum compressive strength for each concrete product mix for which evaluation is sought.

**2.4.3 Infiltration (Percolation) Rate:** When recognition for compliance with the requirements of IgCC Section 408.2.4 is sought, results of testing in accordance with ASTM C1701 to establish the minimum design infiltration rate, shall be submitted. The results shall be expressed in both inches/hour and gallons/minute/square foot.

**2.5 Solar Reflectance Value (Optional):** When recognition for compliance with the requirements of IgCC Section 408.2.1 is sought, data shall be submitted demonstrating compliance with the requirements set forth in Section 2.4 of the ICC-ES Environmental Criteria for Determination of Radiative Properties of Roof Coverings and Solar Reflectance of Hardscape Materials (EC103), for each color of paving for which recognition is sought. **Exceptions:** The following materials shall be deemed to comply with this section and need not be tested:

1. Pervious and permeable concrete pavements.
2. Concrete paving and *interlocking concrete pavers*, without added color or stain.

## 3.0 QUALITY CONTROL

**3.1 Required Elements of the Quality System Documentation:** Quality system documentation shall be submitted that meets the following requirements:

**3.1.1** The quality system documentation shall be signed and dated by an authorized representative of the manufacturer.

**3.1.2** The documentation shall clearly state the facility name of the manufacturing location for prefabricated paving units or batch plant location for field-mixed materials, the street address and telephone number, and the name of the contact person at the facility.

**3.1.3** There shall be provisions for the quality system documentation to be reviewed at least annually. A record of revisions shall be maintained.

**3.1.4** The documentation shall indicate how the recognized product is to be identified in the field. This information shall be consistent with the information in the "Identification" section of the VAR, and should include a copy of the form of identification or a description of what is included on the method of identification. Product identification shall include, at a minimum, the report holder's name, the VAR number (ICC-ES VAR-XXXX), and information required by the applicable environmental criteria.

**3.1.5** Based on the product identification, the quality system shall provide a means to trace finished product back to the production and quality control records at the location where the subject of the VAR was produced.

**3.1.6** The documentation shall describe the process used in producing the product or system.

**3.1.7** The documentation shall include provisions for the documenting of product changes, evaluation of product changes and notification to the appropriate parties.

**3.1.8 Incoming Materials:** The documentation shall include procedures regarding inspections or tests that are

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conducted on incoming materials, or other means used to determine that the materials meet specifications (for example, mill test reports, certificates of analysis, certificates of compliance, etc.). If incoming material requiring a certificate at the time of receipt does not carry a certificate, then the documentation shall contain provisions for the material to be segregated until it has been appropriately tested or inspected, or the certificate is received.

**3.1.9 In-process Quality Control:** The documentation shall describe in-process quality control procedures, including how the production processes are monitored to ensure that the product is consistently produced within the allowable tolerances.

**3.1.10 Final Inspection:** The documentation shall detail any final inspections and/or tests that are conducted to ensure that the finished product complies with specifications and applicable design values.

**3.1.11 Nonconforming Materials:** The documentation shall specify how nonconforming materials—incoming materials, materials in production, and finished materials—are segregated from production until a decision is made as to their disposition.

**3.1.12** When products are produced at multiple locations, the report applicant shall submit quality system documentation for each of the manufacturing sites.

**3.1.13** When the product is produced by a party other than the report holder, a form provided by ICC-ES to the applicant to cover this circumstance shall be submitted.

**3.2** The following declarations shall be provided to ICC-ES in a signed and dated affidavit from the report holder:

**3.2.1** The ICC-ES name, mark, or report number will only be used on products that are in compliance with the VAR and the quality system documentation.

**3.2.2** The report holder will promptly investigate and respond to ICC-ES when apprised by ICC-ES of complaints concerning product performance.

**3.2.3** The report holder agrees to permit ICC-ES representatives to examine, at distribution points and the manufacturing plant, any product labeled as being in conformance with the VAR.

**3.2.4** ICC-ES will be notified in writing if there is a significant change in the product, manufacturing

procedures or quality system documentation from what was recognized upon issuance of the VAR.

**3.3** Prior to issuance of a VAR, an initial on-site inspection of the manufacturing facility shall be conducted by an ICC-ES representative or a representative of an accredited inspection agency with the proper technical disciplines.

**3.4** At the time of renewal of a VAR, a third-party inspection of the manufacturing facility shall be conducted as a condition of renewal of the report. This inspection shall verify that no changes to the production process, raw materials or quality program as they relate to the components of the pervious or *permeable paving*.

### 4.0 VAR RECOGNITION

**4.1** The VAR shall identify the specific product for which data was submitted.

**4.2** The VAR shall state the minimum infiltration rate established by testing in accordance with ASTM C 1701 and the minimum design mix requirements established by testing in accordance with ASTM C 1688 (for field cast paving only). Paving that meets the requirements of pervious concrete is exempt from this requirement.

**4.3** When testing in accordance with Section 2.4.4 is provided, the report shall include the initial solar reflectance value established by submitted test data. For *pervious concrete* and concrete paving that comply with the exception in Section 2.4.4 the following statement will be included:

“The pervious concrete paving evaluation contains no stain or colors and is deemed to comply with the requirements of IgCC Section 408.2.1.”

**4.4** The VAR shall include the following statements:

**4.4.1** “The evaluation is limited to the infiltration rates of the pervious or permeable paving only. The evaluation of the subgrade material or the design of the subgrade on which the paving is installed is outside the scope of this report.”

**4.4.2** “The report subject shall be subject to the commissioning requirements set forth in IgCC Table 903.1 and Section 904.3 for hardscape and stormwater management system operation.”■