



Designation: C1781/C1781M – 21

Standard Test Method for Surface Infiltration Rate of Permeable Unit Pavement Systems¹

This standard is issued under the fixed designation C1781/C1781M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This test method covers the determination of the field surface infiltration rate of in place permeable unit pavement systems surfaced with solid interlocking concrete paving units, concrete grid paving units, or clay paving brick.

NOTE 1—For in-place pervious concrete, Test Method C1701/C1701M should be used. Test Method C1701/C1701M is functionally identical to this standard, but does not include the added provisions for positioning and securing the test ring to a discontinuous surface, which are detailed in this standard. Both tests methods give comparable results

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 The text of this test method references notes that provide explanatory material. These notes shall not be considered as requirements of the test method.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This test method is under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and is the direct responsibility of Subcommittee C15.04 on Research.

Current edition approved Dec. 1, 2021. Published December 2021. Originally approved in 2013. Last previous edition approved in 2018 as C1781/C1781M – 18^ε. DOI: 10.1520/C1781_C1781M-21.

2. Referenced Documents

2.1 ASTM Standards:²

C902 Specification for Pedestrian and Light Traffic Paving Brick

C920 Specification for Elastomeric Joint Sealants

C936/C936M Specification for Solid Concrete Interlocking Paving Units

C1232 Terminology for Masonry

C1272 Specification for Heavy Vehicular Paving Brick

C1319 Specification for Concrete Grid Paving Units

C1701/C1701M Test Method for Infiltration Rate of In Place Pervious Concrete

2.2 Other Standards:³

Federal Specification A-A-3110 (TT-P-1536A) Plumbing Fixture Setting Compound

3. Terminology

3.1 The terms used in this test method are defined in Terminology C1232.

3.2 Definitions:

3.2.1 *permeable unit pavement system, n*—pavement with wearing surface made from clay or concrete units that allows infiltration of water through open-graded aggregate in the joints, cores, or other openings, to a bed, base, and subbase, or combinations thereof.

3.2.1.1 *Discussion*—Permeable pavement systems are utilized to reduce stormwater runoff. Permeable pavements have wearing surfaces with high initial water infiltration through open spaces filled with aggregates to drain water into open-graded bedding and base materials. The open spaces in the

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://dodssp.daps.dla.mil>.

*A Summary of Changes section appears at the end of this standard

wearing surface are designed to enable sufficient infiltration rates to handle runoff from designated storm types (for example, 1 year, 24-hour event). With unit pavers the open spaces can be achieved with exposed coring, a specially-shaped perimeter configuration, or wider joints, or combinations thereof. Permeable pavement systems can also be made with standard units and a laying pattern that permits sufficient water entry.

4. Summary of Test Method

4.1 An infiltration ring is temporarily sealed to the surface of a permeable unit pavement system. These pavements typically consist of solid concrete paving units conforming to Specification **C936/C936M**, concrete grid paving units conforming to Specification **C1319**, or clay paving brick conforming to Specification **C902** or **C1272**. These pavements allow drainage through joints between the units or through voids formed by the intersection of two or more units or intentionally manufactured into the units. The results of this test method for unit pavement systems can be compared to that using Test Method **C1701/C1701M** for pervious concrete. After pre-wetting the test location, a given mass of water is introduced into the ring and the time for the water to infiltrate the pavement is recorded. The infiltration rate is calculated in accordance with **9.1**.

5. Significance and Use

5.1 This test method can be used for acceptance of surface infiltration of new permeable unit pavement systems.

5.2 Tests performed at the same location across a span of years may be used to detect a reduction of infiltration rate of the permeable surface, thereby identifying the need for any remedial maintenance intended to increase the infiltration rates to predefined levels.

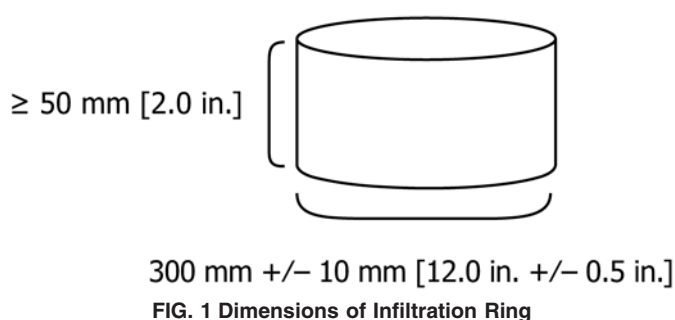
5.3 The infiltration rate obtained by this method is valid only for the localized area of the pavement where the test is conducted. To determine the surface infiltration rate of the entire permeable pavement, multiple locations must be tested and the results averaged.

5.4 The minimum acceptable infiltration rate is typically established by the design engineer of record or the municipality and can be a function of the design precipitation event.

5.5 This test method can also be used to demonstrate the infiltration rate of a particular permeable unit pavement system if the drainage joints are filled with the aggregate that is specified for use in that system.

6. Apparatus

6.1 **Infiltration Ring**—A cylindrical ring, open at both ends (See **Fig. 1**). The ring shall be watertight, sufficiently rigid to retain its form when filled with water, and shall have a diameter of 300 ± 10 mm [12.0 ± 0.5 in.] with a minimum height of 50 mm [2.0 in.]. The bottom edge of the ring shall be even. The inner surface of the ring shall be marked or scored with two lines at a distance of 10 and 15 mm [0.40 and 0.60 in.] from the bottom of the ring. Measure and record the inner diameter of the ring to the nearest 1 mm [0.05 in.].



NOTE 2—Ring materials that have been found to be suitable include steel, aluminum, rigid plastic, and PVC.

6.2 **Balance**—A balance or scale accurate to 0.05 kg [0.1 lb].

6.3 **Container**—A cylindrical container typically made of plastic having a volume of at least 20 L [5 gal], and from which water may be easily poured at a controlled rate into the infiltration ring.

6.4 **Stop Watch**—Accurate to 0.1 s.

6.5 **Plumbers Putty (Non-Hardening)**—Meeting Specification **C920** or Federal Specification A-A-3110.

6.6 **Water**—Potable water.

7. Test Locations

7.1 Perform tests at multiple locations at a site as requested by the purchaser of testing services. Unless otherwise specified, use the following to determine the number of tests to perform:

7.1.1 Three test locations for areas up to 2500 m² [25 000 ft²].

7.1.2 Add one test location for each additional 1000 m² [10 000 ft²] or fraction thereof.

7.2 Provide at least 1 m [3 ft] clear distance between test locations, unless at least 24 h have elapsed between tests.

8. Procedure

8.1 Clean the pavement surface by only sweeping off trash, debris, and other non-seated material.

8.2 If the test is being conducted to demonstrate the infiltration rate of a particular permeable unit pavement system, fill the drainage joints with the aggregate specified for use in that system (see **Note 3**).

NOTE 3—The performance of any permeable unit pavement system is related to the interaction of the paving units with the aggregate that is used to fill the drainage joints. When conducting tests to document the performance of a particular permeable unit pavement system, tests should not be conducted with empty or partially filled drainage joints as this will yield unrealistically high drainage rates that are not representative of the complete system.

8.3 Take a photograph of the immediate area to be tested to document the pavement pattern and layout. Move the ring over the surface of the pavement until the pattern, drainage joints and drainage voids framed within the infiltration ring are representative of the entire paving pattern, drainage joints and drainage voids across the pavement surface. Set the ring on the pavement surface and mark its location by circumscribing it