



Designation: C1781/C1781M – 13

# Standard Test Method for Surface Infiltration Rate of Permeable Unit Pavement Systems<sup>1</sup>

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 ( $\epsilon$ ) 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.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

C902 Specification for Pedestrian and Light Traffic Paving Brick

C920 Specification for Elastomeric Joint Sealants

C936 Specification for Solid Concrete Interlocking Paving Units

C1232 Terminology of Masonry

C1272 Specification for Heavy Vehicular Paving Brick

C1319 Specification for Concrete Grid Paving Units

C1701 Test Method for Infiltration Rate of In Place Pervious Concrete

2.2 *Other Standards:*<sup>3</sup>

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

## 3. Terminology

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

## 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, 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 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.

<sup>1</sup> 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.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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

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.

**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 1—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 10 g [0.02 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 m<sup>2</sup> [25 000 ft<sup>2</sup>].

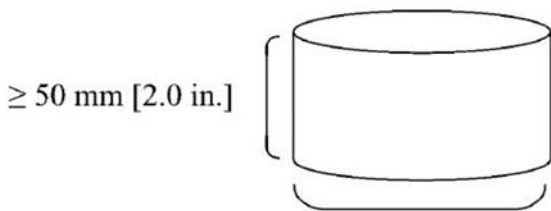
7.1.2 Add one test location for each additional 1000 m<sup>2</sup> [10 000 ft<sup>2</sup>] or fraction thereof.

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

7.3 Do not test if there is standing water on top of the permeable pavement. Do not test within 24 h of the last precipitation.

**8. Procedure**

8.1 *Infiltration Ring Installation*—Clean the pavement surface by only sweeping off trash, debris, and other non-seated material.



300 mm +/- 10 mm [12.0 in. +/- 0.5 in.]  
**FIG. 1 Dimensions of Infiltration Ring**

8.2 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 with chalk or other temporary marking. Take a photograph of the circumscribed chalk or temporary marking to document the placement of the ring relative to the pavement pattern and layout (see Note 2).

NOTE 2—The procedure in 8.2 for selecting and documenting the placement of the infiltration ring on a representative area of the pavement is sufficient in most cases for determining the infiltration rate of the pavement. The drainage area within the infiltration ring is typically within ±20 % of the average drainage area of the pavement as a whole. This accuracy is adequate for most situations. If a more accurate quantification of the infiltration rate is needed, the procedure detailed in Appendix X1 can be used to normalize the drainage area within the infiltration ring to the average drainage area of the pavement as a whole.

8.3 For solid interlocking concrete paving units and clay brick paving, remove aggregate to a depth of no greater than 10 mm [0.5 in.] in any joint or drainage void that will be directly below the test ring and fill these areas with plumbers putty so that a positive seal can be made to the test ring once it is placed on the surface. Take care not to extend the plumbers putty more than 10 mm [0.5 in.] inside the perimeter of the chalk line or other temporary marking. For concrete grid paving units, center as much of the ring as possible on the webs. For ring locations over openings, remove any vegetation, if present, directly below the test ring to a depth of no greater than 10 mm [0.5 in.] and apply plumbers putty to the surface of the soil, or to the aggregate, if present, so that a positive seal can be made to the test ring once it is placed on the surface. Take care not to extend the plumbers putty more than 10 mm [0.5 in.] inside the perimeter of the chalk line or other temporary marking.

8.4 Apply plumbers putty around the bottom edge of the ring and place the ring onto the surface being tested. Press the putty into the surface and around the bottom edge of the ring to create a watertight seal making sure that the putty does not extend more than 10 mm [0.5 in.] inside the perimeter of the ring. Place additional putty as needed to ensure a watertight seal.

NOTE 3—In a hot environment or when the surface temperature is over 38°C [100°F] plumbers putty may not adhere to the surface of the pavement easily. Therefore it is advisable to perform this test during a cooler temperature.

8.5 *Prewetting*—Pour water into the ring at a rate sufficient to maintain a head between the two marked lines. Take care to pour the water such that it falls directly on the surface of a paving unit and not onto the joints. This minimizes displacement of jointing aggregate and any accumulated sediment in the joints during the test (see Note 4). Use a total of 3.60 ± 0.05 kg [8.0 ± 0.1 lb] of water. Begin timing as soon as the water impacts the permeable pavement surface. Stop timing when free water is no longer present on the surface. Record the amount of elapsed time to the nearest 0.1 second.

NOTE 4—It is recommended that the pour height be limited to a