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.



Designation: C1701/C1701M - 17a

Standard Test Method for Infiltration Rate of In Place Pervious Concrete¹

This standard is issued under the fixed designation C1701/C1701M; 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 water infiltration rate of in place pervious concrete.

Note 1—For permeable unit pavement systems, Test Method C1781/ C1781M should be used. Test Method C1781/C1781M is functionally identical to this test method but includes added provisions for positioning and securing the test ring to a discontinuous surface. 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 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.

1.4 The text of this standard references notes that provide explanatory material. These notes shall not be considered as requirements of the standard.

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.

2. Referenced Documents

2.1 ASTM Standards:²

C125 Terminology Relating to Concrete and Concrete Aggregates

C920 Specification for Elastomeric Joint Sealants

C1781/C1781M Test Method for Surface Infiltration Rate of Permeable Unit Pavement Systems

2.2 Other Standards Federal Specification A-A-3110 (TT-P-1536A) Plumbing Fixture Setting Compound³

3. Terminology

3.1 Definitions:

3.1.1 The terms used in this test method are defined in Terminology C125.

4. Summary of Test Method

4.1 An infiltration ring is temporarily sealed to the surface of a pervious pavement. After prewetting 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 Tests performed at the same location across a span of years may be used to detect a reduction of infiltration rate of the pervious concrete, thereby identifying the need for remediation.

5.2 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 infiltration rate of the entire pervious pavement multiple locations must be tested and the results averaged.

5.3 The field infiltration rate is typically established by the design engineer of record and is a function of the design precipitation event.

5.4 This test method does not measure the influence on in-place infiltration rate due to sealing of voids near the bottom of the pervious concrete slab. Visual inspection of concrete cores is the best approach for determining sealing of voids near the bottom of the pervious concrete slab.

6. Apparatus

6.1 *Infiltration Ring*—A cylindrical ring, open at both ends (See Fig. 1). The ring shall be watertight, sufficiently rigid to

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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 http://www.everyspec.com

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≥ 50 mm [2.0 in.]



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

retain its form when filled with water, and shall have a diameter of $300 \pm 10 \text{ mm} [12.0 \pm 0.5 \text{ in.}]$ 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 2,500 m² [25,000 ft^2].

7.1.2 Add one test location for each additional 1,000 m^2 [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.

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

8. Procedure

8.1 *Infiltration Ring Installation*—Clean the pavement surface by only brooming off trash, debris, and other non-seated material. Apply plumbers putty around the bottom edge of the ring and place the ring onto the pervious concrete surface being tested. Press the putty into the surface and around the bottom edge of the ring to create a watertight seal. Place additional putty as needed

Note 3—In a hot environment where the surface temperature is over 38 $^{\circ}$ C [100 $^{\circ}$ F] plumbers putty may not adhere to the concrete surface easily. Therefore it is advisable to perform this test during cooler temperature.

8.2 *Prewetting*—Pour water into the ring at a rate sufficient to maintain a head between the two marked lines. 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 pervious concrete surface. Stop timing when free water is no longer present on the pervious surface. Record the amount of elapsed time to the nearest 0.1 s.

8.3 *Test*—The test shall be started within 2 min after the completion of the prewetting. If the elapsed time in the prewetting stage is less than 30 s, then use a total of 18.00 ± 0.25 kg [40.0 \pm 0.5 lb] of water. If the elapsed time in the prewetting stage is greater than or equal to 30 s, then use a total of 3.60 ± 0.05 kg [8.0 ± 0.1 lb] of water. Record the weight of water to the nearest 0.05 kg [0.1 lb]. Pour the water onto the ring at a rate sufficient to maintain a head between the two marked lines and until the measured amount of water has been used. Begin timing as soon as the water impacts the permeable pavement surface. Record the testing duration (*t*) to the nearest 0.1 s.

Note 4—If a sloped pavement is being measured, maintain head between the two marked lines at the lowest point of the slope.

8.4 If a test is repeated at the same location, the repeat test does not require pre-wetting if conducted within 5 min after completion of the first test. If two tests are conducted at a location on a given day, the infiltration rate at that location on that day shall be calculated as the average of the two tests. No more than two tests shall be conducted at the same location on the same day.

9. Calculation

9.1 Calculate the infiltration rate (*I*) using consistent units as follows:

$$I = \frac{KM}{\left(D^{2} * t\right)}$$

where:

I = Infiltration rate, mm/h [in./h],

M = Mass of infiltrated water, kg [lb],

D = Inside diameter of infiltration ring, mm [in.],

t = time required for measured amount of water to infiltrate the concrete, s K = 4 583 666 000 in SI units or 126 870 in [inch-pound] units.

Note 5—The factor *K* has units of $(\text{mm}^3 \cdot \text{s})/(\text{kg-h})$ [(in.³ · s)/(lb·h)] and is needed to convert the recorded data (*W*, *D*, and *t*) to the infiltration rate *I* in mm/h [in./h].

10. Report

10.1 Report the following information:

10.1.1 Identification number,

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10.1.2 Location,

10.1.3 Date of test,

10.1.4 Age and thickness of concrete (label Unknown if not known),

10.1.5 Time elapsed during prewetting, s,

10.1.6 Amount of rain during last event, if known, mm [in.],

10.1.7 Weight of infiltrated water, kg [lb],

10.1.8 Inside diameter of infiltration ring, mm [in.],

10.1.9 Time elapsed during infiltration test, s,

10.1.10 Infiltration rate, mm/h [in./h], and

10.1.11 Number of tests performed at each location, if applicable.

11. Precision and Bias

11.1 Repeatability testing was performed by a single laboratory by making 2 replicate measurements at three locations

on a newly placed pervious concrete pavement. The replicate measurements were repeated daily from day 1 to day 10. The single-operator coefficient of variation of the infiltration rate at one test location was found to be 4.7 %.

11.2 The multi-operator variability data has not been developed. The reproducibility of this test method is being determined and will be available on or before October 1, 2014.

11.3 This test method has no bias because the infiltration rate of in-place pervious concrete is defined only in terms of this test method.

12. Keywords

12.1 concrete; infiltration; pervious; water

SUMMARY OF CHANGES

Committee C09 has identified the location of selected changes to this standard since the last issue (C1701/C1701M-17) that may impact the use of this standard. (Approved March 15, 2017.)

(1) Note 1 was added to 1.1 to give guidance on testing permeable unit pavement systems.(2) Revised 6.2 and 8.3 to require the accuracy of the balance and the weight measurements to be to the nearest 0.05 kg [0.11b].

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