Designation: D7351 – 07

StandardTest Method for Determination of Sediment Retention Device Effectiveness in Sheet Flow Applications[1]

This standard is issued under the fixed designation D7351; 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 establishes the guidelines, requirements and procedures for evaluating the ability of Sediment Retention Devices (SRDs) to retain sediment when exposed to sediment-laden water "sheet" flows.

1.2 This test method is applicable to the use of an SRD as a vertical permeable interceptor designed to remove suspended soil from overland, nonconcentrated water flow. The function of an SRD is to trap and allow settlement of soil particles from sediment laden water. The purpose is to reduce the transport of eroded soil from a disturbed site by water runoff.

1.3 The test method presented herein is intended to indicate representative performance and is not necessarily adequate for all purposes in view of the wide variety of possible sediments and performance objectives.

1.4 The values stated in SI units are to be regarded as standard. The inch-pound values given in parentheses are provided for information purposes only.

1.5 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026.

1.5.1 The procedures used to specify how data are collected/recorded and calculated in this standard are regarded as the industry standard. In addition, they are representative of the significant digits that should generally be retained. The procedures used do not consider material variation, purpose for obtaining the data, special purpose studies, or any consideration for the user's objectives; and it is common practice to increase or reduce significant digits of reported data to commensurate with these considerations. It is beyond the scope of this standard to consider significant digits used in analysis methods for engineering design.

1.6 *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:*[2]

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3))

D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

D5141 Test Method for Determining Filtering Efficiency and Flow Rate of the Filtration Component of a Sediment Retention Device

D6026 Practice for Using Significant Digits in Geotechnical Data

3. Terminology

3.1 For definitions of terms used in this test method, see Terminology D653.

4. Summary of Test Method

4.1 Sediment-laden water is allowed to "sheet flow" up to and seep through, over, and/or under an installed sediment retention device (SRD). At a minimum, the amount (via water and soil weight) of sediment-laden flow is measured both upstream and downstream of the SRD.

4.2 The measurement of sediment that passes through, over, and/or under the SRD compared to the amount in the upstream flow is used to quantify the effectiveness of the SRD in retaining sediments[3,4].

[1] This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.25 on Erosion and Sediment Control Technology.

Current edition approved May 1, 2007. Published June 2007. DOI: 10.1520/D7351-07.

[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] Sprague, C.J. (2004), "*Testing the Effectiveness of Sediment Retention Devices*", StormCon '04, Palm Desert, CA, (digital proceedings).

[4] Sprague, C.J. and Carpenter, T. (2004), "*A New Procedure for Testing the Effectiveness of Sediment Retention Devices*", Conf. XXXV, International Erosion Control Assoc., Philadelphia, pp. 265-275.

5. Significance and Use

5.1 This test method quantifies the ability of a sediment retention device (SRD) to retain eroded sediments caused by sheet flowing water under full-scale conditions. This test method may also assist in identifying physical attributes of SRDs that contribute to their erosion control performance.

5.2 The effectiveness of SRDs is installation dependent. Thus, replicating field installation techniques is an important aspect of this test method. This test method is full-scale and therefore, appropriate as an indication of product performance, for general comparison of product capabilities, and for assessment of product installation techniques.

NOTE 1—Test Method D5141 is an alternate test method for evaluating sediment retention device effectiveness, if it is not necessary to simulate field installation conditions.

NOTE 2—The quality of the result produced by this standard is dependent on the competence of the personnel performing it, and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice D3740 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with Practice D3740 does not in itself assure reliable results. Reliable results depend on many factors: Practice D3740 provides a means of evaluating some of those factors.

6. Apparatus

6.1 Equipment required. (See Fig. 1 and Fig. 2)

6.1.1 *Combination mixing tank and scale*—A tank with an internal paddle mixer device mounted on scales capable of holding/weighing 4500 kg of sediment-laden water.

6.1.2 *A clean water source and pumping equipment*—A source of water and associated pumping equipment sufficient to repeatedly fill the mixing tank in a timely manner.

6.1.3 *A consistent soil stockpile* —A stockpile of soil in sufficient quantity to both create sediment-laden water and to create/replace subgrade in the installation zone. The general soil type to be used for testing shall be loam with target grain sizes and plasticity index as shown in Table 1, unless otherwise specified.

6.1.4 *A loader for moving the soil to the mixer*—A front-end loader of sufficient reach and capacity to dump a prescribed amount of soil into the mixing tank.

6.1.5 *A variable discharge apparatus from the mixer*—A variable discharge apparatus from the mixer – A valve-controlled discharge hose that allows for controlled, uniform discharge from the mixing tank.

6.1.6 *Soil and water sampling equipment* —Sampling jars (at least 12 per test) for taking "grab" samples periodically during the test.

6.1.7 *Excavating/compacting machinery for cleaning and preparing the test area* — Earthmoving and compacting equipment is needed to prepare/replace the soil in the installation zone.

6.1.8 *A scaled collection system adequate to handle the released runoff*— A tank mounted on scales of sufficient volume to collect all runoff passing the SRD.

6.2 *Retention Area:*

6.2.1 A non-permeable, smooth, 3:1 slope surface (at least 5 m long) immediately below the mixer discharge shall be provided to spread the discharge to the width of the retention zone (length of the SRD installation) and to provide a retention zone above the installation zone.

6.2.2 An installation zone approximately 2 m wide by the intended length of the SRD installation (typically 20 ft) comprised of prepared soil subgrade to allow full-scale installation of the SRD to be tested.

6.2.3 The center of the installed SRD should be placed in the center of the installation zone each time to replicate height of water as it relates to volume retained.

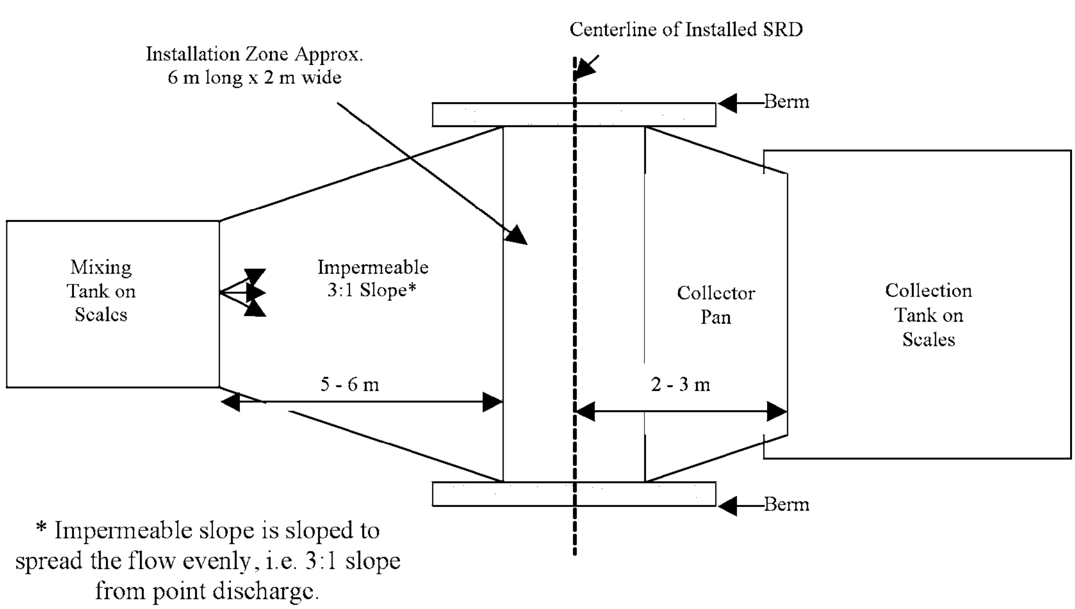

FIG. 1 Profile Schematic

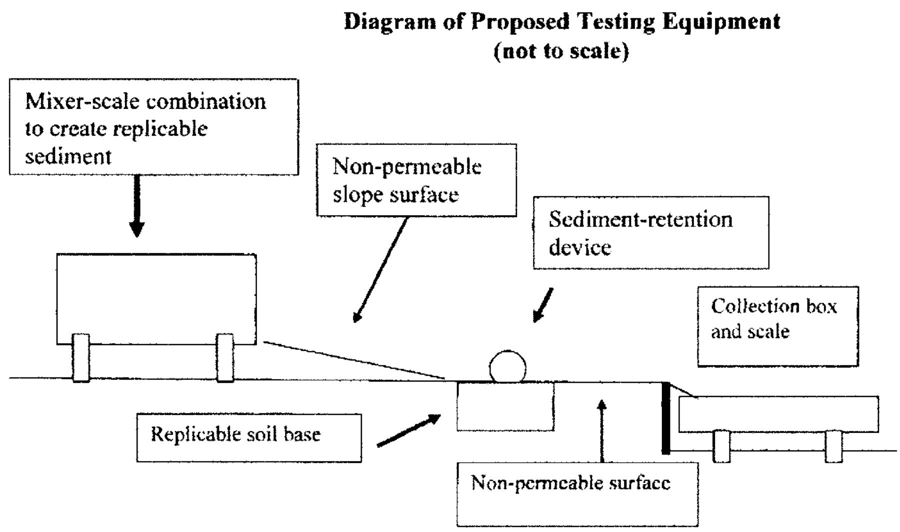

FIG. 2 Schematic (Plan) Diagram

TABLE 1 Target Grain Sizes and Plasticity Indices

Loam	Clay
D_{100} (mm)	$D_{100} < 25$
D_{85} (mm)	$0.5 < D_{85} < 5.0$
D_{50} (mm)	$0.001 < D_{50} < 1.0$
D_{15} (mm)	$0.005 < D_{15}$
Plasticity Index	1 < PI < 8

6.2.4 The prepared soil subgrade will be compromised each test, so it will have to be reconstructed after each test.

6.2.5 The area below the installation zone should be non-permeable to facilitate efficient transmission of runoff passing the SRD to the collection tank.

6.3 *The Collection Area:*

6.3.1 The collection tank shall be at a lower grade than the installation area so that runoff passing the SRD will efficiently flow via gravity into the tank. A retaining wall between the installation zone and the collection tank is recommended. The area between the retaining wall and the installed SRD should be impermeable, and so facilitate collection of sediments deposited after passing the SRD but before entering the collection tank.

7. SRD Installation

7.1 A representative sample of the SRD to be tested shall be used.

7.2 The SRD sample shall be installed in accordance with the manufacture's recommendations or, lacking recommendations, in accordance with generally accepted construction procedures, including orientation perpendicular to flow with appropriate trenching and/or staking.

8. Procedure

8.1 *SRD Installation:*

8.1.1 Prepare the installation zone using the same soil to be used as sediment, unless otherwise agreed with the client. The soil shall be placed to a depth in excess of the depth of installation and compacted to 90 ± 3% of Standard Proctor density, at a soil moisture within ±3 % of optimum moisture content per Test Method D698. , unless otherwise requested by the client. The installation zone should be wide enough to accommodate the desired length of SRD. Unless otherwise agreed with the client, the SRD length exposed to flow between end abutments shall be sufficient to completely contain the test flow, but no more than the 7 m.

8.2 *Mixing, Releasing, and Collecting Sediment-Laden Runoff:*

8.2.1 Procure soil as described in 6.1.3 in adequate quantities for the testing process, determine its characteristics for future replication needs, and cover to prevent contamination and rainfall degradation.

8.2.2 Create sediment-laden runoff by combining water and soil in the mixing tank and maintain agitation during the test. Unless otherwise directed by the client, 2270 kg of water and 136 kg of soil shall be combined to create the sediment-laden runoff. This amount of water and sediment simulates sheet flow from a slope measuring 6.1 m wide by 30 m long exposed to the peak 30 min of a 100 mm per hour rainfall hydrograph.

NOTE 3—An important variable in any testing procedure is the establishment of test "conditions". For a sediment control performance test this means selecting an appropriate design storm event and associated runoff along with an expected amount of sediment to be transported by the runoff. For this testing, a standard 10-y, 6-h storm event (mid-Atlantic region of US) was selected. This return frequency is commonly used for sizing sediment control ponds and, thus, was deemed appropriate for the testing of other SRDs. Using this criterion, a 100 mm (4 in) rainfall was selected. It was also assumed that approximately 25% of the storm would occur during the peak 30 minutes, and that 50% of the rainfall would infiltrate into the ground. (Goldman, et al, 1986) A theoretical contributory area of 30 m (100 ft) slope length by 6 m (20 ft) wide was selected to limit runoff to sheet flow conditions. (Richardson, 1990). Runoff and associated sediment were calculated using the Modified Universal Soil Loss Equation