



Standard Test Method for Determination of Erosion Control Blanket (ECB) Performance in Protecting Earthen Channels from Stormwater-Induced Erosion¹

This standard is issued under the fixed designation D 6460; 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 guidelines, requirements and procedures for evaluating the ability of Erosion Control Blankets (ECBs) to protect earthen channels from stormwater-induced erosion. Critical elements of this protection are the ability of the ECB to:

1.1.1 Neutralize and absorb the hydraulic force of stormwater, thereby reducing soil particle loosening through “scour” mechanisms, and;

1.1.2 Slow runoff and encourage sedimentation, thereby reducing soil particle transport downstream;

1.1.3 Absorb shear forces of overland flow; and,

1.1.4 Trap soil particles beneath.

1.2 This test method utilizes full-scale testing procedures, rather than reduced-scale (bench-scale) simulation, and is patterned after conditions typically found on construction sites at the conclusion of earthwork operations, but prior to the start of revegetation work. Therefore this considers only unvegetated conditions.

NOTE 1—Future revisions may consider partial or fully vegetated conditions.

1.3 This test method provides a comparative evaluation of an ECB to base line bare soil conditions under controlled and documented conditions.

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

1.5 *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.* Also, the user must comply with prevalent regulatory codes, such as OSHA (Occupational Health and Safety Administration) guidelines, while using the test method.

2. Referenced Documents

2.1 ASTM Standards:

¹ This Test Method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock; Subcommittee D 18.25 on Erosion and Sediment Control Technology; and is the direct responsibility of Section .02 on Erosion Control Blankets (ECBs). Current edition approved Oct. 10, 1999. Published January 2000.

C 136 Test Method for Sieve Analysis of Fine and Course Aggregates²

D 422 Test Method for Particle-Size Analysis of Soils³

D 698 Test Method for Laboratory Characteristics of Soil Using Standard Effort⁴

D 2974 Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils³

D 4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils³

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *erosion control blanket (ECB)*, *n*—a degradable material, composed primarily of processed natural organic materials, manufactured or fabricated into rolls designed to reduce soil erosion and assist in the growth, establishment and protection of vegetation.

3.1.2 *erosion control net (ECN)*, *n*—a planar woven natural fiber or extruded synthetic mesh used as a component in the manufacture of ECBs.

3.1.3 *index test*, *n*—a test procedure which may contain a known bias, but which may be used to establish an order for a set of specimens with respect to the property of interest.

3.1.4 *lot*, *n*—a unit of production, or a group of other units or packages, taken for sampling or statistical examination, having one or more common properties and being readily separable from other similar units.

3.1.5 *natural*, *n*—a class name of various fibers of animal, mineral or vegetable origin.

3.1.6 *open weave textile (OWT)*, *n*—a temporary degradable ECB composed of natural or polymer yarns woven into a matrix used to provide erosion control and facilitate vegetation establishment.

3.1.7 *polymer*, *n*—a chemical compound or mixture of compounds formed by polymerization and consisting essentially of repeating molecular structural units.

3.1.8 *sample*, *n*—a portion of material which is taken for testing or documentation and used in the laboratory as a source of individual specimens.

² *Annual Book of ASTM Standards*, Vol 04.02.

³ *Annual Book of ASTM Standards*, Vol 04.08.

⁴ *Annual Book of ASTM Standards*, Vol 15.09.

3.1.9 *shear stress, n*—the force of flowing water applied to the surface of a channel in Newtons per square metre (pounds per square foot); also, commonly referred to as “tractive force”.

3.1.10 *temporary degradable, adj*—composed of biologically, photochemically or otherwise degradable materials that temporarily reduces soil erosion and enhances the establishment of vegetation.

4. Summary of Test Method

4.1 The performance of an erosion control blanket in reducing stormwater-induced erosion is determined by subjecting the material to simulated stormwater flow in a controlled and documented environment.

4.2 Key elements of the testing process include:

- 4.2.1 Calibration of the stormwater simulation equipment;
- 4.2.2 Preparation of the test channel;
- 4.2.3 Documentation of the ECB to be tested;
- 4.2.4 Installation of the ECB;
- 4.2.5 Performance of the test;
- 4.2.6 Collection of hydraulic, topographical and associated data;
- 4.2.7 Analysis of the resultant data, and;
- 4.2.8 Reporting.

5. Significance and Use

5.1 This test method evaluates ECBs and their means of installation to:

5.1.1 Reduce soil loss and sediment concentrations in stormwater runoff under conditions of varying channel conditions and soil type, and;

5.1.2 Improve water quality exiting the area disturbed by earthwork activity by reducing suspended solids.

5.2 This test method models and examines conditions typically found on construction sites involving earthwork activities, including: highways and roads; airports; residential, commercial and industrial developments; pipelines, mines, and landfills; golf courses; etc.

5.3 This test method is a performance test, but can be used for quality control to determine product conformance to project specifications. Caution is advised since information about between-laboratory precision is incomplete. Unique project-specific conditions should be taken into consideration.

6. Apparatus

6.1 *Water Delivery System*—The water delivery system shall include pump(s), piping, channels, and water control structures, as necessary, to achieve the desired hydraulic conditions. The water control structures shall regulate the flow and to direct it into the desired test channel. The water delivery system shall be constructed such that turbulence at the entrance to the test channel is minimized. Use of flow straighteners (for example, tube racks or vanes) are recommended to reduce turbulence and achieve uniform flow conditions. A direct flow system (that is, controlled flow diverted from a natural waterway) may also be employed for this purpose. For maximum test conditions, a total discharge capability of approximately 0.9 m³/s (30 ft³/s) is recommended. The water delivery system in Fig. 1 shows an example of a closed-loop water delivery system.

6.2 *Water Source*—Any water source shall be suitable for this use provided that it is not sediment laden or contains deleterious materials which could impair the operation of the pumps.

6.3 *Total Station System*—The total station system is a standard surveying instrument which is capable of measuring vertical and horizontal angles, and distance, simultaneously to determine measurement point coordinates (that is, X, Y and Z axis) and which uses an internal data logger to store this information for future use. In lieu of a total station system, manual surveying equipment may be used provided that equivalent accuracy is achievable. Periodic calibration and certification of this equipment shall be performed.

6.4 *Velocity Probe*—A propeller-type probe shall be used to identify flow conditions during test operation. In lieu of a propeller-type probe, other velocity measurement devices may be used provided that equivalent accuracy is achievable. Periodic calibration and certification of this equipment shall be performed.

6.5 *Miscellaneous*—Other miscellaneous equipment includes: meteorological equipment (wind speed, temperature, precipitation), and cameras or video recorders.

7. Procedure

7.1 *Test Channel Preparation:*

7.1.1 Construct earthen test channels using conventional

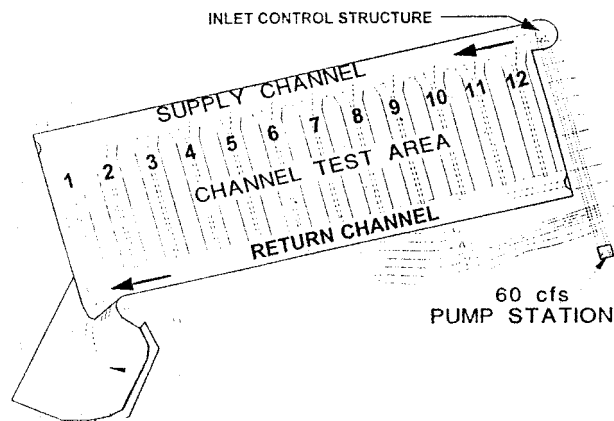


FIG. 1 Typical Closed Looped Water Delivery System

earthwork placement techniques. Perform compaction of channel bed material to create a geotechnically (structurally) stable subgrade.

7.1.2 Plate the channel surface with a minimum 45- cm (18- in.) thick veneer of soil. General soil types to be used for testing shall be loam, clay and sand. The target gradation curves for the loam and sand soil types are included in Fig. 2 and Fig. 3. The target Plastic Indices (PI) for the loam and clay soil types shall be approximately 4.5 and 15.0 ± 2.0 and 5.0, respectively. Place the veneer in 15- cm (6- in.) lifts and compact to approximately 90 to 95 % of standard Proctor density in accordance with Test Method D 698.

7.1.3 Excavate the channels to a trapezoidal cross-section with a 0.61- m (2-ft) bottom width and 2H:1V side slopes. The test channels shall be a minimum of 24.4 m (80 ft) in length. A bed slope of approximately of 5 and 10 % is necessary to achieve the target shear stress. Fig. 4 shows a typical channel profile and Fig. 5 shows a typical channel cross-section.

7.1.4 Begin the test reach 6.1 m (20 ft) below the inlet to the channel and extend 12.2 m (40 ft) downstream from that point. Establish benchmarks on either side of the channel at each end of the test reach and at 1.5- m (5- ft) intermediate intervals (nine cross-sections total).

7.1.5 Loosen the soil veneer in the test reach and 1.5 m (5 ft) upstream and downstream of the test reach to a depth of approximately 10 cm (4 in.) using a tiller or other appropriate tools. Rake the tilled channel smooth with a steel hand rake and compact using a vibratory plate compactor. Repair depressions, voids, soft or uncompacted areas before testing can commence. Also, free the channel from obstruction or protrusions, such as roots, large stones or other foreign material.

7.1.6 If the channel has been used previously for a test series, discard the soil carried out of the channel, and obliterate any rills and gullies. Spread new soil of the same type across the channel and blend (rake or tilled) into the surface.

7.2 Calibration:

7.2.1 Perform determination of the water delivery system

discharge (Q) using: the weir equation, and; velocity-area equation. Begin calibration of the water delivery system when a steady-state flow is achieved.

7.2.2 For open-channel water delivery systems, measure the depth of water flowing into the test channel. Measure the velocity in the supply channel using the velocity probe in the three-point measurement pattern shown in Fig. 5. Base calculation of total discharge on the weir equation and the velocity-area equation (see Section 8).

7.3 Pre-Test Documentation:

7.3.1 Maintain a test folder for each test cycle, including information on:

- 7.3.1.1 Site conditions;
- 7.3.1.2 Geotechnical and soil conditions;
- 7.3.1.3 Meteorological data;
- 7.3.1.4 ECB product type, description and installation procedure, and;
- 7.3.1.5 Photo documentation.

7.3.2 Include the following subjective site information: general visual conditions of the channel to be tested; general meteorological information; channel treatment; photographs or videotape, or both, and any supplemental information that is not included in the following sections, but is felt to be of interest to the test.

7.3.3 Include the following geotechnical and soils information : soil classification [Unified Soil Classification System (USCS) and USDA classification system.]; standard proctor moisture-density relationship; "K" factor; and; gradation (including hydrometer test for the P₂₀₀ fraction).

7.3.4 Include the following meteorological information: all data from the on-site weather station at the time of the test (that is, ambient air temperature, wind speed and precipitation).

7.3.5 Include the following product type and description information: manufacturer name; product name; description; specifications; size, and; a sample of the material, if practical.

7.4 Test Set-Up

7.4.1 Install the ECB in the channel after calibration has

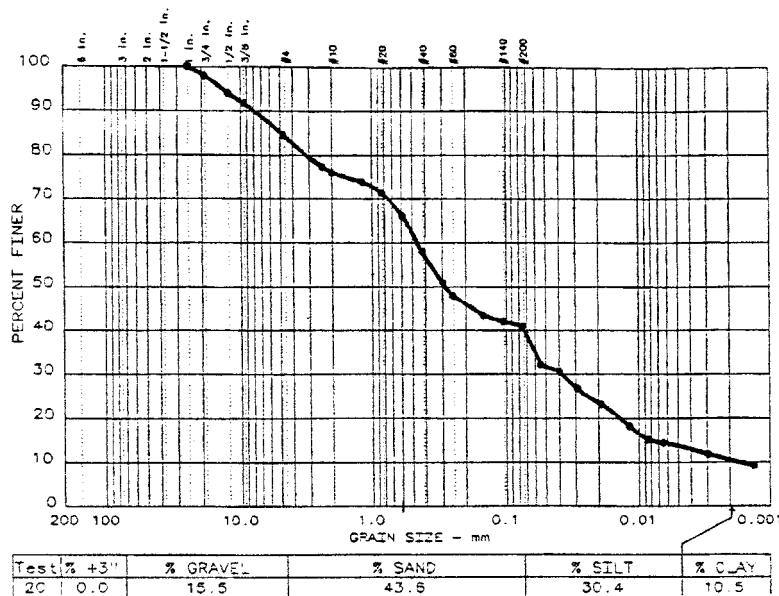


FIG. 2 Typical Loam Grain Size Distribution