Designation: D6567 – 17

Standard Test Method for Measuring the Light Penetration of a Rolled Erosion Control Product (RECP)[1]

This standard is issued under the fixed designation D6567; 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 measuring the amount of incandescent light that penetrates through a rolled erosion control product.

1.2 This test method does not provide light penetration values for RECPs under variable normal sun and soil conditions. This test method determines nominal light penetration.

1.3 This test method is not to be used to determine a percent ground cover value for RECPs, as the amount of light penetration may include light passing through translucent material or reflecting off surfaces.

1.4 The values stated as a percentage are to be regarded as the standard. The values provided in foot-candles are for information 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.*

1.6 *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]

D123 Terminology Relating to Textiles

D4354 Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs) for Testing

D4439 Terminology for Geosynthetics

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 *Definitions:*

3.1.1 *light penetration, n*—the percent of light incident on the front surface of a material that is emitted from the back surface of the material.

3.2 For definitions of other textile terms used in this test method, refer to Terminology D123.

3.3 For definitions of other terms relating to geotextiles and geomembranes used in this test method, refer to Terminology D4439.

4. Summary of Test Method

4.1 The nominal light penetration of RECPs is determined by the meter reading in foot candles with and without placement of the specimen in a determined location between the light source and the meter.

5. Significance and Use

5.1 Light penetration may be used to control the quality of many RECPs. Light penetration has not been proven to relate to field performance for all materials.

5.2 The light penetration of RECPs may vary considerably depending on the composite materials used in the matrix of the mat or due to inconsistency within a given mat. To minimize variation, specific sample size and procedures are indicated in this test method to help ensure comparable results.

5.3 This test method may be used to determine the effect of different composite materials and makeup of RECPs on the penetration of light.

5.4 This test method may be used for acceptance testing of commercial shipments of RECPs. Comparative tests as directed in 5.4.1 may be advisable.

5.4.1 In case of a dispute arising from differences in reported test results when using this test method for acceptance

[1] This test method is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.05 on Geosynthetic Erosion Control.

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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.

testing of commercial shipments, the purchaser and the supplier should conduct comparative tests to determine if there is a statistical bias between their laboratories. Competent statistical assistance is recommended for the investigation of bias. As a minimum, the two parties should take a group of test specimens that are as homogeneous as possible and that are formed from a lot of material of the type in question. The test specimens should be randomly assigned in equal numbers to each laboratory for testing. The average results from the two laboratories should be compared using Student's *t*-test for unpaired date and an acceptable probability level chosen by the two begun. If bias is found, either its cause must be corrected, or the purchaser and supplier must agree upon the known bias.

NOTE 1—The light penetration has no definitive relationship to the amount of ground cover provided by a RECP, as the amount of light penetration may include light passing through translucent elements or light deflecting off of elements of the RECP structure. Thus, this test method is not intended to be used to determine a percent ground cover value for RECPs.

NOTE 2—The user should be aware that the makeup and possible movement of the composite materials, and the like, may affect the RECPs following the time when they are rolled up on rolls, shipped, and stored.

6. Apparatus

6.1 *Light Penetration Box*—See Fig. 1 (length view), and Fig. 2 (width view).

NOTE 3—The light penetration box shown in Fig. 1 is built from ¾-in. wood.

6.2 *Adjustable Rod with Light Bulb*—See Fig. 3.

6.3 *Light Meter*—The light meter must measure in foot-candles and be capable of measuring determined open area foot-candle reading as well as determined area with dense RECP material in place. A meter with a digital readout such as Extech Instruments Model 407026 Heavy Duty Light Meter is recommended.[3]

6.4 *Cutting Dies*—The cutting dies must be capable of cutting specimen dimensions at least 200 mm (8 in.) by at least 250 mm (10 in.).

NOTE 4—Due to possible loss of loose internal components during cutting and handling of many RECPs, care should be exercised to minimize these effects.

7. Sampling

7.1 *Sample by Lot*—In the absence of other guidelines, divide the product into lots and take lot samples in accordance with Practice D4354.

7.2 *Laboratory Sample*—For the laboratory sample, take a full-width sample of sufficient length in the machine direction so that the required size and number of specimens can be obtained. Exclude the inner and outer layers or wraps of the roll or any material containing folds, crushed areas, or other distortions not representative of the sampled lot.

7.3 Remove test specimens from the laboratory sample so that each specimen will contain different machine and cross-machine elements with no specimen taken nearer than 100 mm (4 in.) from the roll sides or ends, unless otherwise specified.

7.4 *Test Specimens*—Test specimens from the sample shall be at least 250 by 200 mm (10 by 8 in.). Handle the specimens in a manner to avoid the loss of loose filler and weaving components.

[3] The sole source of supply of the apparatus known to the committee at this time is Extech Instruments Corporation, 9 Townsend West, Nashua, NH 03063. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

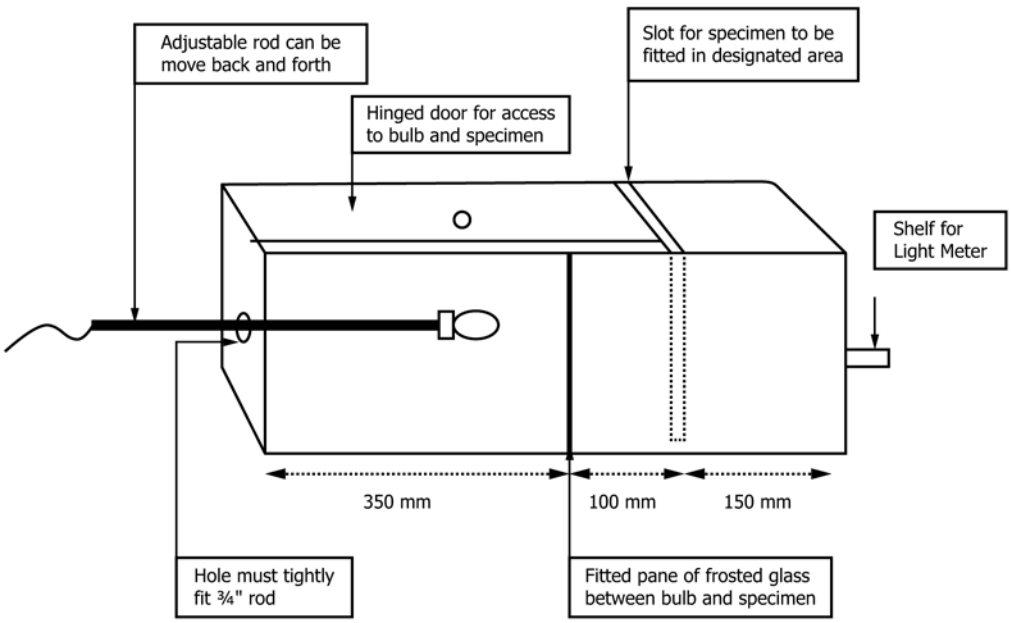

FIG. 1 Light Penetration Box

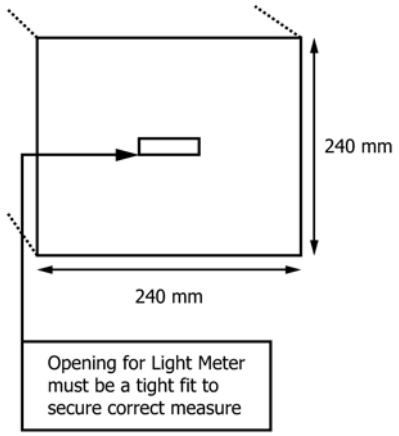

FIG. 2 End View of Box

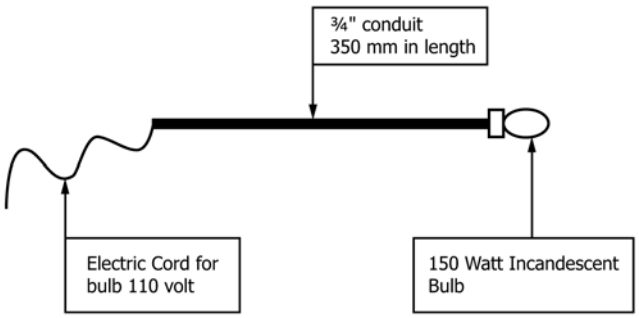

FIG. 3 Adjustable Rod and Bulb

7.5 *Number of Specimens*—Unless otherwise agreed upon, as when provided in an applicable material specification, take the number of test specimens per laboratory sample as follows:

7.5.1 *Reliable Estimate of* v—When there is a reliable estimate of v based upon extensive part records for similar materials tested in the user's laboratory as directed in this test method, calculate the required number of specimens as follows so that the user may expect at the 95 % probability level that the test result is not more than 5.0 % of the average above or below the average of the sample:

$$n = (tv/A)^2 \quad (1)$$

where:

n = number of test specimens (rounded upward to a whole number),
v = reliable estimate of the coefficient of variation of the individual observations on similar materials in the user's laboratory under conditions of single-operator position, %,
t = the value of Student's t for one-sided limits, a 95 % probability level, and the degrees of freedom associated with the estimate of v, and
A = 5.0 % of the average, the value of the allowable variation.

7.5.2 *No Reliable Estimate of* v—When there is no reliable estimate of v for the user's laboratory, measurements shall be made on a minimum of five (5) specimens per laboratory sample.

8. Conditioning

8.1 Bring the specimens to moisture and temperature equilibrium in the atmosphere for testing RECPs, that is, a temperature of 21 ± 2 °C (70 ± 4 °F) and relative humidity of 60 ± 10 %.

NOTE 5—The positive and negative variations specified, along with the temperature and relative humidity settings, are the maximum allowed operational fluctuations from the set points under equilibrium conditions. They do not imply that the set points can be higher or lower than those specified.

9. Procedure

9.1 Test the conditioned specimens in the standard atmospheric condition as set forth in 8.1.

9.2 Care should be taken in handling of the test specimens to avoid altering the natural finished state of the material.

9.3 Close the top of the box, cover the slot where the sample is placed, and turn on the light source. Place the light meter on the shelf in front of the opening at the end of the box.

9.4 Slide the adjustable rod with bulb inside the box to obtain maximum brightness (highest meter reading), record reading.

9.5 Open top of box and insert the specimen into the slotted area, being sure to leave no area open to avoid false readings.

NOTE 6—A stiff, opaque border may be use to ensure proper holding of the specimen in place if material is flexible. When a border is used, the

meter reading taken before placement of the specimen must include the open border placed in the slot.

9.6 After the top has been closed and the slot opening covered, obtain meter reading. Ensure meter is set on the appropriate scale to obtain best reading. Record the results.

9.7 Repeat the procedure for each of the remaining specimens.

10. Calculation

10.1 Calculate the percent of light penetration as follows in Eq 2:

$$\% \text{ light penetration} = \frac{MR2}{MR1} \times 100 \quad (2)$$

where:

$MR1$ = meter reading prior to placement of specimen, and
$MR2$ = meter reading with specimen in place.

10.2 Calculate the average % light penetration for all specimens.

11. Report

11.1 The report for the nominal % light penetration shall include the following information:

11.1.1 Project, type of RECP tested, and test method of sampling,

11.1.2 Specimen size used in testing if other than standard,

11.1.3 Number of tests performed,

11.1.4 Type of light source and testing apparatus used,

11.1.5 Average nominal % light penetration,

11.1.6 Coefficient of variation of light penetration within the sample, in percent (optional), and

11.1.7 Any unusual observations or modifications of sample specimens as manufactured or test method as described.

12. Precision and Bias[4]

12.1 *Precision*—The precision of this test method is based on an interlaboratory study of D6567 Standard Test Method for Measuring the Light Penetration of a Rolled Erosion Control Product (RECP), conducted in 2013. Seven laboratories participated in this study. Each of the labs reported three replicate test results for two different types of mats and a double net blanket. Every "test result" reported represents the average of five measurements taken from a sample. Practice E691 was followed for the design and analysis of the data; the details are given in ASTM Research Report No. RR:D35-1018.

12.1.1 *Repeatability (*r*)*—The difference between repetitive results obtained by the same operator in a given laboratory applying the same test method with the same apparatus under constant operating conditions on identical test material within short intervals of time would in the long run, in the normal and correct operation of the test method, exceed the following values only in one case in 20.

12.1.1.1 Repeatability can be interpreted as the maximum difference between two results, obtained under repeatability conditions, that is accepted as plausible due to random causes under normal and correct operation of the test method.

12.1.1.2 Repeatability limits are listed in Table 1.

12.1.2 *Reproducibility (*R*)*—The difference between two single and independent results obtained by different operators applying the same test method in different laboratories using different apparatus on identical test material would, in the long run, in the normal and correct operation of the test method, exceed the following values only in one case in 20.

12.1.2.1 Reproducibility can be interpreted as the maximum difference between two results, obtained under reproducibility conditions, that is accepted as plausible due to random causes under normal and correct operation of the test method.

12.1.2.2 Reproducibility limits are listed in Table 1.

12.1.3 The above terms (repeatability limit and reproducibility limit) are used as specified in Practice E177.

12.1.4 Any judgment in accordance with statements 12.1.1 and 12.1.2 will have an approximate 95 % probability of being correct. The precision statistics obtained in this ILS must not be treated as exact mathematical quantities which are applicable to all circumstances and uses. The limited number of materials tested may lead to times when differences greater than predicted by the ILS results will arise, sometimes with considerably greater or smaller frequency than the 95 % probability limit would imply.

12.2 *Bias*—At the time of the study, there was no accepted reference material suitable for determining the bias for this test method, therefore no statement on bias is being made.

12.3 The precision statement was determined through statistical examination of 63 results, from seven laboratories, on three materials.

12.4 To judge the equivalency of two test results, it is recommended to choose the material closest in characteristics to the test material.

[4] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D35-1018. Contact ASTM Customer Service at service@astm.org.

TABLE 1 Average Light Penetration (%)

Material	Average[A] $\bar{x}$	Repeatability Standard Deviation S_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
Double Net Coconut Fiber Blanket	12.939	2.563	3.147	7.175	8.812
Double Net Poly Fiber TRM #1	22.208	6.131	8.531	17.168	23.886
Double Net Poly Fiber TRM #2	17.807	4.384	4.769	12.275	13.353

[A] The average of the laboratories' calculated averages.

13. Keywords

13.1 adjustable rod and bulb; light meter; light penetration; light penetration box; RECP