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Standard Practice for Obtaining Samples of Geosynthetics from a Test Section for Assessment of Installation Damage[1]

This standard is issued under the fixed designation D 5818; 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 practice covers standardized procedures for obtaining samples of geosynthetics from a test section for use in assessment of the effects of damage immediately after installation caused only by the installation techniques. The assessment may include physical testing. This practice is applicable to geotextiles, geomembranes, geogrids, geocomposites, geonets, and geosynthetic clay liners.

1.2 This practice is limited to full-scale field test sections, and does not address laboratory modeling of field conditions. This practice does not address which test method(s) to use for quantifying installation damage.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 4439 Terminology for Geotextiles[2]

D 4873 Guide for Identification, Storage, and Handling of Geotextiles[2]

3. Terminology

3.1 *Definitions:*

3.1.1 *geosynthetic*, *n*—a planar product manufactured from polymeric material used with soil, rock, earth, or other geotechnical engineering-related material as an integral part of a man-made project, structure, or system.

3.1.2 *sample*, *n*—(*1*) a portion of material that is taken for testing or for record purposes; (*2*) a group of specimens used, or of observations made, which provide information that can be used for making statistical inferences about the population(s) from which the specimens are drawn.

3.1.3 *test section*, *n*—a distinct area of construction.

3.1.4 For definitions of other geosynthetic terms used in this practice, refer to Terminology D 4439.

4. Summary of Practice

4.1 Damage to geosynthetics from installation operations may be quantified by evaluating specimens from a sample(s) exhumed from field installations. The sample(s) should be installed under conditions that are representative or more severe than those anticipated during construction of the particular earth structure under consideration. Addressed within this practice are: area of geosynthetic sample(s) to install for testing; procedures for installing the geosynthetic sample(s); procedures for exhuming the geosynthetic sample(s); procedure for obtaining control sample(s); and report preparation guidelines. The sample(s) should be retrieved immediately after installation to minimize potential aging of the geosynthetic. Comparison of test results on exhumed and control specimens may be used to assess effects of installation. Tests to perform are not addressed within, and will vary with type and function of geosynthetic and project requirements.

5. Significance and Use

5.1 The ability to maintain design function (for example, reinforcement, separation, barrier, etc.) or design properties (for example, tensile strength, chemical resistance, etc.), or both, of a geosynthetic may be affected by damage to the physical structure of the geosynthetic due to the rigors of field installation. The effect of damage may be assessed by analyzing specimens cut from sample(s) retrieved from an installed representative test section. Analysis may be performed with visual examination or laboratory testing of specimens from the control sample(s), or both, and from the exhumed sample(s).

5.2 A uniform practice of installing and retrieving representative sample(s) from a test section is needed to assess installation damage under particular site, specified, or project conditions, or both. Damage of a specific grade and type of geosynthetic under specific installation procedures may be assessed with sample(s) exhumed from a test section on the project site, or on a representative site.

6. Procedure

6.1 *Objective*—Geosynthetic and soil placement techniques shall model the methods anticipated during construction. The modeled methods should address specified or anticipated installation techniques, whichever is most severe. An additional test section may be used to assess worst case (for

[1] This practice is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.01 on Mechanical Properties.

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[2] *Annual Book of ASTM Standards*, Vol 04.09.

example, overcompaction, thin lift heights, greater drop heights, etc.) installation techniques and fill material.

6.2 *Exhumed Sample*:

6.2.1 The amount, or area, of geosynthetic to install in or to retrieve from a test section is a function of the type and number of laboratory tests to be conducted for assessment of damage, geosynthetic roll width, and the number of installation conditions being modelled. An area of material equal to or greater than 60 times the cumulative laboratory test specimen size is recommended for each laboratory test to be conducted. This number anticipates up to 20 tests on representative specimens and a usage rate of one-third of retrieved material. A total geosynthetic area equal to or greater than the sum of areas required (60 times the specimen size) for each type of test should be installed for each set of installation conditions. A minimum area of 10 m^2, with a length at least 50 % of the roll width, of geosynthetic should be used. Full geosynthetic roll width(s) should be used in test sections.

6.2.2 The exhumed test sample should be marked prior to installation, or a template made, showing the exact location where specimens for testing are to be obtained. Machine and transverse machine direction of specimens shall be designated. Designation of specimen locations is recommended to eliminate potential bias in specimen selection after the geosynthetic has been damaged. Alternate areas may also be designated in the event the primary specimen area is damaged by exhumation.

6.2.3 The geosynthetic being investigated may be designed to be installed directly on top of soil or rock fill, or to be placed above another base layer of geosynthetic.

6.3 *Control Sample*:

6.3.1 Original (un-installed) sample(s) of the geosynthetic being investigated shall be retrieved from the same material for base line data. Control samples should be whole roll widths and shall be from the same roll of material that is to be installed in the test section. Sample(s) from each roll shall be gathered in cases where multiple rolls are used in the test section. Control samples shall be labeled with all information pertinent to adequate identification of the sample, including date of manufacture, manufacturer or supplier, geosynthetic grade and type, machine and transverse machine directions, and roll and lot number. These control samples shall be handled and stored (see Guide D 4873) in such a manner to eliminate, or minimize, damage or degradation (for example, exposure to ultraviolet light).

6.3.2 The orientation of the exhumed sample(s) and control sample(s) are to be documented. That is, the left and right hand sides of the roll width of each sample must correspond. It is also recommended that the control sample should be a direct continuation of the exhumed sample so as to minimize differences in control and exhumed specimen properties due to inherent product variability.

6.3.3 The positions of the test specimens on the control sample, relative to roll edge, must correspond identically with the positions of the exhumed sample.

6.3.4 The amount, or area, of control sample(s) geosynthetic to be retrieved shall be equal to the area of exhumed sample(s), as defined in 6.2.1.

6.4 *Installation Procedure*:

6.4.1 The soil subgrade on which the geosynthetic(s) will be placed shall be constructed to specified conditions of soil type, moisture content and compaction. Construction equipment used in subgrade preparation should be the same as that to be used in construction of the earth structure. The geosynthetic should be installed to simulate the specified or anticipated project installation methods, whichever is most severe.

6.4.2 The material to be placed above the geosynthetic under investigation will typically be a soil or rock fill, or another geosynthetic material(s) with soil then placed upon it. In the case of another geosynthetic, it also shall be placed under anticipated field conditions.

NOTE 1—In certain situations, such as multiple layer installations, movement of individual layers in test sections may occur. Care should be taken to ensure that stress and potential slippage conditions in the test sections simulate project conditions, as closely as possible.

6.4.3 Fill placement above the geosynthetic shall model expected field conditions. Construction equipment used in fill placement should be the same as that to be used in construction of the earth structure. Equipment shall be operated (for example, initial fill lift height) under anticipated project conditions.

6.4.4 Fill spreading into lifts above the geosynthetic shall model expected field conditions. Construction equipment used in fill spreading should be the same as that used in construction of the earth structure. Equipment shall be operated under anticipated project conditions.

6.4.5 Fill lift compaction above the geosynthetic shall model expected field conditions. Construction equipment used in soil compaction should be the same as that used in construction of the earth structure. Equipment shall be operated under anticipated project conditions. Compaction control techniques and results shall be documented.

6.5 *Exhuming of Samples*:

6.5.1 Samples from the test section should usually be exhumed within 48 h after installation.

6.5.2 Samples should be photographed as they are exhumed.

6.5.3 Method(s) employed to exhume the samples shall prevent or minimize additional damage to the geosynthetic. Mechanical construction equipment may be used to remove soil down to a height of soil of 150 mm above the geosynthetic. Low ground pressure equipment should be used between 150 mm and approximately 300 mm. Ground contact pressure equipment of less than 35 kPa is recommended. The lower 150 mm, or more, of soil shall be removed by non-mechanical methods.

NOTE 2—Water jetting has also been used for removal of gravel soils above geogrids and geotextiles, with minimal exhumation damage.

6.5.4 Areas of the geosynthetic damaged during removal shall be marked (for example, spray painted) and designated as being non-representative of installation damage.

6.5.5 Exhumed samples shall be labeled with manufacturer or supplier, style number, roll numbers, installation and exhumation dates, geosynthetic grade and type, and machine and transverse machine direction. These samples shall be handled, shipped and stored in such a manner to eliminate, or minimize,

additional damage or degradation (for example, exposure to ultraviolet light).

6.5.6 The receiving laboratory shall make an accurate record (map) of all installation damage (holes, abrasions, cuts, etc.). This record shall reflect the magnitude of damage incurred. The entire sample shall be visually surveyed to distinguish between relative significance of the different types (for example, abrasion, cut, hole) damage.

7. Report

7.1 Report the following information:

7.1.1 Anticipated installation procedures for construction of the earth structure including, but not limited to, equipment types, equipment operation, subgrade and fill types and gradation, maximum particle size, fill placement and compaction requirements, and fill compaction control technique(s).

7.1.2 The construction conditions used for this test section(s) including, but not limited to, equipment types, equipment operation, subgrade and fill types and gradation, maximum particle size, fill placement and compaction requirements, and fill compaction control technique(s).

7.1.3 Laboratory test(s) to be conducted on both exhumed and control samples.

7.1.4 Conditioning of samples prior to testing (for example, washing and removing of soil, drying, etc.).

7.1.5 Provide the record (map) of sample damage incurred, including use of alternative specimens due to unrepresentative damage to a primary specimen location.

7.1.6 Geosynthetic material(s) identification including manufacturer or supplier, style number, roll numbers, material grade and type, and applicable index properties.

7.1.7 Identification of subgrade and overlying test section fill(s) including classification, grain size distribution, maximum particle size, angularity, specified compaction, lift thickness, number of soil lifts, and compaction control results.

7.1.8 Applicable visual observations of test section construction and retrieval of samples.

7.1.9 Photographs of test section construction and of damaged samples.

8. Precision and Bias

8.1 No statement is made about either the precision or bias of this practice since it does not address which test method(s) to use for quantifying installation damage.

9. Keywords

9.1 construction; fill; geosynthetics; installation; sampling; soil; test section

APPENDIX

(Nonmandatory Information)

X1. ASSESSING THE AMOUNT OF DAMAGE

X1.1 This practice has been developed to standardize a method of obtaining samples of installed geosynthetics. The exhumed samples are to be tested to assess damage caused by the rigors of installation. This damage is to be differentiated from damage that occurs during shipping and handling and damage caused by deterioration that may occur over time after construction.

X1.2 Techniques for assessing the amount of damage, and documentation of installation and retrieval techniques used, may be found in the following references:

Allen, T. M., and Bathurst, R. J., "Characterization of Geosynthetic Load-Strain Behavior After Installation Damage," *Geosynthetics International*, Vol 1, No. 2, 1994.

Bush, D. I., and Swan, D. B. G., "An Assessment of the Resistance of TENSAR SR2 to Physical Damage During the Construction and Testing of a Reinforced Soil Wall," *The Application of Polymeric Reinforcement in Soil Retaining Structures*, Jarrett, P. M. and McGown, A., Eds., NATO ASI Series, Kluwer Academic Publishers, Dordrecht, The Netherlands, 1988, pp. 173–180.

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Paulson, J. N., "Summary and Evaluation of Construction Related Damage to Geotextiles in Reinforcing Applications," *Proceedings of the 4th International Conference on Geotextiles, Geomembranes and Related Products*, D. den Hoedt, Ed., A. A. Balkema, 1990, pp. 615–619.

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"Durability of Geosynthetics," *Transportation Research Record No. 1439*, Transportation Research Board, National Research Council, Washington, DC, 1994.