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Standard Specification for Geosynthetic Cementitious Composite Mat (GCCM) Materials¹

This standard is issued under the fixed designation D8364/D8364M; 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 specification covers the requirements and properties for geosynthetic cementitious composite mat materials, or GCCM materials, in various applications. The applications where GCCM materials are utilized shall have different required physical properties, which this standard describes.

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 nonconformance 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *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

- C1185 Test Methods for Sampling and Testing Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards
- C1353/C1353M Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform Abraser
- D4439 Terminology for Geosynthetics

¹ This specification is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.06 on Geosynthetic Specifications.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

- D4759 Practice for Determining the Specification Conformance of Geosynthetics
- D4885 Test Method for Determining Performance Strength of Geomembranes by the Wide Strip Tensile Method
- D5199 Test Methods for Measuring the Nominal Thickness of Geosynthetics
- D5494 Test Method for the Determination of Pyramid Puncture Resistance of Unprotected and Protected Geomembranes
- D5641/D5641M Practice for Geomembrane Seam Evaluation by Vacuum Chamber
- D5820 Practice for Pressurized Air Channel Evaluation of Dual-Seamed Geomembranes
- D5993 Test Method for Measuring Mass per Unit Area of Geosynthetic Clay Liners
- D6768/D6768M Test Method for Tensile Strength of Geosynthetic Clay Liners
- D7177/D7177M Specification for Air Channel Evaluation of Polyvinyl Chloride (PVC) Dual Track Seamed Geomembranes
- D8030/D8030M Practice for Sample Preparation for GCCM
- D8058 Test Method for Determining the Flexural Strength of a Geosynthetic Cementitious Composite Mat (GCCM) Using the Three-Point Bending Test
- D8173 Guide for Site Preparation, Layout, Installation, and Hydration of Geosynthetic Cementitious Composite Mats
- D8329 Test Method for Determination of Water/Cementitious Materials Ratio for Geosynthetic Cementitious Composite Mats (GCCMs) and Measurement of the Compression Strength of the Cementitious Material Contained Within

3. Terminology

3.1 *Definitions*—For definitions of terms related to geosynthetics, refer to Terminology D4439.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *cured, adj*—a description of the state of a GCCM or cementitious mixture after hydration for a specific period of time and quantity of water under specified conditions, followed by a period of time when the GCCM is kept under a specified environmental condition during which the cementitious material continues to cure and develop compressive strength.

3.2.2 *uncured, adj*—a description of the state of a GCCM or cementitious mixture prior to hydration.

4. Classification of GCCM Materials in Applications

4.1 Prefabricated geosynthetic cementitious composite mats (GCCMs) covered by this specification shall be classified as Type I, Type II, and Type III. Distinctions between the types is related to the requirements found in [Table 1](#). Typically, higher grade types would be expected to be durable and longer lasting than lower grade types in the same application.

4.2 Typical Applications By Classification Type:

4.2.1 Type I GCCM applications have minimal requirements for abrasion and wear; will be exposed to shear stresses of less than 50 kg/m² [10 lb/ft²] and lower flow velocities up to 6 m/s [20 ft/s]; will not be subjected to impact loads, wave action, water over topping or similar forces; and are installed above a dense subgrade capable of supporting them, such as concrete or rock. Applications include but are not limited to: erosion control, weed suppression, slope protection, berm protection, and remediation of concrete hydraulic structures. Slope protection applications of Type I GCCMs shall be limited to slopes of grades lower than 3:1 with slope lengths of less than 50 ft; extensions of this limit are permissible only with the use of suitable intermediate fixings such as percussion anchors. Installations for Type I GCCM applications shall include perimeter fixings to all unjointed edges (leading, trailing, toe, and crest) such as anchor trenches, or fixed mechanically and sealed in such a way that liquid, wind, or both cannot ingress. Intermediate fixings such as metal pegs, earth percussion anchors, mechanical fixings, or check slots

shall be required to limit movement of the GCCM under wind or hydraulic loading conditions or when the recommended slope angle or length is exceeded.

4.2.2 Type II GCCM applications would include all Type I applications, and applications that would have abrasion and wear requirements greater than Type I, will be exposed to shear stresses greater than 50 kg/m² [10 lb/ft²] and flow velocities greater than 6 m/s [20 ft/s], or will be subject to design requirements for impact loads, or have medium dense subgrades. Erosion protection and weed suppression applications of Type II GCCMs include but are not limited to: channel lining, berm protection, armoring, slope protection (any angle and run length), culvert invert lining and concrete overlay, and remediation of concrete hydraulic structures. Installations of Type II GCCM applications shall require all the same securing mechanisms as outlined for Type I GCCM installations.

4.2.3 Type III GCCM applications would include all Type I and Type II applications that require additional flexural strength of the GCCM material due to unsuitable (that is, loose) subgrades. The same securing mechanisms as outlined for Type I or Type II GCCM installations may be required.

4.2.4 A special category of Type I, Type II, and Type III GCCM applications is armoring of containment structures. The containment GCCM systems must meet the requirements for field seam testing as outlined in Practice [D5641/D5641M](#) or [D5820](#), Specification [D7177/D7177M](#), or similar.

4.2.5 It is incumbent upon the designer to ensure that the proper GCCM type is specified for the bearing capacity of the subgrade and the application.

4.2.6 Installation requirements are detailed in Guide [D8173](#).

TABLE 1 Classifications for GCCMs

Property		Test Method	State of GCCM	Minimum Values Unless Specified		
				Type I	Type II	Type III
Thickness		D5199	uncured cured 24 h	4.5 mm [0.17 in.]	7.0 mm [0.27 in.]	
Mass per unit area ^A		D5993	uncured	6.5 kg/m ² [1.33 lb/ft ²]	10.5 kg/m ² [2.15 lb/ft ²]	
Density		D5993/D5199	uncured	1250 kg/m ³ [78 lb/ft ³]		
Flexural strength ^B	Initial breaking load	D8058	cured 24 h	625 N/m [3.5 lbf/in.]	1500 N/m [8.5 lbf/in.]	3750 N/m [21 lbf/in.]
	3.5 MPa [500 psi]					
	Final flexural strength			4.0 MPa [580 psi]		
Compressive strength of cementitious mix		D8329	cured 28 days	40 MPa [5800 psi]	50 MPa [7200 psi]	60 MPa [8700 psi]
Pyramid puncture		D5494, Type B	cured 28 days	2 kN [450 lbf]	3.5 kN [780 lbf]	4.5 kN [1000 lbf]
Abrasion (maximum value) ^C		C1353/C1353M	cured 28 days	0.3 mm [0.012 in.]/1000 cycles		
Tensile strength ^{B,D,E}	Final	D6768/D6768M	uncured	8 kN/m [45 lbf/in.]		
	Initial	D4885	cured 28 days	3.5 kN/m [20 lbf/in.]	6.5 kN/m [36 lbf/in.]	9 kN/m [50 lbf/in.]
	Final			10 kN/m [57 lbf/in.]	19 kN/m [108 lbf/in.]	
Freeze-thaw ^F		Residual initial flexural strength (D8058)	C1185	cured 28 days 200 cycles	>80 % (Pass)	

^A See modifications to Test Method [D5993](#) as given in [7.1.1](#).

^B GCCM materials are non-isotropic and the values for flexural strength, tensile strength, and initial breaking load shall be measured as the lower of the material machine production direction (length of roll) or material cross-machine production direction (width of roll).

^C See modifications to Test Method [C1353/C1353M](#) as given in [7.1.3](#).

^D Tensile strength of the uncured material shall be measured as per Test Method [D6768/D6768M](#) at the loading rate of 300 mm/min [12 in./min], which is typical of rates which could occur during installation.

^E Tensile strength of the cured material shall be measured as per Test Method [D4885](#) at a loading rate of 20 mm/min [0.9 in./min] to represent the in-use properties; see [7.1.4](#).

^F Freeze-thaw applicable in freeze-thaw susceptible regions.