



Designation: D6102 – 23

Standard Guide for Installation of Geosynthetic Clay Liners¹

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1. Scope

1.1 This guide covers directions for the installation of geosynthetic clay liners (GCLs) under field conditions typically present in environmental lining applications.

1.2 This guide contains general installation guidelines. It is not intended to replace project-specific installation requirements as found in the contract drawings or specifications. In the event of a conflict, the requirement of the project specifications will supersede the requirements of this guide.

1.3 This guide does not purport to establish specific procedure for all climatic, geographical, hydraulic, or topographical conditions that may exist at a site. Appropriate installation procedures under atypical field conditions should be modified as necessary to maintain the integrity of the GCL and adjacent lining system components.

1.4 Different GCLs have different materials of construction with different physical properties. The procedures contained in this guide, therefore, may not be universally applicable to all GCLs under all field conditions.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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

1.7 *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

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D4439 Terminology for Geosynthetics

D5888 Guide for Storage and Handling of Geosynthetic Clay Liners

2.2 GRI Document:³

GRI-GCL-5 Standard Guide for Design Considerations for Geosynthetic Clay Liners (GCLs) in Various Applications

3. Terminology

3.1 *Definitions*—For definitions of other geosynthetic terms used in this guide, refer to Terminology **D4439**. For definitions of soils terms, refer to Terminology **D653**.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *fresh water, n*—water with a salinity less than 0.5 parts per thousand.

3.2.2 *geosynthetic clay liner (GCL), n*—a manufactured hydraulic barrier consisting of clay bonded to a layer or layers of geosynthetics.

4. Significance and Use

4.1 For optimum performance, GCLs must be installed in a manner that does not impact their physical, mechanical, or hydraulic properties.

4.2 This guide identifies the proper installation procedures and equipment for use by GCL designers, inspectors, and installers.

5. Procedure

5.1 The methods and equipment used for placement of the GCL can vary, but the primary objective of the process is to minimize the potential for GCL damage. The placement methods and equipment should be evaluated appropriately within this context.

¹ This guide is under the jurisdiction of ASTM Committee **D35** on Geosynthetics and is the direct responsibility of Subcommittee **D35.04** on Geosynthetic Clay Liners.

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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.

³ Available from Geosynthetic Institute, 475 Kedron Avenue, Folsom, PA 19033-1208, <http://www.geosynthetic-institute.org>.

5.2 Subgrade Preparation:

5.2.1 For projects where the GCL is to be placed over an earthen subgrade, the subgrade surface must be prepared and approved prior to installation in accordance either with project specifications or with this guide. The surface should be firm and unyielding, with no abrupt elevation changes, voids and cracks, ice, or standing water.

5.2.2 The subgrade surface should be smooth and free of vegetation, sharp-edged rocks, stones, sticks, construction debris, and other foreign matter that could contact the GCL. The subgrade surface shall be compacted in accordance with the project specifications. At a minimum, the subgrade should be rolled with a smooth-drum compactor of sufficient weight to remove any excessive wheel ruts, footprints, or other abrupt grade changes. Excessive rutting should be clearly defined and quantified. In some cases 25 mm is the maximum rut depth allowed. Furthermore, all protrusions extending more than 12 mm from the subgrade surface shall either be removed, crushed, or pushed into the surface with a smooth-drum compactor.

5.3 GCL Placement:

5.3.1 All handling of the GCL at the job site should be conducted in accordance with Guide [D5888](#).

5.3.2 GCL rolls are to be delivered to the working area of the site in their original packaging. Immediately prior to deployment, the packaging shall be carefully removed without damaging the GCL.

5.3.3 The orientation of the GCL (that is, (1) which side faces up, and (2) latitudinal versus longitudinal) may be important and shall be in accordance with the engineer's requirements.

5.3.4 No equipment that could damage the GCL shall be allowed to travel directly on the GCL. Acceptable installation, for example, may be accomplished such that the GCL is unrolled in front of the backwards-moving deployment equipment, such as a front-end loader or bulldozer. If the equipment causes rutting of the subgrade, the subgrade must be restored to its originally accepted condition before placement continues.

5.3.5 Care must be taken to minimize the extent to which the GCL is repositioned across the subgrade in order to minimize damage to the subgrade and to the bottom surface of the GCL. A temporary geosynthetic subgrade covering commonly known as a slip sheet or rub sheet may be used to reduce friction damage during placement.

5.3.6 The GCL should be placed so that seams are parallel to the direction of the slope. Other industry-accepted practices for installing geosynthetics on slopes shall be followed where appropriate, to help ensure that the stability and performance of the GCL are adequate.

5.3.7 All GCL should lie flat on the underlying surface, with no wrinkles or folds, especially at the exposed edges of the panels.

5.3.8 Only as much GCL shall be deployed per working day as can be covered in accordance with [5.8](#). The GCL shall be covered overnight.

NOTE 1—If the GCL is hydrated when no confining stress is present, it may be necessary to remove and replace the hydrated material. The project

engineer, construction quality assurance (CQA) inspector, and GCL supplier should be consulted for specific guidance if premature hydration is suspected to have occurred.

5.3.9 The GCL should not be installed when it is frozen.

5.3.10 If GCL is placed over geosynthetic, care must be taken so as to not damage underlying material with high ground pressure equipment directly on the geosynthetic.

5.4 Anchorage:

5.4.1 At the top of a slope, the end of the GCL roll may be placed in an anchor trench in accordance with the project drawings and specifications. The front edge of the trench should be rounded so as to eliminate any sharp corners that could cause excessive stress on the GCL.

5.4.2 If a trench is used for anchoring the end of the GCL, soil backfill should be placed in the trench to provide resistance against pullout. The size and shape of the trench, as well as the appropriate backfill procedures, should be in accordance with the project drawings and specifications.

5.5 Seaming:

5.5.1 GCL seams are constructed by overlapping their adjacent edges. Care should be taken to ensure that the overlap zone is not contaminated with loose soil or other debris. The overlap may require supplemental (powdered or granular) bentonite as directed by the project specifications. Geomembrane-based GCLs also may be welded together.

NOTE 2—Alternate seaming methods may be approved.

5.5.2 Unless otherwise specified, the minimum dimension of the longitudinal overlap should be 150 mm. End-of-roll overlapped seams should be constructed similarly but the minimum overlap should measure 500 mm. Care should be taken to maintain these overlap dimensions at the time of covering in all climatic conditions.

NOTE 3—It has been documented that GCLs may have some propensity for shrinkage if they are left under an exposed (that is, no soil cover or confining pressure) geomembrane for months or years. Additional information related to potential shrinkage mechanisms, as well as suggested measures to mitigate shrinkage, are provided in two documents from the Geosynthetic Research Institute, GRI White Paper #5 (2005)^{4,3} and Standard Guide GRI-GCL-5 (2011). This issue is not envisioned to occur for the more common situation where soil cover is promptly placed over the geomembrane/GCL composite liner system.

5.5.3 Seams should be constructed such that they are shingled in the direction of the grade in a manner that prevents the potential for flow entering the overlap zone.

5.6 Sealing Around Penetrations and Structures:

5.6.1 Cutting the GCL should be accomplished using a sharp utility knife. Frequent blade changes are recommended to avoid damage to the synthetic components of the GCL during the cutting process.

5.6.2 The GCL shall be sealed around pipe penetrations and structures embedded in the subgrade using granular bentonite, powdered bentonite, or bentonite paste, in accordance with the design drawings or as recommended by the manufacturer. Examples of these details are presented in [X1.1](#).

⁴ Koerner, R. M., and Koerner, G. R., "In-Situ Separation of GCL Panels Beneath Exposed Geomembranes," 2005.