



Standard Practice for Obtaining Samples of Geosynthetic Clay Liners¹

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1. Scope

1.1 This practice covers procedures for sampling geosynthetic clay liners (GCLs) for the purpose of laboratory testing. These procedures are designed to ensure that representative samples are obtained and properly packaged for submittal to a testing laboratory.

1.2 The procedures in this practice may be applied to either samples of unhydrated GCLs obtained at the project site prior to installation (or at the production facility, prior to shipment to the project site) or samples exhumed from a project site after installation.

1.3 It is assumed that the *number* of samples to be obtained has already been determined in the project specification, standard test method, or by prior agreement between the purchaser and seller. This practice covers only the methods for obtaining a pre-arranged number of samples and does not describe methods for obtaining individual specimens from the sample.

1.4 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 non-conformance with the standard.

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.*

2. Referenced Documents

2.1 ASTM Standards:²

¹ This practice 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.

D4220 Practices for Preserving and Transporting Soil Samples

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

D4439 Terminology for Geosynthetics

D5888 Guide for Storage and Handling of Geosynthetic Clay Liners

3. Terminology

3.1 Definitions:

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

3.1.2 *sample*, *n*—a portion of a material which is taken for testing or for record purposes (See Practice D4354).

3.1.3 *specimen*, *n*—a specific portion of a material or laboratory sample upon which a test is performed or which is taken for that purpose (See Practice D4354).

3.1.4 For definitions of other geosynthetic terms used in this practice, refer to Terminology D4439.

4. Significance and Use

4.1 This practice provides a procedure by which samples of GCL should be obtained for laboratory testing. The practice applies to materials obtained prior to installation (either at a job site or at a production facility) or exhumed material after installation.

4.2 Only GCL samples obtained in accordance with 5.1 of this practice will be considered representative of the actual manufactured GCL for quality assurance/quality control (QA/QC) purposes.

4.3 The quantity of GCL received by the laboratory should be sufficient for the preparation of several representative test specimens for the standardized physical, hydraulic, and mechanical tests to be performed on the GCLs.

4.4 The procedures in this practice should be used by plant and field personnel for obtaining GCL samples for laboratory testing.

5. Procedure

5.1 Obtaining Samples Prior to Installation:

5.1.1 In accordance with the project specifications or with Practice **D4354**, divide the shipment or other given quantity of GCL into lots, and select lot and laboratory samples. This will usually involve the selection of a certain number of finished GCL rolls from which samples will be cut.

5.1.2 Affix on the packaging of the GCL rolls to be sampled adhesive labels or other markings which clearly identify that the roll is to be sampled.

5.1.3 Record the label information from each roll to be sampled for future incorporation into within the quality assurance/quality control (QA/QC) documentation for the GCL.

5.1.4 Segregate the rolls identified for sampling. Refer to Guide **D5888** for the proper equipment and techniques for handling the GCL rolls.

5.1.5 Inspect the packaging of the selected GCL rolls for damage. Describe and record the damage, if any.

5.1.6 Remove the outer packaging from the GCL as carefully as possible, taking precautions not to damage the GCL and to preserve the packaging as much as possible for re-use after sampling is completed.

5.1.7 Obtain samples from the selected GCL rolls prior to deployment. If cut on a surface, the surface on which the GCL is cut shall be dry, clean, smooth, hard and free of irregularities and potential contaminants.

NOTE 1—At the discretion of the engineer, shorter or narrower samples, or both, may be obtained provided that the packaging procedures in this guide are followed.

5.1.8 A unique sample number shall be written on the sample. Additional markings should be made on the sample to identify the machine direction and the top/bottom sides of the GCL.

5.1.9 The GCL sample shall then be manually rolled around a core at least 75 mm in diameter, in the same direction as the cut. Care should be taken to wind the GCL without slack. Wide strapping tape (50 mm) shall then be wound around the sample in at least two places to secure the loose end. Bentonite loss from the sample may be minimized by applying the tape around the roll ends.

5.1.10 At least two layers of plastic sheeting shall be used to wrap the GCL sample roll for shipment to the laboratory, so as to minimize GCL sample disturbance or changes in moisture content. A thin cellophane material may be used for the inner wrapping, provided it is wound securely and repeatedly around the rolled sample. The outer sheeting shall be at least 0.15 mm [6 mils] in thickness and shall be wrapped to minimize the amount of GCL shifting within the wrapping.

5.1.11 To ensure proper sample chain-of-custody tracking, all shipping documents shall indicate the sample number, project name and contact, and laboratory name and contact.

5.1.12 If an additional sample from the same GCL roll is required for testing, 5.1.6 through 5.1.10 of this practice may be repeated on the exposed end of the roll until a sufficient amount of GCL is obtained.

NOTE 2—Additional material cut from the same roll is still considered part of the same sample therefore should not be designated any differently than those samples previously obtained from the same roll.

5.1.13 Samples should be transmitted to the laboratory in a manner that minimizes the amount elapsed time, sample handling, disturbances (such as moisture, vibration, impact, etc.) that could occur in transit. Expedited delivery will help to ensure that moisture content changes are minimized.

NOTE 3—These packaging procedures were developed under the assumption that the area from which specimens are obtained is at least 75 mm from the edges of the sample.

5.2 *Exhuming Samples After Installation:*

5.2.1 There are two methods for exhuming GCL samples. Method A is the suggested method for multi-component GCLs or GCLs covered with a geomembrane. Method B is the suggested method when there is no multi-component GCL nor is the GCL covered with a geomembrane, although Method A can be used in cases where larger samples are required.

5.2.2 *Method A—Hand Cutting method:*

5.2.2.1 Using a small backhoe or other piece of construction equipment carefully excavate a hole at the desired location down to within hand shoveling distance of approximately 150 mm [6 in.] of the GCL. Once cover removal begins, machinery should not be placed in the area to be exhumed. To minimize stress on GCL, within 150 mm [6 in.] the GCL, the overlying soil should be removed by hand and any overlying geosynthetics shall be cut by hand. Measure the depth of the cover soil, as well, the inclination and direction of inclination; for example, south, east, west, north.

NOTE 4—Once the overlying soil is removed, evaporation of water in the GCL may occur. Consequently, the GCL should be removed no more than 30 min from the time the overlying soil is removed. When a GCL is overlain by a geomembrane, the geomembrane should remain in place until the GCL is to be sampled. If heating of the geomembrane by solar radiation is a concern during this period, a white fabric or white plastic sheet should be draped over the geomembrane to reflect solar radiation.

5.2.2.2 The sample area shall be large enough such that specimens subsequently cut from the removed sample in the laboratory for testing are no closer than 75 mm from any edge. The sample also must not be cut too close to the side of the excavation so that the geomembrane and GCL may be repaired or patched as recommended by the manufacturers.

5.2.2.3 If the GCL is overlain with a geomembrane, first the geomembrane shall be cut over an area larger than the subsequent GCL sample area and removed prior to cutting the GCL. GCL samples shall be cut with a sharp utility knife or other implement capable of making a clean, straight cut through all the components of the GCL.

5.2.2.4 The sample width and length dimensions shall be measured and recorded.

5.2.2.5 To minimize the potential for bending or distorting the GCL, the sample shall be kept flat at all times during removal and placed upon a nonporous rigid plate. This can be accomplished by cutting a notch into the subgrade adjacent to the GCL, placing the rigid plat into the notch adjacent to the GCL sample and either sliding the GCL onto the plate or sliding the plate below the GCL (see Fig. 1).

5.2.2.6 To minimize changes in moisture content, at least two layers of plastic sheeting shall be used to wrap the GCL sample and plate for shipment to the laboratory. A thin cellophane material may be used for the inner wrapping,

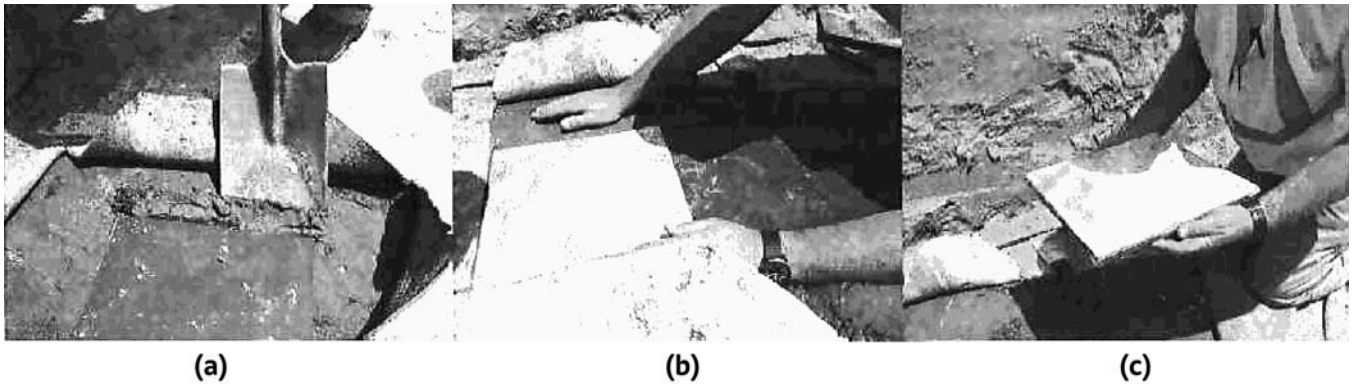


FIG. 1 (a) Digging Notch in Subgrade Adjacent to Sample Covered by Rigid Plate (b) Rigid Plate Placed into Notch Adjacent to GCL Sample. (c) GCL sample on Rigid Plate.

provided the cellophane is wound securely and repeatedly around the sample and plate. The outer sheeting shall be at least 0.1 mm [4 mils] in thickness and shall be wrapped tight enough to minimize the amount of GCL shifting within the wrapping.

5.2.2.7 Unique sample identification shall be marked on the wrapped sample.

5.2.2.8 If requested and practical, a confining pressure can be applied upon the GCL sample. This can be accomplished either by placing a second rigid plate over the GCL prior to wrapping and then placing dead weights over the sample, or by placing the sample in a container and then carefully placing a sufficient amount of soil over the sample.

5.2.2.9 Sample soils immediately adjacent to the GCL per Practices D4220.

5.2.2.10 If required, repair and/or patch the geosynthetics in the excavation as recommended by the manufacturers and backfill the entire excavation according to the protocol agreed to by the parties involved.

5.2.2.11 To ensure proper sample chain-of-custody tracking, all shipping documents shall indicate the sample number, project name and contact, and laboratory name and contact.

5.2.2.12 Samples should be transmitted to the laboratory in a manner that minimizes the amount of elapsed time, sample handling, disturbances (such as moisture loss, distortion,

impact, etc.) that could occur in transit. Expedited delivery will help to ensure that moisture content changes are minimized.

5.2.2.13 Samples should be stored and handled by the laboratory in a manner that minimizes the amount of elapsed time, sample handling, disturbances (such as moisture loss, distortion, impact, etc.) that could occur prior to testing.

5.2.3 Method B—Coring method:

5.2.3.1 Using a small backhoe or other piece of construction equipment carefully excavate a hole at the desired location down to within hand shoveling distance of approximately 15 cm [6 in.] of the GCL. Carefully remove the remaining soil by hand to within 25 mm [1 in.] of the top of the GCL.

5.2.3.2 Advance a hand auger with a 150 mm [6 in.] diameter, end-sharpened thin-wall sampling tube (see Fig. 2(a)) into the cover soil to the top of the GCL.

NOTE 5—Par Aide Turf Mender Model #1004 with Par Aide Tube Blade Model #1010 has been found satisfactory for this purpose.

5.2.3.3 After advancing the auger to the surface of the GCL, a utility knife should be used to pre-cut the GCL around the 150 mm [6 in.] diameter inner perimeter of the tube. Then advance the auger through the pre-cut GCL and approximately 25 mm [1 in.] beneath the GCL.

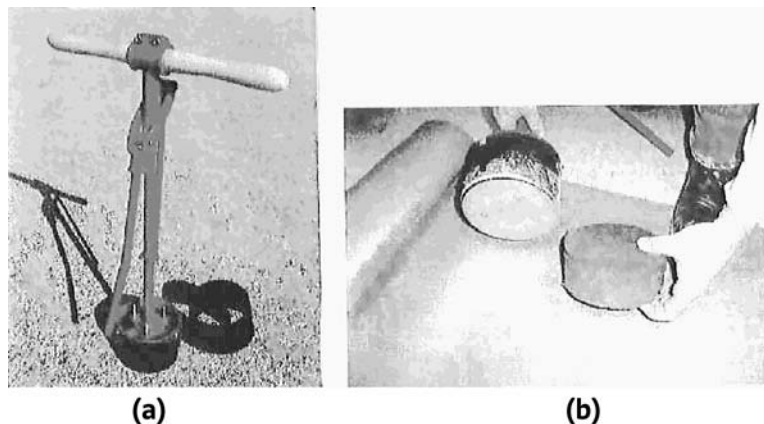


FIG. 2 (a) Auger and Sampling Tube Next to Spare Sampling Tube Turned on its Side (b) Composite (Soil/GCL/Soil) Sample Extracted from Sampling Tube.

5.2.3.4 Withdraw the sampler from the soil formation as carefully as possible in order to minimize disturbance of the sample. The tube can be slowly rotated to shear the material at the end of the tube, and to relieve water or suction pressures, or both, and improve recovery. Retrieve the auger with its soil/GCL/soil sample. Remove the thin-wall sampling tube at the end of the auger, and immediately seal both sample ends assuring that the sample has no way of moving about in the tube.

NOTE 6—If soil is lost and not flush with either end of the tube, then spacers or appropriate packing materials should be inserted prior to sealing the tube end(s) to provide proper confining pressure. Packing materials must be nonabsorbent and must maintain their properties to provide the same degree of sample support with time.

5.2.3.5 Unique sample identification shall be marked on the assembly, as well as, field orientation (that is, top, bottom).

5.2.3.6 If repair of the excavation area is required, first carefully fill and compact the hole up to the level of the GCL with soil. Then patch the sampled GCL hole with a patch of similar GCL that is at least 0.3 m [12 in.] beyond the edges of the sampled hole placing 0.4 kg/m [0.25 lb/linear foot] of bentonite between the patch and the GCL. Carefully backfill the entire excavation according to the protocol agreed to by the parties involved.

5.2.3.7 To ensure proper sample chain-of-custody tracking, all shipping documents shall indicate the sample number, project name and contact, and laboratory name and contact.

5.2.3.8 Samples should be transmitted to the laboratory in a manner that minimizes the amount of elapsed time, sample handling, disturbances (such as moisture loss, distortion, impact, etc.) that could occur in transit. Expedited delivery will help to ensure that moisture content changes are minimized.

5.2.3.9 Samples should be stored and handled by the laboratory in a manner that minimizes the amount of elapsed time, sample handling, disturbances (such as moisture loss, distortion, impact, etc.) that could occur prior to testing.

5.2.3.10 Immediately prior to GCL testing, carefully remove the tape and caps from the top and bottom of the sampling tube.

5.2.3.11 the composite soil/GCL/soil sample from the sampling tube using a soil extruder (see Fig. 2(b)).

5.2.3.12 Remove and discard the upper wax material and carefully remove the upper soil layer collecting it for further analysis. Then place a stiff layer over the GCL sample and carefully flip the assembly over. Carefully remove the other wax material and lower soil. Save the lower soil for further analysis.

6. Keywords

6.1 GCL; geosynthetic clay liner; sample

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