

CHAPTER 3.4
GEOSYNTHETIC CLAY LINER (GCL)

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CHAPTER 3.4 GEOSYNTHETIC CLAY LINER (GCL)

3.4-1. GENERAL. Geosynthetic clay liners (GCLs) are factory manufactured hydraulic barriers consisting of bentonite clay materials supported by geotextiles or geomembranes. GCLs are used to augment or replace compacted clay layers or geomembranes. All of the GCL products available in North America use sodium bentonite in powder or granular form. The bentonite thickness of the products vary between 4.0 to 8.0 mm (160 to 320 mils). GCLs are available in widths of 2.2 to 5.2 m (7 to 17 ft) and lengths of 30 to 60 m (100 to 200 ft). GCLs are most often considered for use where there is a limited supply of natural clay or limited landfill space. GCLs are also less susceptible to the effects of desiccation and freeze/thaw than natural clay layers.

a. Preconstruction Submittals. The contractor should provide preconstruction submittals as required by the specifications. The following is a list of typical submittal requirements.

- (1) The manufacturer's QC manual and QC test results.
- (2) GCL roll layout and penetration details.
- (3) Qualifications for the manufacturer, installer, inspector (if required), and QA laboratory (if required).

(4) Mid-plane and interface friction test results.

(5) Sample of GCL (if required).

b. Delivery, Storage, and Handling.

(1) A QA Representative should be present during delivery and unloading of the GCL to inspect for damage.

(2) Verify rolls are labeled with the manufacturers name, product identification, lot number, roll number, roll dimensions, roll weight, and date manufactured.

(3) The QA Representative should record applicable roll numbers, date delivered, name of manufacturer, and product type. This data is used to verify manufacturer's QC data sheets have been submitted for the rolls being delivered.

(4) Verify each GCL roll is wrapped around a central core and covered with an opaque, waterproof, protective covering. Require that tears in the packaging be repaired using tape and plastic sheeting to restore a waterproof protective barrier around the GCL.

(5) Do not allow rolls to be dragged, lifted by one end, or dropped to the ground.

(6) A pipe or solid bar of sufficient strength to support the full weight of the roll without significant bending should be used for all handling activities. Chains should be used to link the ends of the core pipe to the ends of a spreader bar. The spreader bar should be wide enough to prevent the chains from rubbing against the ends of the GCL rolls.

(7) Alternatively, a stinger bar protruding from the end of forklift or other equipment may be used. The stinger bar should be at least three-fourths the length of the core and also must be capable of supporting the full weight of the GCL without significant bending.

(8) If recommended by the manufacturer, a sling handling method utilizing loading straps may be used for handling.

(9) Verify rolls are stored in a flat dry area where water cannot accumulate. If rolls are elevated off the ground using blocks or pallets, make sure the entire roll bottom is supported.

(10) Do not allow rolls of GCL to be stacked more than three high.

c. Weather Limitations. GCL should not be deployed if precipitation is likely to hydrate the bentonite prior to placement of a geomembrane or cover soils.

3.4-2. PRODUCTS.

Geosynthetic Clay Liner.

(1) Cross check the roll numbers of the GCL delivered to the site against the roll numbers on the manufacturer's QC test data submittals to ensure they match. Ensure the GCL meets the property requirements outlined in the specifications for material type and physical properties (bentonite mass per unit area, free swell of bentonite, hydraulic conductivity, etc...).

(2) If a geotextile backed GCL is being used, verify the two layers of geotextile surrounding the bentonite are stitch-bonded or needle-punched together.

(3) Verify friction test results indicate adequate interface shear strength exists between the GCL and adjacent materials.

(4) GCLs must also be tested for internal shear strength. Verify internal shear strength results meet the specified requirements.

3.4-3. EXECUTION.

a. Subgrade Preparation.

(1) Inspect the subgrade daily to ensure it is smooth and free of vegetation, standing water, sharp-edged rocks, or any other material that could damage the GCL. The condition of the subgrade is generally certified in writing by the QA Representative and installer each day prior to GCL placement.

(2) Verify the final lines and grades of the subgrade are correct prior to GCL placement.

(3) Typically the subgrade surface is rolled with a smooth-drum compactor of sufficient weight to remove any protrusions, wheel ruts, footprints, or other abrupt changes in grade.

(4) Typically, specifications will require the repair of ruts

or protrusions greater than 12.5 mm (.5 inches) in depth or height.

(5) Do not allow the use of calcium rich soil, such as limestone, in the subgrade because it will reduce the effectiveness of the GCL.

b. Installation.

(1) A QA Representative should be present at all times during GCL installation.

(2) Protective plastic covering should not be removed from a roll of GCL until immediately prior to deployment.

(3) Do not allow personnel working on the GCL to smoke or wear shoes which could damage the GCL.

(4) Ensure equipment used to deploy the GCL will not damage geosynthetics located beneath the GCL.

(5) GCL rolls should be slowly unrolled. Do not allow the contractor to freely roll GCL down the slopes.

(6) Care must be taken to minimize the extent to which the GCL is dragged across the subgrade in order to minimize damage to the bottom surface of the GCL. GCL is often placed on sheets of plastic (slip sheets) so it can be moved without being damaged.

(7) Ensure the deployed GCL is smooth and free of wrinkles.

(8) Check the specifications for overlap requirements. Generally, GCL rolls should be overlapped a minimum of 150 mm (6 inches) for roll sides and 450 mm (18 inches) for roll ends.

(9) Ensure the overlap areas are free of dirt.

(10) On warm days, some GCLs tend to shrink. This reduces the overlap present along the sides and ends. Periodically check the overlaps. If significant shrinkage has occurred (25 to 50 mm (1 to 2 inches)) contact the designer to see if the GCL should be repositioned.

(11) GCL should generally be placed parallel to the line of maximum slope. For any horizontal seams on slopes, ensure overlaps are constructed with the up slope GCL shingled over the down slope GCL.

(12) Check the manufacturer's recommendations to determine if there are any special seaming requirements for horizontal seams constructed on slopes.

(13) Granular bentonite is sometimes placed along GCL seams if the GCL is constructed using nonwoven geotextiles. Check manufacturer's recommendations for proper seam construction procedures.

(14) GCL should not be left uncovered overnight. Require temporary plastic covers to be placed over exposed GCL.

(15) If exposed to water prior to being covered, check to see if the GCL has become hydrated. Hydrated GCL is often defined as material which has become soft as determined by squeezing the

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material with finger pressure or material which has exhibited swelling. Another indication that hydration has occurred is the presence of bentonite swelling through the void spaces of the geotextile backing material. Contact the designer if it appears the GCL has become hydrated.

(16) Any area requiring repair should be clearly marked on the GCL.

c. Repairs. Patches should be constructed and secured as recommended by the manufacturer. Generally, patches for holes and tears should extend a minimum of 300 mm (12 inches) beyond the edge of the defect.

d. Penetrations. Penetration details should be constructed as recommended by the manufacturer. This will generally involve a collar of GCL wrapped around the pipe and hand placement of dry bentonite.

e. Covering. Refer to Chapter 3.9 Cover Soil Layer for additional information on cover soil placement.