GCL PANEL SEPARATION: CAUSES AND PREVENTION

Concerns have been raised about the potential for in-situ separation of overlapped GCL panels in "exposed" lining systems, where a GCL is under a geomembrane with no confining cover (soil, stone, waste, etc.). In these conditions, there have been some documented instances where overlapped seams were compromised, resulting in gaps between the panels. See Thiel (2005) and Koerner and Koerner (2005) for more information on the nature of the seam gaps. In response to these findings, CETCO has investigated the problem and has identified three separate causes of panel separation. It is important to understand each cause so that preventative measures can be implemented in cases where the GCL will be unconfined for long periods of time. The three causes of panel separation as identified by CETCO are:

1. Cyclical wetting and drying. This has been shown to occur in conditions where the GCL is covered only with a geomembrane and subjected to heating and cooling cycles. Moisture absorbed by the GCL from the subgrade and later released through evaporation. This repeated wetting and drying action can result in shrinkage.

2. Tension necking. This phenomenon appears to have occurred in one case where Bentomat DN was installed on a very steep slope (1H:1V) and overlain with a textured geomembrane above it (no soil cover). The self-weight of the geomembrane apparently pulled downward on the GCL, creating tension and causing "necking" in the midsection (both materials were anchored at the top of the slope). This effect was likely exacerbated by thermal expansion/contraction whereby the GCL was relatively easily put in tension during the downslope expansion cycle, but was released during the upslope contraction cycle. GCLs with woven geotextiles would not be as susceptible to this problem.

3. Drying upon installation. Claymax 200R is made with a moisture content of over 50%, and its bentonite layer is compressed into a monolithic mass during production to facilitate adhesion of the geotextile carrier layers. Therefore, when installed in warm weather, it has the potential to shrink if it is allowed to dry out before or after cover is placed over it. It should be noted that Bentomat, manufactured at a maximum of 30% moisture and without compressing the clay into a monolithic mass, does not shrink upon drying after installation.

If the GCL will be left under an exposed geomembrane for an extended period of time (months or years), the following measures can be considered to prevent the possibility of panel separation:

1. Cover the liner system with 30 cm soil. The confinement will provide a resisting force to shrinkage forces and also will prevent the large daily temperature fluctuations that facilitate geomembrane expansion/contraction and the movement of moisture.

2. Use Bentomat ST or Bentomat FLW to reduce the possibility of shrinkage due to tension necking on steep slopes. Discuss whether a textured membrane is actually needed against the GCL in steep-slope applications. Site geometry and filling operations may be such that additional interface friction is not required.

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3. Increase the overlap of the GCL to account for the potential of panel separation or shrinkage in the event that other preventative measures cannot be taken. Increasing the overlap to 18 inches allows 6.7% shrinkage to occur while still leaving a 6-inch overlap. Preliminary lab and field forensic data suggests that this allowance would be acceptable for all but the most extraordinary circumstances.

4. Heat-tack weld the GCL seams with a quick application of a flame torch followed immediately by light pressure, as discussed in TR-263.

In conclusion, panel separation concerns are warranted only in those very few GCL projects where the GCL will remain unconfined for significant periods of time. Reasonable measures can be implemented to prevent panel separation problems. CETCO continues to research the issue and will provide additional information as it becomes available.

References:

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