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Specifying geotextiles using M-288

I AM IN TOTAL SUPPORT OF YOUR call for standardizing specifications (May editorial), which would dramatically simplify this industry on many fronts. However, I think you missed the mark with your statement that one of the benefits would be that users could get more bids for a given job and keep costs down. There is currently not a shortage of cheap pricing.

The real benefits are that it would simplify this technology for the design engineer, reduce production and inventory problems, and allow us the time as an industry to focus on increasing this market instead of fighting for market share. Instead of wasting enormous energy analyzing specifications and trying to convince engineers that our 205-lb grab tensile fabric is better than our competitor's 200-lb grab tensile fabric, we could spend time talking to other engineers, owners and contractors about the benefits of using our products.

The ultimate driving force behind a move like this has to be the opportunity to expand our market and increase profits, so we don't have to cut each other's throats for every 20,000 yd^2 job that comes along.

TOM TURNER
Sales manager
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Who cares about $30 million?

GFR'S EDITOR SENT ME AN ADVANCE copy of the U.S. Federal Highway Administration (FHWA) geotechnical note on degradation reduction factors for geosynthetics (page 24). I'd like to comment on the statement that the fiscal impact of reducing the k factor from 7 to 5 would save $30 million. This is ridiculous. Who cares about $30 million?

What will happen when the total default or k factor is reduced to 3 or even 4, is that geosynthetics will take the reinforcement market, accelerate the paradigm shift and get us on the road to the billion-dollar annual impact. But the money is not the most important aspect. With realistic k factors the vendor death grip on our technology will break up and we will finally see the myriad of applications that are in fact restrained at this time.

Claiming only $30 million for this baby step is in fact counterproductive. It takes urgency away from people learning and adopting generic reinforced-soil technology. The end result of these baby steps is a powerful new suit of space constraint resolutions that carry a tremendous economic impact.

What can we do? Right now, Grand County, Colo., is building a generic 55-ft-high wall that is costing about $12 per square face foot. Think about how much they are saving and what else they can do with that money—money that everywhere else is supporting the footdraggers and vendor royalties. Geese o' Pete, it's only a simple repetition of a row of blocks, a sheet of reinforcement, and a lift of roadbase.

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Terratask
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GCL field thickness may be less than assumed

IN THE ARTICLE "GCLS: ALTERNATIVE Subtitle D Liner Systems" (May, page 36), Gregory R. Richardson states that one of the key assumptions used when evaluating a geosynthetic clay liner (GCL) composite-liner system is that "under anticipated field-loading conditions, and where fully hydrated, the GCL has a thickness > $thickness_{assumed}$." He also states that "the thickness of a GCL under a given normal load can be obtained...by measuring the thickness of the GCLs placed in a consolidation cell, saturated, and loaded under the desired range of normal loads."

This method for determining the thickness of a hydrated GCL is only valid in the field if there is a uniform load distribution across the landfill and the hydrated bentonite is prevented from flowing laterally. In this instance, any change in bentonite thickness is dependent only upon the vertical load. In actual practice, however, (1) landfills are not loaded uniformly—especially in a phased operation, and (2) the geomembrane of a composite liner system may not be in true intimate contact with either a compacted clay liner (CCL) or a GCL because of wrinkles.

Koerner and Narejo (1995) and Fox et al. (1996) have shown that hydrated bentonite will migrate away from a concentrated load. The U.S. Army Corps of Engineers (1995) requires a minimum cover soil thickness of 0.45 m before construction equipment can operate on top of a GCL to reduce the potential of bentonite migration. Stress concentrations are ubiquitous in a liner system, especially around all sumps and pipe locations, at slope transitions and benches, and in areas where the subgrade is uneven or contains rocks. In fact, Tedder (1997) recommends "additional layers of protection in the sumps" because of increased leakage rates due to high hydraulic heads. Another possible mechanism for stress concentration development is local differential settlement caused by natural variations in foundation bearing capacity and compressibility.

The presence of wrinkles in the geomembrane (see **Photo 1,** page 8) can also create zones of non-uniform normal stress, which can allow hydrated bentonite to migrate into the airspace under the wrinkle when subjected to landfill loading conditions. Koerner (1996) reported on the progress of a current research project on the

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fate of wrinkles in geomembranes. He concluded that the shape of a wrinkle or wave can change with time but the void does not appear to reduce significantly. In addition, Eith and Koerner (1996) describe a municipal solid-waste landfill double liner system that was exhumed after eight years of service. After exhumation, a number of large wrinkles were found in the geomembrane. These observations show that wrinkles are not removed after installation and thus can be long-term zones of low normal stress acting on an underlying GCL.

Anderson and Allen (1995) and Anderson (1996) showed that the thickness of hydrated needlepunched GCLs can be significantly reduced in the vicinity of a geomembrane wrinkle. The hydrated bentonite migrated towards the area or void under the geomembrane wrinkle where the normal stress was at or near zero (see **Photo 2**). The thickness of the needlepunched GCL under the wrinkle was 20 to 25 mm, while the GCL thickness farthest away from the wrinkle was less than 2.5 mm. The manufactured thickness of the GCL was approximately 7.0 mm. In addition, the upper woven geotextile separated from the GCL under the geomembrane and formed a shape similar to the wrinkle. This was caused by the needlepunched fibers breaking or being pulled back through the woven geotextile in the wrinkle area because of the low-confining pressure. Along the edges of the GCL, where the bentonite was in compression, the needlepunched fibers remained intact.

In summary, the field GCL thickness may be less than the assumed thickness, and conducting a one-dimensional compression test on a GCL may not accurately simulate the field conditions in a landfill liner system unless the design and field CQA programs eliminate nonuniform normal loads and geomembrane wrinkles.

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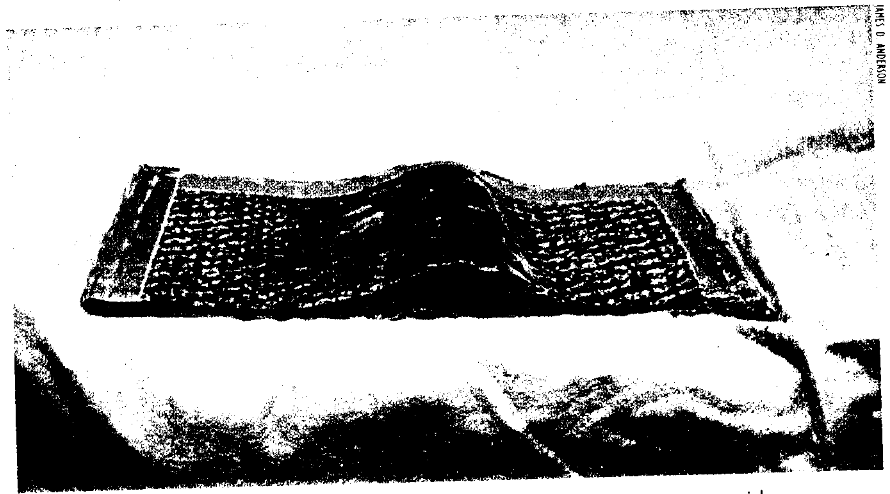
Photo 1. Typical pattern of wrinkles with a black, smooth HDPE geomembrane.



JAMES D. ANDERSON

Photo 2. Needlepunched GCL after one-dimensional compression tests with a geomembrane wrinkle.

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Corrections to the May issue

- The key to the GAI-LAP accreditation chart published on page 13 left out Geotechnics Inc., East Pittsburgh, Pa. This mistake, in turn, set off a chain of errors. The corrected portion of the key is:

14. Geotechnics
15. Serrot Corp.
16. FMSM Engineers
17. ITRI, Union Chemical Laboratories.

- The U.S. Bureau of Reclamation, Denver, should have been credited for the photo that ran on page 43.
- The listing for I-Corp International Inc., Ocean Ridge, Fla., on page 46, included an incorrect fax number. It should have read 561/369-0895.