GEOSYNTHETIC MANUFACTURING CONCERNS FROM A CONSULTANT'S PERSPECTIVE

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BACKGROUND

As a consultant designing a project that involves the use of geosynthetics, you are selecting materials based on their "stand-alone" properties, as well as their "interaction" properties.

The "stand-alone" properties define the generic purpose of the geosynthetic material. The ability for it to flow liquid, the ability for it not to flow liquid, the ability to filter out fine grained soils, the ability to cushion against larger aggregate.

Interaction properties determine the selection of specific materials. Smooth or textured geomembrane can be selected for stability considerations. Drainage material can be selected based on anticipated loads and intrusion of adjacent materials. Geotextiles can be selected based on anticipated loading and aggregate size for cushion materials or based on the gradation of soils for filtration. Various Geosynthetic Clay Liner (GCL) options can be selected based on friction and strength requirements.

It is the Geosynthetic Manufacturer who makes the material and can define the stand alone properties, it is the Consultants role to understand these properties and incorporate these properties into the design.

What the consultant expects from the manufacturer is consistency, consistency and more consistency. Although the manufacturers have been able to "meet the specification", it is much more difficult to maintain a consistent product from week to week and year to year. Specifications change, raw materials change, manufacturing owners change, and equipment is constantly changing. In addition, manufacturing variability is inherent in almost all geosynthetic products produced. This is reason we take 5 or 10 samples across a roll width to define the properties of the roll?

As a designer, you select key design elements that are the basis for maintaining regulatory compliance, slope stability, minimal leachate head, puncture resistance, resistance to clogging, long-term creep, and chemical resistance among others. Engineers are constantly pushed to lower construction costs and for landfills, increase airspace. Slopes are getting steeper and cells are getting deeper. Designs are pushing the limits on what the traditional geosynthetic materials can support.

Now add the above issues to just in time construction philosophy, there is no room for error in the schedule to open the new disposal cell or complete a project.

During the permitting and design phase, you are selecting materials that may not be available at the time of construction. You are performing minimal testing for the purpose of obtaining the permit due to budget constraints; assuming that you will do the testing as part of the CQA program. There are times that the material is not yet available when you go to construction.

By the time the construction starts, the material has already been purchased (often through a National contract) and now the CQA Consultant has to figure out if the material that has already been shipped will meet the key design elements that were part of the permit.

Again, if the materials provided are "consistent" this would not be much of a concern.

TEXTURED GEOMEMBRANE

A huge variable on the issue of consistency is the degree of texturing with textured sheet. As slopes get steeper on landfills, the consistency of texturing becomes more critical.

Two issues come to mind, first, 10 mils of asperity may qualify the geomembrane to be called textured, but sometimes 10 mils is not enough to satisfy the site-specific stability needs. For many years, the asperity height was much higher and the degree of texturing was considerably more aggressive. As designers, we saw this as our definition of textured sheet-and took it for granted. As manufacturer's fine tuned their processes and standard specifications become more accepted, the aggressive texturing started to disappear. From a design perspective, what really happened is the factor of safety for the slope stability changed dramatically. The sheet still meets the specification, but the sheet is dramatically different in how it interacts with adjacent materials. When were the manufacturers going to tell us? Well, you are being told today; that the standard specification for asperity height may not meet the intent of your design using traditional construction techniques. As proof, there have been several slope failures with textured sheet over the past year to validate this point. I like to refer to this material as "textured-lite". By definition it is a textured geomembrane; but direct shear testing is warranted when using this material to qualify it for your project.

Second, it is the consistency of the texturing both across the roll and roll to roll that should be a concern to the engineering community. It is not uncommon to walk the slope of a geosynthetic installation and to observe varying degrees of texture from panel to panel and even across an individual panel. What good is direct shear testing if the material provided is not consistent with respect to texturing? Again, it may all meet the 10 mil asperity height requirement, but will it provide for a stable installation? Manufacturers have an obligation to provide material that is consistent with what was tested and accepted. Material provided by the manufacturer for direct interface friction testing should be considered as a submittal similar to a shop drawing. Once approved, this sets the standard for all materials delivered to the project. If the manufacturer submits a sample with a 20 mil asperity for testing, 20 mil is now the requirement for all materials delivered to the project.

You will hear the geosynthetic manufacturers state that they will not agree to specifications that have interface friction requirements-that it is the consultants responsibility to verify interface friction as part of the design or as part of the CQA program. As long as the manufacturers continue to produce and sell inconsistent texturing on the geomembrane, they will continue to avoid commitment to any friction angle requirement. Manufacturers want to ship all the materials they produce and want to be held to only the 10 mil asperity height.

Interface friction angle is a component of many factors including adjacent materials, normal loading, and rate of displacement. In fact there is a whole course offered on this subject. What we as consultants are asking for is that the manufactured components be consistent from day to day and year to year and provide a level of texturing that can provide the desired stability. The existing minimum values are no longer enough to ensure stability. A higher minimum value or a range of values must be specified to assure consistency. I would go as far as recommending that the specifications (both GRI and manufacturer's) clearly state that the use of textured geomembranes with asperity height in the range 10-15 mil should be used with caution and only when validated with interface friction testing of field specific materials. The factor of safety on a steep slope with minimal texturing is gone, manufacturers should at least warn the less experienced among us to this fact.

DRAINAGE GEOCOMPOSITES

With respect to geosynthetic drainage materials, the emphasis has been to maintain high flows under the higher loads that landfills are experiencing. This emphasis has moved the densities of some of the drainage materials beyond where they had traditionally been produced. Again, the manufacturer is controlling the "stand-alone' properties of the drainage nets, but have they looked at the effects on the materials that they interact with? Will a very high density geonet cut a softer geomembrane liner? Is a cushion geotextile required when the geonet is higher density than the geomembrane? What happens to these higher density geonets when evaluated for stress crack resistance? More research is needed in this area to address how the higher density materials interact with adjacent materials and what precautions may be required

With respect to primary flow directions of drainage geocomposites, why do the manufacturers only represent transmissivity values in the machine direction? Traditionally, the only time that the machine direction is oriented to the maximum gradient of the design is on slopes. The geosynthetic drainage materials are rarely installed on the floor of a landfill oriented parallel to the maximum slope. This would require the geocomposites to be installed along the resultant vector of the two floor slopes. However, the manufacturers don't tell consultants that the published numbers only apply under this condition when plugging into their calculators for determining head on the liner.

In fact, some drainage products have as much as a 90% reduction in flow when tested in the cross direction when compared to the machine direction. Thus high flow drainage geocomposites now become a dam within your drainage system. Recommendations for installation by the manufacturer is necessary to take advantage of these high flow materials, but rarely is this point brought up in trying to sell the product. Manufacturers need to be up front with all the properties of their materials for consultants to properly prepare designs and prequalify acceptable products.

GEOSYNTHETIC CLAY LINERS (GCLS)

Focusing now on GCLs, why do we still see needles in the finished product. Often times, the Consultant has just modified the permit to allow a GCL as an approved alternate to a compacted clay liner. All the calculations have been prepared to justify the technical equivalency the GCL alternative-however; we generally don't have to include the use of metal detectors in the field for compacted clay liners. Although this phenomenon is rare, it still occurs and leads us back to the goal of having a geosynthetic manufacturer provide consistent product that Owner's and Consultants can depend on to meet the requirements of the project.

Now that the GCL's are under the microscope for panel separation potential, more information and research is required. Dimensional stability of materials on the slopes needs to be addressed. Manufacturers need to be clear about how their specific product line can manage the panel separation concern.

TECHNICAL SUPPORT OR SALES

Finally some discussion about technical support from the manufacturers when assisting the engineering community in designing for the use of geosynthetic materials is necessary. There are still a large number of consultants that are incorporating geosynthetics into their designs for the first time and they will need to talk to the manufacturer about the specific properties of their materials and how they will function to accomplish the goals of the design.

What these consultants don't realize is that the Technical Support Product Managers are usually under the sales umbrella of the manufacturer-and their goal is to guide you into a sole source design or a preferred design emphasis that will lead to a "sale" for their company.

The manufacturing community has done itself a disservice by disguising salesmanship under the cloak of technical support. It is hard for an engineer to determine what products or properties of products can benefit his project when the engineer gets conflicting information from different manufacturers. It is even more difficult for the regulators to determine what is appropriate when develop the rules and specifications for

geosynthetics in their state. Many times the regulators will only hear one side of a story and start requesting specific changes based on the latest brown bag seminar put on by the "sales group" disguised as Technical Support.

SUMMARY

It is common that the Manufacturers will talk about improved communications with the consultant as a positive step to a successful project. I would like to take that concept a little bit further and ask that unbiased and honest communication be presented to the consulting and regulatory community on how the various products function and behave over time.

More technical support needs to be provided from organizations such as North American Geosynthetics Society (NAGS), Geosynthetic Materials Association (GMA), and the Geosynthetic Institute (GSI) on the use of geosynthetics to eliminate that salesmanship of technical support groups within the manufacturing community. The manufacturers need to support these organizations in the development of training courses, hot lines and technical manuals.

Short courses presented by the manufacturer are great "marketing tools" for the introduction of new products. However, the design community would be better served by courses that promote growth in use of geosynthetics as a whole.