FABRICATED GEOMEMBRANES: ADVANTAGES AND USES

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SUBMITTED for review and possible publication in WASTE AGE Magazine

September 28, 2010

Abstract

In general, geomembranes come in two distinct types. The first type is flexible enough for folding, transport to a job-site in large panels, unfolding, and seaming to other panels for field testing. The other type cannot be safely folded and instead ships as rolled goods. As a result, more field seaming and testing for the second type of geomembrane must occur in the field. This results in longer construction time (and costs) than for geomembranes that can be folded in the factory. This article discusses a few other advantages of large panels of geomembrane for containment applications.

Factory Fabricated Geomembranes

Some geomembranes are flexible enough that they can be factory seamed, folded, and unfolded without creasing or damage to the liner and then seamed to other panels and tested as necessary in the field. These geomembranes are most commonly thin gauge (less than 45 mils thick). They are produced by calendering, lamination, and extrusion manufacturing. If a geomembrane is not flexible, creases in the geomembrane may result in a weakness and possible cracking or accelerated aging.

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Geomembranes that can be folded are usually seamed in a factory to reduce field seaming cut installation time, and minimize field tests and patching. In addition, revised field testing procedures (e.g. air-channel testing (Thomas et al., (2003) and Stark et al. (2004)) further reduces the number of destructive samples required on a job site. Installation time and testing is particularly important in harsh environments with pending storms, or where an Owner may want to "extend the field installation season." These fabricated liners can facilitate installations in difficult climates and are less expensive to install than fully field-assembled liners.

Folding and shipping large prefabricated panels allows for increased field production. The photograph below shows a pre-fabricated panel being unfolded for deployment -- while the first geomembrane panel is ballasted in the background. Quick deployment of panels allows large areas of carefully prepared subgrade to be covered quickly and prevent degradation from weather and other operations. It also allows large areas of GCLs (geosynthetic clay liners) to be covered quickly and thus limit premature hydration of the bentonite. It is common that after completing only one field seam between two factory-fabricated panels, the area covered exceeds one acre.

Flexible geomembranes are fabricated into panels in a controlled factory environment more suitable to high quality seaming than variable field environments. The size of panels is usually limited only by allowable shipping and handling weight. It is common to ship panels that weigh 1,816 kg (4,000 lbs) but panels as heavy as 4,086 kg (9,000 lbs.) have been shipped. On-site,

fewer field seams are required to complete the field installation because of the large panels. Field seaming usually utilizes thermal fusion for production. Patches also utilize thermal fusion though materials like PVC also allow for field solvent welds.

Factory v. Field Seaming

Field seams face a few more challenges than factory seaming. Wind, dirt, precipitation, temperature fluctuations, crew changes, and machine performance can all affect field seaming. Bonding two sheets of geomembrane in the factory usually on a smooth and clean concrete floor enables (1) quicker and more consistent welding, (2) higher seam shear and peel strengths, and (3) lower frequency for destructive testing and thus fewer patches in the completed liner. Excessive destructive testing presents more potential weak points in areas subjected to tensile stresses.

Fabricated geomembranes can be especially efficient for small projects where one or a few panels can line the entire project area. For example, 0.81 hectares (2 acres) can be completely covered, tested, patched, and certified in one day with 2 or 3 panels. Savings on a small project include smaller crew size, less mobilization cost, less equipment, and less detail work. Generally a field-assembled geomembrane will require a second day of work to complete the testing and detail work. In a given liner area, the amount of field seams may be 80% less (Stark et al. 2005 a and b) than that required for a similar non-fabricated liner.

Estimated Installation Cost.

In general, field assembled geomembrane material is frequently comparable in cost with fabricated geomembrane material. However, the installed cost is usually higher for field assembled geomembranes because of the greater scope of installation and field testing costs.

When a project requires CQA/CQC, a fabricated geomembrane installation reduces these third party costs significantly. Simply put, large factory fabricated panels have less field seams; therefore, less third party costs.

Summary

The use of fabricated geomembranes can facilitate installation of a containment system, closure cell, sports turf barrier, floating cover, pond liner of all types due to large reductions in field seams and field testing protocols. In addition, prefabricated panels and fewer field seams result in liner phases being completed quicker and with fewer patch locations. Fabricated geomembranes generate lower installation and CQA costs because large panels reduce time and expense by field personnel, inspectors and general contractors. Finally, fabricated geomembranes show more consistent seam performance than field assembled liners because the majority of the welds are created in a controlled factory environment. Factory fabrication has been performed since the 1950s and will be an important facet of the geomembrane industry for years to come.

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