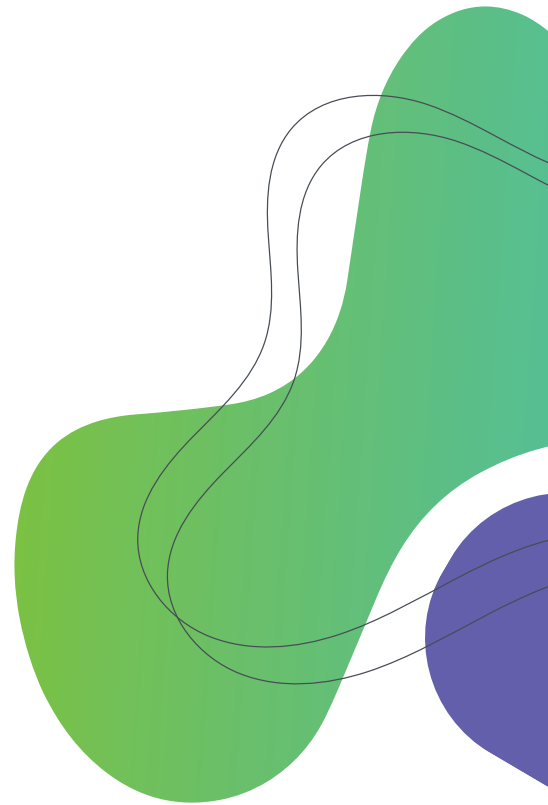




COST REDUCTION PROGRAM



THE SOLMAX COST REDUCTION PROGRAM (CRP)

GEOMEMBRANE PERFORMANCE TESTING

Liner costs may contribute significantly to the overall cost of materials in mining applications. Selecting the optimal geomembrane liner that is compatible with field materials and conditions is critical to achieving a cost effective and safe design. Using the Cost Reduction Program (CRP), we will look at the original specifications for the project, and then refine the lining system to give savings and a cost effective solution with the critical understanding of performance that is required.

Chemical resistance, puncture resistance and interface shear resistance are key performance indicators for geomembrane liners in mining applications. The significance of these parameters to projects with geomembranes has been reported considerably in the literature (e.g. Renken et al., 2005¹; Lupo, 2008² and Fourie et al., 2010³). The common questions asked are:

- How long will the geomembrane perform when exposed to a given chemical and conditions?
- What liner thickness is needed to resist puncture whilst providing chemical resistance?
- What surface texturing or asperity height is needed for maximum interface friction?

A design flowchart for liner material selection based on these properties is presented in Figure 1.

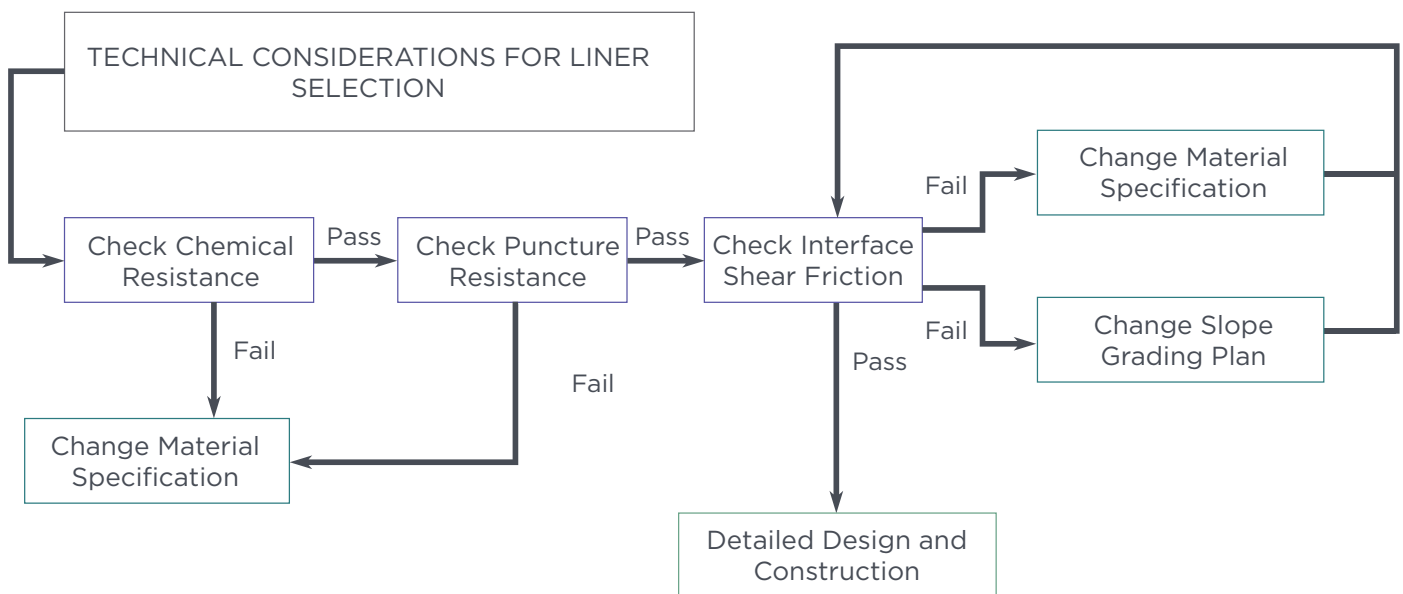


Figure 1: Geomembrane liner design logic (Adapted from Lupo, 2008; Fourie et al., 2010)

REFERENCES

- ¹ Renken, K., Mchaine, D. M., & Yanful, E. K. (2005). Geosynthetics Research and Applications in the Mining and Mineral Processing Environment.
- ² Lupo, J. F. (2008). Liner system design for tailings impoundments and heap leach designs. Tailings and Mine Waste 2008 (pp. 177 - 186). Taylor & Francis Group, London.
- ³ Fourie, A. B., Bouazza, A., Lupo, J., & Abrao, P. (2010). Improving the Performance of Mining Infrastructure through the Judicious Use of Geosynthetics. 9th International Conference on Geosynthetics, (pp. 193-219). Brazil.

The answers to these questions, in essence the field performance and design life of geomembranes are best evaluated from performance tests. Performance tests are different from routinely completed index tests and the main differences are described in Table 1 below.

PERFORMANCE TESTING	INDEX TESTING
Involves the use of site specific materials and expected conditions to simulate field response	Performed in accordance with industry specifications and standards to characterize geomembranes in terms of their physical, mechanical and durability properties
Provides a reliable representation of the design life and performance of geomembrane liners to be used in an application	The compatibility of geomembrane liners with site specific loading conditions, chemicals and interface contact materials are not captured effectively in index tests
Are effective for comparing the performance of various potential alternatives for an application	Effective for material characterization
Completed on a case-by-case/site-by-site basis	Routinely completed and results are typically presented in the Technical Data Sheets provided by the manufacturer

Table 1: Performance Tests vs. Index Tests

At Solmax, we are offering the CRP entailing performance testing for chemical resistance, puncture resistance and interface shear resistance using site specific materials and conditions. The benefit of the CRP is that in critical mining applications requiring the use of geomembrane liners, designs will be based on a reliable knowledge of the expected performance of the liners in service and not on a presumed performance, since the actual materials to be used on the site would have been tested.

Hence, with Solmax’s CRP, clients will be able to avoid some of the pitfalls associated with presumed performance of materials - such as overestimation of performance, which could result in unsafe designs or product failure or underestimation of performance, which could result in “overdesigning” or paying more for what is not needed.

A material that has worked in a particular application or on a site may not be suitable for the same application on a different site since site conditions can vary significantly. For instance, a 2 mm (80 mils) thick HDPE liner that was found to be ideal for a site may not be optimal for another site. The best way to ascertain the material that is actually needed is to conduct performance testing.

The responsibility of conducting performance testing to determine the appropriate materials for an application is usually placed on the client or the end user. At Solmax, we are strongly committed to providing value-added services to our clients and we are taking this commitment several steps further by offering the specialized performance testing programs for chemical resistance, puncture resistance and interface shear resistance at no additional cost to our clients. These tests will be completed in house using our state-of-the-art laboratory testing equipment.

The purpose of taking care of the costs associated with these specialized material testing in the CRP is to support our clients through their material selection and design process to ensure that they select the right product for the right application and achieve maximum performance from their liner systems in service, whilst also achieving cost effective designs and substantial monetary savings².

SOLMAX'S CHEMICAL RESISTANCE PERFORMANCE TESTING FOR COST REDUCTION IN MINING

RATIONALE FOR TESTING

Mine solutions, reagents, solvents, lixiviants, process water, waste rock leachate, tailings, milling liquor and effluent may expose geomembranes that are used for containment on mine sites to hydrocarbons¹, low pH - acidic², high pH - alkaline³ and oxidizing⁴ environments for extended periods. For instance, in the recovery of metals by heap leaching, the bottom of the heap leach pads are lined with geomembranes to maximize ore recovery and to prevent the lixiviating chemicals from getting into the environment.

The lixiviating chemicals may be acidic with a low pH ≤ 4 e.g. sulphuric acid used in the recovery of copper, nickel or uranium metals or may be alkaline with a high pH ≥ 10 e.g. cyanide for the recovery of gold and silver from ore. Over time, the percolating lixiviants will accumulate at the bottom of the heap leach pad on top of the geomembrane liner and site specific factors such as the residence time of the chemicals, the increased concentration of the chemicals at the bottom of the cell, elevated temperature and pressures may facilitate adverse chemical reactions on the geomembrane liner.

Acid Mine Drainage (AMD) resulting from the oxidation of sulphidic waste rock and mine tailings are also sources of potentially adverse chemical environments for geomembranes on mine sites. It has been reported that the metal concentrations in AMD or tailings may speed up the rate of antioxidant depletion in geomembranes significantly⁵. Likewise, kerosene used in solvent extraction plants is an example of an aromatic hydrocarbon that could potentially cause damages to geomembranes .

CHEMICAL RESISTANCE TESTING

At Solmax, the performance of our geomembranes under any given site condition to achieve safe and cost effective containment systems is paramount to us. Hence in the CRP, chemical resistance testing of candidate geomembranes for an application will be completed by immersion in site specific chemicals as per ASTM standard D 5322 - "*Standard Practice for Laboratory Immersion Procedures for Evaluating the Chemical Resistance of Geosynthetics to Liquids*". This will provide our clients with science-based evidence of the expected performance of their proposed geomembrane material in service.

For the testing, coupons from candidate geomembranes will be placed in a temperature control vessel and the test chemical liquid will be added to the vessel to fully immerse the test coupons. The duration of the test may be short (less than 4 months) to demonstrate a lack or presence of chemical resistance or it may be over 4 months to demonstrate long-term chemical resistance.



Figure 2: Water Bath Test

Following exposure by immersion the geomembrane coupons will be tested for the retention of antioxidants, physical, mechanical and durability properties including puncture resistance, shear strength and elongation at break, tear resistance, seam shear elongation and stress crack resistance. The expected values for some of these parameters are presented in Table 2.

PROPERTY	FOR HDPE GEOMEMBRANES		FOR NON HDPE GEOMEMBRANES	
	Resistant	Not resistant	Resistant	Not resistant
Change in weight (%)	< 2	≥ 2	< 10	> 10
Change in volume (%)	< 1	≥ 1	< 10	> 10
Change in tensile strength (%)	< 20	≥ 20	< 20	> 20
Change in elongation at break (%)	< 30	≥ 30	< 30	> 30
Change in modulus (%)	< 30	≥ 30	< 30	> 30
Change in hardness (points)	Not applicable	Not applicable	< 10	> 10
Change in tear strength (%)	< 20	≥ 20	Not applicable	Not applicable
Change in puncture strength (%)	< 30	≥ 30	Not applicable	Not applicable

Table 2: Adapted from Scheirs (2009)⁷

At Solmax our geomembranes are manufactured using a three layer co-extrusion process, as such we have the unique advantage of being able to customize our products' surface finishes to suit our clients' material performance needs. For instance, the top layer of our geomembranes can be packaged with specially formulated additives and stabilizers such as acid or alkaline resistant stabilizers to achieve increased chemical resistance in potentially harsh chemical environments.

By taking advantage of this mine constructions will utilize geomembranes that are safer and more cost-effective. In addition, our clients will have an understanding of the expected design life and performance of their selected liner materials.



REFERENCES

- ¹ Hydrocarbons may cause swelling and softening when absorbed into geomembranes
- ² Additive packages in geomembranes may be adversely affected by acids
- ³ Antioxidants may be depleted by alkalis
- ⁴ Oxidation is a key degradation mechanism for polyethylene geomembranes
- ⁵ Fourie, A. B., Bouazza, A., Lupo, J., & Abrao, P. (2010). Improving the Performance of Mining Infrastructure through the Judicious Use of Geosynthetics. 9th International Conference on Geosynthetics, Brazil (pp. 193-219).
- ⁶ Scheirs, J (2009). A guide to polymeric geomembranes – A practical approach
- ⁷ Scheirs, J (2009). A guide to polymeric geomembranes – A practical approach. pp. 326 - 327

HIGH PRESSURE PUNCTURE PERFORMANCE TESTING FOR COST REDUCTION IN MINING

RATIONALE FOR TESTING

The applied loads from overlying materials on basal liners in mining applications may exceed those found in civil engineering applications such as landfills by some orders of magnitude (Lupo, 2008¹; Fourie et al., 2010²) (Figure 3). The puncture resistance and performance of any geomembrane liner under high loads needs to be tested before deploying on site.

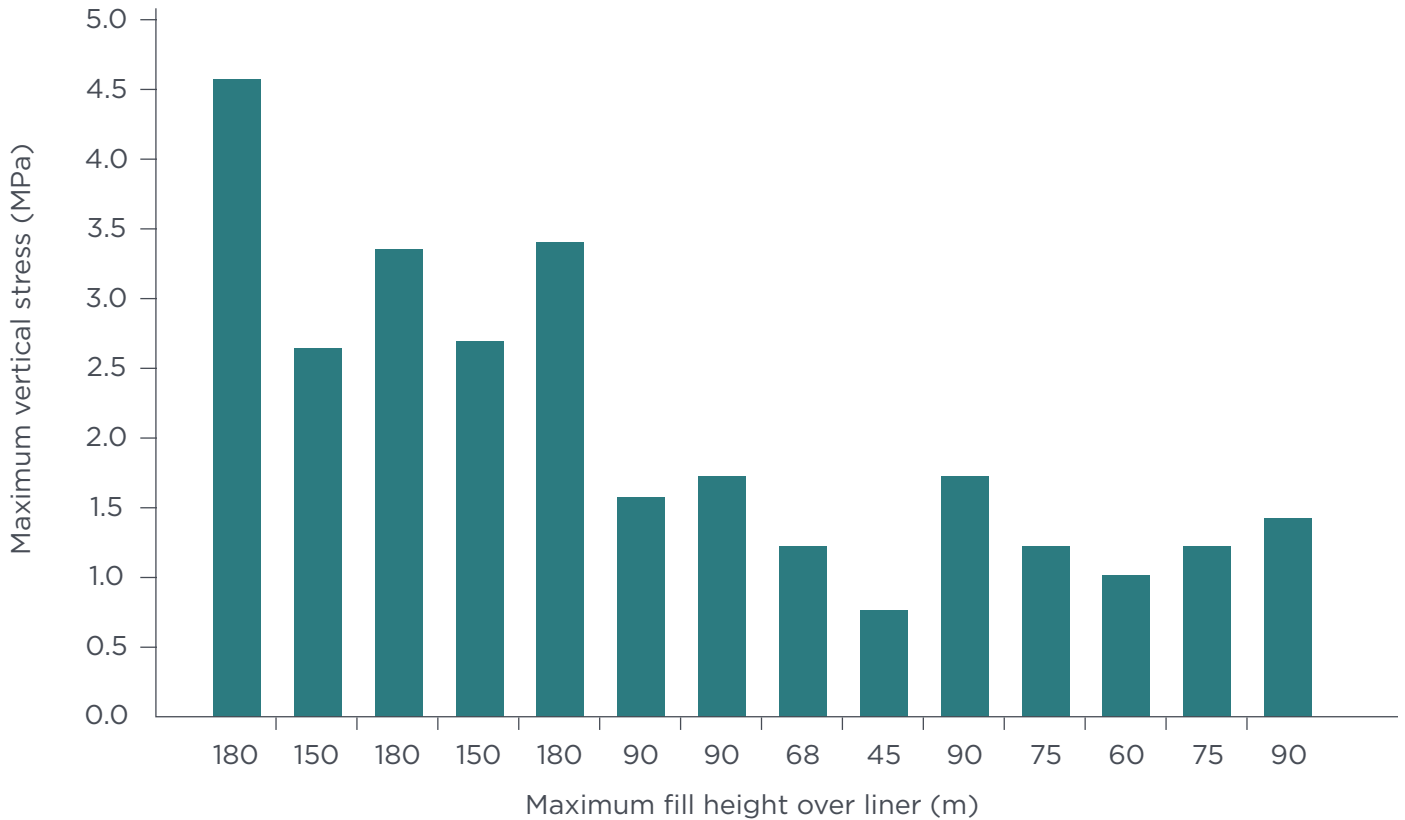


Figure 3: Typical high loads on geomembrane liners in mining applications (After Fourie et al., 2010)



Figure 4: A bottom lined structure

Physical damages such as puncture or excessive localized and differential straining may be induced in geomembrane liners due to non-conformance with the overliner or underliner as applied loads are transferred to the bottom of the structure. These damages are avenues for leaks. Intact geomembrane liners provide excellent containment; however leaks compromise containment.

There are charts in the literature for liner material selection with respect to the applied loads for puncture resistance considerations e.g. Table 3 below adapted from Lupo (2008) and Fourie et al. (2010), however it is recommended to use these charts only as an initial guide in the material selection process to narrow down options. Following the narrowing down of potential liner candidates, performance testing for puncture resistance should be completed to select the appropriate materials for the expected service life and site conditions.

			APPLIED NORMAL STRESS ON THE GEOMEMBRANE FROM OVERLYING MATERIALS AND OTHER EXTERNAL SOURCES (MPa)					
			< 0.5		0.5 to 1.2		> 1.2	
Foundation conditions/ compaction	Overliner aggregate	Underliner aggregate	Geomembrane type	Thickness	Geomembrane type	Thickness	Geomembrane type	Thickness
Firm or high stiffness	Coarse grained	Coarse grained	LLDPE or HDPE	2 mm (80 mils)	LLDPE or HDPE	2 mm (80 mils)	LLDPE or HDPE	2.5 mm (100 mils)
		Fine grained	LLDPE or HDPE	1.5 mm (60 mils)	LLDPE or HDPE	2 mm (80 mils)	LLDPE or HDPE	2.5 mm (100 mils)
	Fine grained	Coarse grained	LLDPE or HDPE	1.5 mm (60 mils)	LLDPE or HDPE	1.5 mm (60 mils)	LLDPE or HDPE	2.0 mm (80 mils)
		Fine grained	LLDPE or HDPE	1 mm (40 mils)	LLDPE or HDPE	1.5 mm (60 mils)	LLDPE or HDPE	2.0 mm (80 mils)
Soft or low stiffness	Coarse grained	Coarse grained	LLDPE	2 mm (80 mils)	LLDPE	2 mm (80 mils)	LLDPE	2.5 mm (100 mils)
		Fine grained	LLDPE	1.5 mm (60 mils)	LLDPE	2 mm (80 mils)	LLDPE	2.5 mm (100 mils)
	Fine grained	Coarse grained	LLDPE	2 mm (80 mils)	LLDPE	2 mm (80 mils)	LLDPE	2.5 mm (100 mils)
		Fine grained	LLDPE	1.5 mm (60 mils)	LLDPE	2 mm (80 mils)	LLDPE	2.5 mm (100 mils)

Table 3: Geomembrane liner design matrix (After Lupo, 2008 and Fourie et al. (2010))

PERFORMANCE TESTING FOR PUNCTURE RESISTANCE

The puncture resistance test that is performed as per ASTM D4833/D4833M - 07 -“Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products” is an index test and although this test provides an insight into the puncture behaviour of geomembranes, it does not capture the site specific conditions and materials at play in critical mining applications. The test is therefore not sufficient for ascertaining the puncture resistance of geomembranes for design purposes and performance puncture testing using site materials and simulating site loading is required to achieve these.

The procedures for specialized performance puncture resistance testing include ASTM D 5514 - 94 - “Standard Test Method for Large Scale Hydrostatic Puncture Testing of Geosynthetics - Method B” and the Cylinder Test. Both methods are based on the same principle of applying vertical load to a liner system using the design specifications that will be used in the construction process on site (Figure 5).

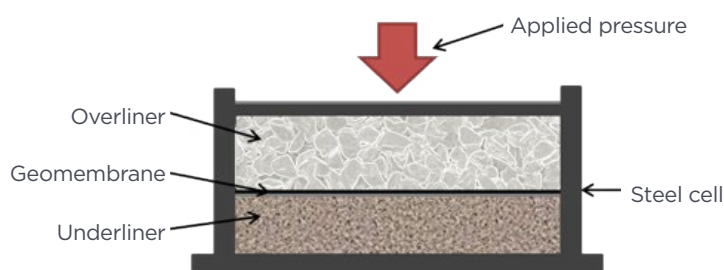


Figure 5: A typical setup for Large Scale Puncture Testing of Geomembrane Liner Systems

The tests are performed in large sized cylindrical or rectangular cells capable of sustaining high applied loads - for instance Brachman et al (2011) used a 590 mm by 500 mm cylindrical steel cell in a Cylinder Test.

No shear stresses are induced during the testing and the load may be applied for up to 1000 hours. Following loading, punctures and deformations are assessed quantitatively using a grid system and by visually inspecting the recovery of deformed areas after several hours. A vacuum pressure (70 mmHg) is also applied to detect leaks in the deformed areas (Fourie et al., 2010)

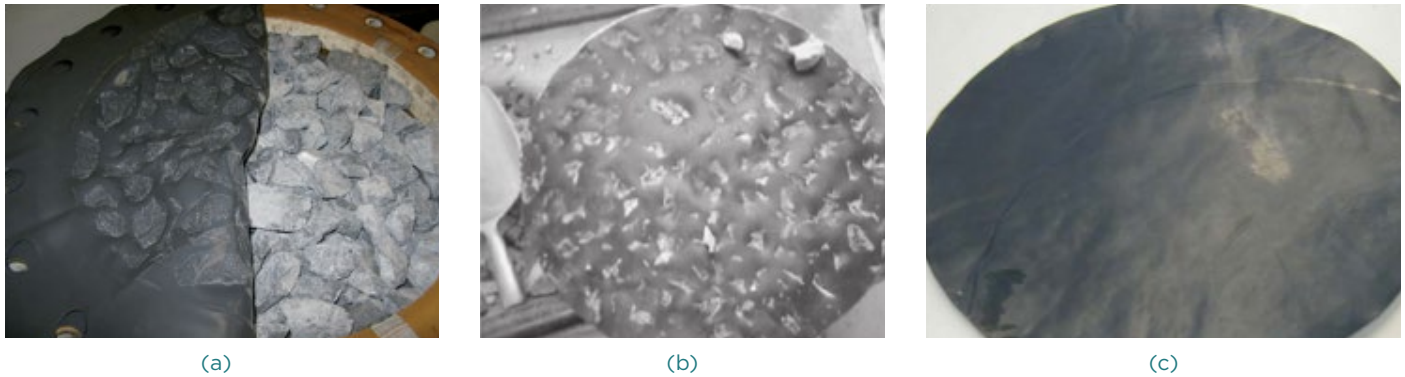


Figure 6: (a) An overliner aggregate on a geomembrane for puncture testing (b) Sample geomembrane surface after high loading showing significant deformations (Source: Lupo, 2008) (c) Sample geomembrane surface after high loading showing minimal deformation

The grid system involves laying out a grid over the specimen before loading and marking areas within the grid where measurements will be taken for evaluation. Baseline measurements are taken from the marked locations from the top of the grid to the top of the geomembrane specimen and after unloading similar measurements are taken at these locations.

After 24 hours of recovery, the specimen is also visually inspected for plastic deformation and puncture. Deformation in the geomembrane is calculated as follows:

$$\text{Deformation (\%)} = \left(\frac{A}{B} \right) \times 100$$

Where:

A = change in depth in millimeters (mm), and

B = original depth in millimeters (mm)

At Solmax, we manufacture HDPE and LLDPE geomembranes with thickness ranging from 0.5 mm (20 mils) to 3 mm (120 mils). As part of our CRP, we are able to complete the high pressure puncture resistance testing at no additional cost to our clients to support them through the process of selecting the optimum material thickness for their mine site and project applications.

REFERENCES

¹ Lupo, J. F. (2008). Liner system design for tailings impoundments and heap leach designs. *Tailings and Mine Waste 2008* (pp. 177 - 186). Taylor & Francis Group, London.
² Fourie, A. B., Bouazza, A., Lupo, J., & Abrao, P. (2010). Improving the Performance of Mining Infrastructure through the Judicious Use of Geosynthetics. *9th International Conference on Geosynthetics*, (pp. 193-219). Brazil.
³ Brachman, R. W., Rowe, K. R., Irfan, H., & Gudina, S. (2011). High Pressure Puncture Testing of HDPE Geomembranes. *Pan-Am CGS Geotechnical Conference*.

SOLMAX INTERFACE FRICTION PERFORMANCE TESTING FOR COST REDUCTION IN MINING

RATIONALE FOR TESTING

For side slope lining systems in mine sites, it is important that the geomembrane liners deployed do not induce, contribute to or make worse potential sliding of materials down these slopes (Figure 7).

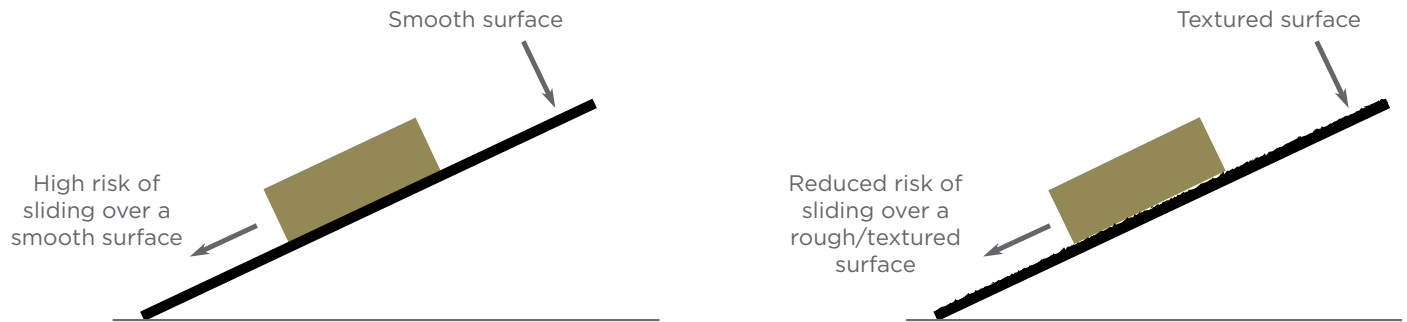


Figure 7: Schematic representation of a block of material over smooth and textured surfaces

Sliding of geomembrane liners over underlying materials may be curtailed sufficiently with effective anchoring but sliding of overlying materials on geomembranes may occur if there is not enough frictional resistance between the geomembrane and these materials. As such, texturing the surface of the geomembrane may reduce the risk of sliding along the geomembrane – overlying materials interface significantly (Figure 7).

The need for increased texturing on geomembrane surfaces may appear to be pushing the geomembrane out of its primary function of containment and into reinforcement. However the intent is to ensure that the geomembrane surface does not create a potential slip surface for sliding of materials in slope lining applications. Blond and Elie (2006) reported that the asperity height from texturing (Figure 8b) is related to the interface shear strength (Figure 8c), they also reported that the optimum asperity height for maximum interface shear strength is 0.5 mm (20 mils) and beyond this no considerable increase in interface shear strength may be achieved (Figure 8c) it is therefore prudent to determine the asperity height within these limits that will be adequate for an application.



Figure 8: (a) Geomembrane texturing with the blown film co-extrusion method (After Blond and Elie, 2006) (b) Asperity height variations (c) Asperity height vs peak interface shear stress

COST CONSIDERATIONS

As the angle of a slope increases, there may be a need to increase the surface roughness, texturing and asperity height on the geomembrane to achieve maximum interface friction against sliding. As presented in Figure 9, the material cost of textured geomembranes typically increases with the asperity height and so for a cost effective design it is necessary to know what material is needed and not pay more for a material with higher asperity than needed.

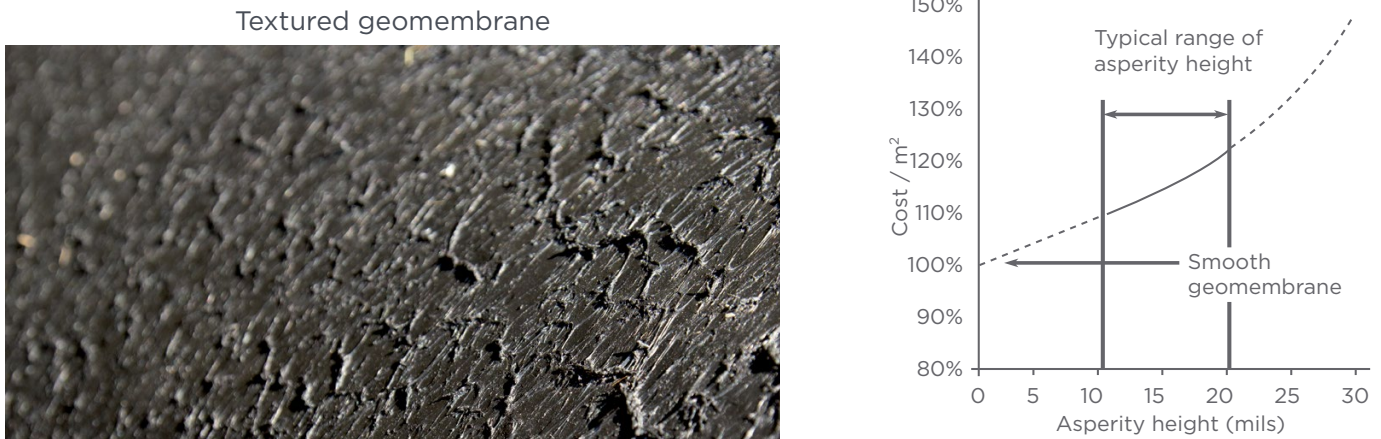


Figure 9: Impact of asperity height on manufacturing cost (After Blond and Elie, 2006)

EVALUATING FACTOR OF SAFETY AGAINST SLIDING²

In evaluating the Factor of Safety (FoS) against sliding i.e. the ratio of resisting forces to driving forces along the geomembrane - adjacent materials interface, the key parameters to consider are:

- the interface friction angle δ (and in some cases the adhesion C_a) resisting sliding between the geomembrane and overlying materials
- the weight of the material overlying the liner
- the slope angle β inducing sliding

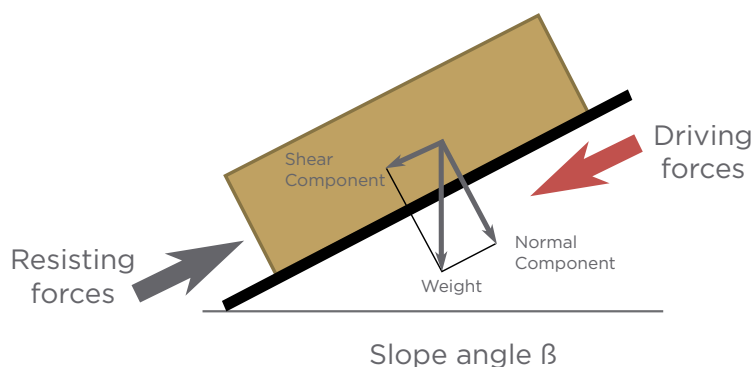


Figure 10: Components of a slope

REFERENCES

- ¹ Eric Blond and Guy Elie, Interface Shear-Strength Properties of Textured Polyethylene Geomembranes 59th CGS Conference, Vancouver October 3 2006
- ² Assuming a slope that is infinite in length with uniform thickness

The FoS against interface sliding is given as³

$$FoS \text{ against sliding} = \frac{\text{Resisting forces}}{\text{Driving forces}}$$

$$FoS = \frac{\tan \delta}{\tan \beta}$$

Where,

δ = the interface friction angle between the geomembrane and overlying block of material

β = the slope angle

Sample design curves for various FoS values relating to the slope angle δ and interface friction angle β for a soil cover overlying a geomembrane are presented in Figure 11.

These design curves were developed for the site conditions specified in the legend. Other site conditions such as the effects of destabilizing forces that can reduce FoS e.g. seepage forces in the cover material, seismic activities or down drag from equipment moving down the slope were not considered and will have to be assessed from site specific testing and evaluation.

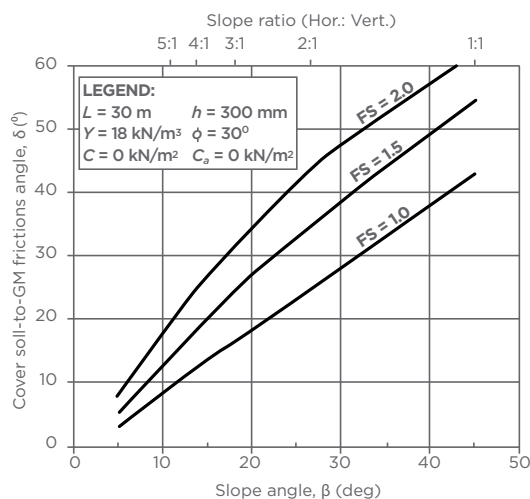


Figure 11: Sample design curves for the stability of a uniformly thick frictional (cohesionless) cover soil over a geomembrane (GM) – (Source: Qian et al., 2002, Koerner, 2005)

Interface shear testing using site specific materials and expected field conditions as described in this note is required to accurately determine the geomembrane surface that will achieve the desired FoS and shear strength parameters that are required for design and construction. At Solmax, we manufacture HDPE and LLDPE geomembranes with smooth, standard textured (T), rough textured (RT) and extra rough textured (XRT) surface finishes. The difference between these surface finishes is the asperity height from texturing. The asperity height and surface roughness of our geomembranes can be customized to meet individual client`s design needs and project applications.

The cost of conducting specialized interface shear testing to determine which of these geomembranes to use in an application could be relatively high. As part of our CRP this testing will be performed in house at no cost to our clients using our state-of-the-art direct shear testing equipment. This will support our clients in selecting the geomembrane liner with the appropriate surface texture and asperity height that may be required to achieve a desired interface shear performance in the construction of various slope angles in mining applications.

REFERENCES

³ Koerner (2005): Designing with Geosynthetics 6th Edition Vol 2, pp. 585

³ Source: Qian et al., (2002) – Geotechnical Aspects of Landfill Design and Construction, pp 489; Koerner (2005) - Designing with Geosynthetics 6th Edition Vol 2, pp. 591

LARGE SCALE INTERFACE SHEAR TESTING OF GEOMEMBRANES

The testing is performed using the materials from the site, candidate geomembrane liners for the site and expected loading conditions. The test is performed in a direct shear box (Figure 12a) as per ASTM D5321 – “Standard Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear”. A large sized direct shear box typically 300 mm by 300 mm having an upper and lower section is used. The materials are arranged in the shear box (e.g. Figure 12b) as they would be laid out in the field.

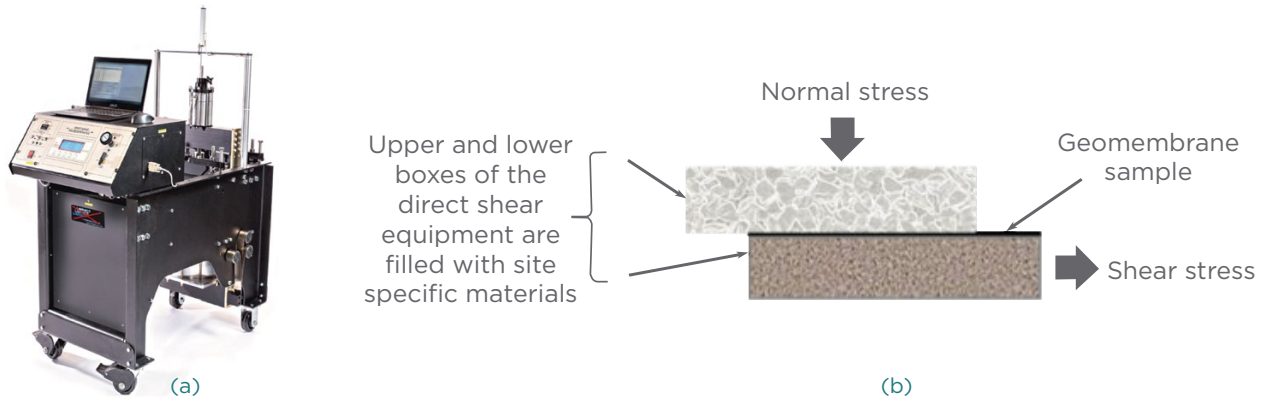


Figure 12: (a) Solmax 12 inch/305 mm direct shear box; (b) a schematic of the setup for interface shear testing of geomembranes

Normal stresses representative of the design stresses are applied to the setup and shear forces are applied at a controlled strain rate so that one section of the shear box moves at a predetermined rate relative to the other section (Figure 12b). The test is performed at three applied normal loads typically consisting of a load that is lower than the expected site load, the expected site load and a load that is higher than the expected site load. For instance, if the expected site load from overlying materials on the geomembrane is 100 kPa, the test may be performed at 50 kPa, 100 kPa and 150 kPa.

From the measurements of shear forces and displacements, peak shear strength and residual shear strength values (Figure 13a) are determined and these values are plotted against the applied normal loads. A linear plot is generated to define the shear properties at the applied loads (Figure 13b) and the parameters (δ) (and C_a) are determined from the equation of the straight line plot.

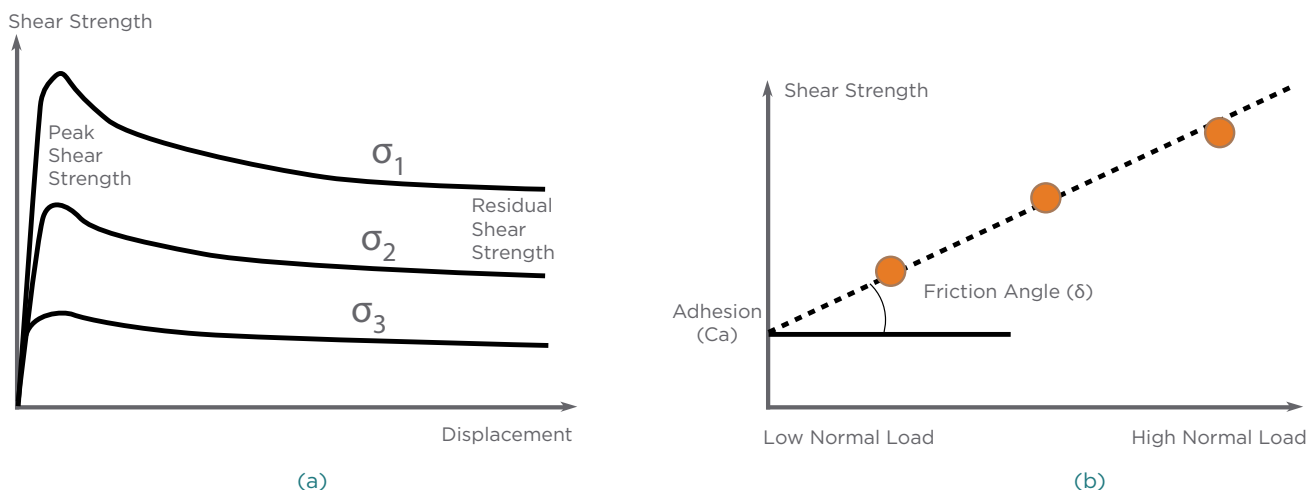


Figure 13: Interface shear strength parameters (After Blond and Elie, 2006)

By taking advantage of Solmax’s CRP for the completion of this specialized interface shear resistance test, clients will not only be able to select the appropriate geomembrane liner for their mine site, they will also be able to achieve a safe and cost effective design with an increased confidence level in the parameters used in the design since the actual site conditions would have been simulated during testing.

THE KARMA GOLD MINE

BURKINA FASO, WEST AFRICA

OVERVIEW

Solmax cost reduction program (CRP) is designed to minimize project costs by utilizing top quality resins to produce optimal products that meet project specific needs. In the CRP, performance testing of geomembranes is tailored to project specific needs by simulating expected field loading conditions and utilizing materials from the site. Following the tests, the most cost effective geomembrane solution for maximum performance in an application is selected from potential alternatives.

The case study described here showcases the successful application of the Solmax CRP to a heap leach gold mining project in West Africa. Solmax's containment solutions that were supplied for the project consisted of:

- Solmax HDPE Series, Single Textured, Black
- Solmax HDPE Series, Smooth, White Reflective

These products were supplied in 2014 to cover over 742,000m² (7,987,800 ft²). By taking advantage of the Solmax CRP, approximately 33 % reduction in project costs was achieved and product performance was not compromised.

BACKGROUND

The Karma property consists of five closely spaced and well defined gold deposits that are located in Burkina Faso, West Africa. The deposits are mined using conventional open pit mining methods and equipment and ore recovery is by heap leaching.

CHALLENGE: COST EFFECTIVE DESIGN OF THE HEAP LEACH PAD

In the design of the heap leach pad an impermeable base was required in large part to reduce the risks of environmental contamination from leaching solutions and chemicals and to maximize recovery. The design specification required that a composite liner be placed on a compacted sub base to form an impermeable base.

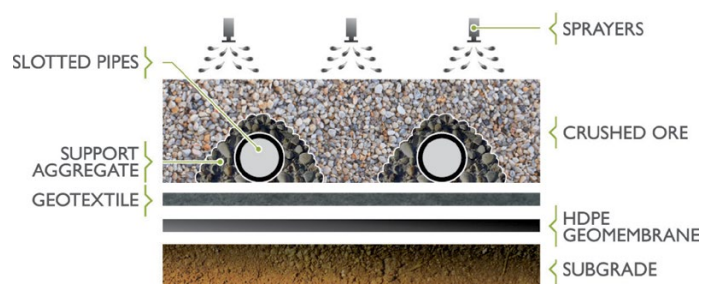


Figure 1: Representation of the heap leach pad design

The composite liner that was initially specified in the design consisted of a 1.5 mm (60 mils) thick HDPE geomembrane placed on top of a 600 mm (23.5 inches) layer of the in-situ ferricrete material compacted to 95% Mod AASHTO. A common goal in projects is to maximize benefits while keeping costs low. It was therefore expedient to evaluate areas within the design where this could be achieved. For this, the need for a 1.5 mm (60 mils) HDPE in the heap leach pad base was re-evaluated using Solmax's CRP.

SOLUTION: SOLMAX CRP HIGH PRESSURE PUNCTURE TESTING

As part of Solmax CRP, high pressure hydrostatic tests were performed on specimens from a 1.5 mm (60 mils) and a 1.0 mm (40 mils) HDPE geomembrane. The tests were performed following ASTM D5514-12 “Standard Test Method for Large Scale Hydrostatic Puncture Testing of Geosynthetics”. A maximum pressure of 1000 kPa was applied to individual specimens from both materials and each test lasted 100 hours. The soil sample used for the tests was supplied from the site to simulate expected service conditions as closely as possible

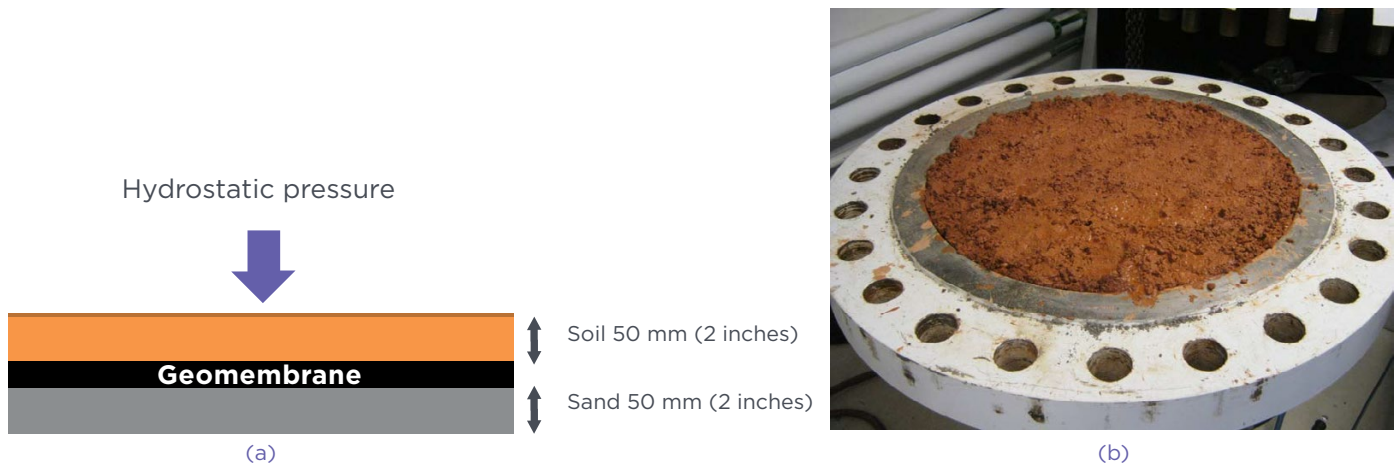


Figure 2: (a) The test configuration from top to bottom (b) soil from the site on top of geomembrane in the test cell





OUTCOME: SIGNIFICANT COST SAVINGS AND OPTIMAL PRODUCT

Upon completion of the High Pressure Puncture Testing tests, the expected field performance of the geomembrane materials was evaluated by assessing plastic deformation in the test specimens after 24 hours of recovery. Specimens from both HDPE geomembranes showed no signs of plastic deformation after the recovery period.

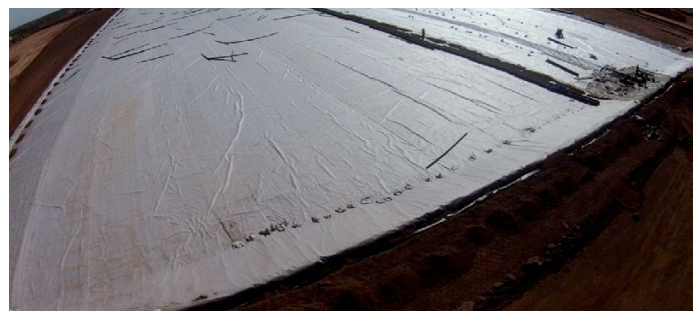
Since both materials showed comparable performance for the application based on the tests results, it was evident that the higher thickness of the geomembrane did not offer a superior performance in this instance and as such the 1.0 mm (40 mils) HDPE Series would be a cost effective alternative for the application. Thus, because of the CRP, the thickness of HDPE geomembrane specified for the base of the heap leach pad was reduced from 1.5 mm (60 mils) to 1.0 mm (40 mils) mils and cost savings of approximately 33 % was achieved.

CONCLUDING NOTES

Every application and site is unique; Solmax's CRP is a great way to sift through potential alternatives to determine the best geomembrane solution for an application with regards to cost and performance. Results from the implementation of Solmax's CRP in a project should not be used generically for similar applications since site conditions can vary widely. Every application should be evaluated on a case by case basis using the expected field loading conditions and site specific materials.

In addition to the CRP solution, Solmax's White Reflective geomembranes were used in applications that will be exposed or have parts exposed for extended periods such as the storm water, raw water and detox ponds. The geomembranes were chosen for their beneficial material properties in these applications. The White Reflective Prime Finish surface of the geomembranes reflects UV light, and prevents excessive temperature rise in the geomembrane, thus enhancing the durability of the geomembranes significantly. Overall, the utilization of Solmax's suite of containment solutions in this project highlights a continued commitment to providing a holistic containment solution package to projects.

- Location: Burkina Faso, Africa
- Material: Solmax HDPE Series
 - Colour: Black
 - Finish: Smooth/Single Textured
 - Prime Finish: White Reflective
 - Thickness: 1.0/1.5 mm | 40/60 mils
- Surface Area: 742,000 m² | 7,987,800 sqft



OUR LOCATIONS



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