Geotechnical Laboratory Testing Related to AquaBlok®

TEST REPORT # 11
SHEAR STRENGTH LABORATORY TESTING RESULTS OF AQUABLOK® 2080 FW AND 3070 FW (NO. 8 AGGREGATE)

Background and Purpose of Testing

The low conductivity and chemical attenuation capabilities, discussed in previous test reports, demonstrate AquaBlok as a practical alternative for *in-situ* contaminated sediment sequestration. However, to achieve optimal results an *in-situ* capping project should be treated as an engineering project with carefully considered design, construction, and monitoring (Palermo, 1998). Thus, in addition to the above-mentioned qualities there must be a good understanding of the geotechnical properties of various formulations of AquaBlok. Summarized in this test report are results of geotechnical laboratory testing performed on AquaBlok 2080 FW (i.e., 20:80 percent clay to aggregate by dry weight) and 3070 FW – AquaBlok design mixes that are typically used for capping applications. The results can be used to verify the stability of this AquaBlok formulation for specific applications. The samples were prepared using aggregate nominally equivalent in size gradation to AASHTO No. 8 aggregate, which is considered representative of material to be used during cap construction.

Methods

The tests were carried out as close as possible to the procedures outlined in their respective American Society for Testing and Materials (ASTM) standard. Deviations were necessary in some instances due to the uniqueness of the AquaBlok material. The tests were carried out under close supervision of an engineer and followed practical engineering theories and applications. All laboratory tests were performed on samples hydrated with de-aired tap water.

Results

Consolidated Undrained (CU) Triaxial Test (ASTM D4767, AASHTO T297)

CU triaxial tests (two points each set) with pore-water pressure measurements were performed. The samples were considered completely hydrated and were sheared at a lateral pressure of approximately 1 and 2 tons per square feet (tsf). The results from the CU triaxial tests provided an effective internal friction angle of approximately 25.8 degrees and a cohesion of 140 pounds per square feet (psf) for the 2080 FW formulation and 5.5 degrees with a cohesion of 280 psf for the 3070 FW formulation (See test results below).

CU Triaxial Test Results

	Total	Effective
2080 FW		
Cohesion (psf)	180	140
Ø (degrees)	11.7	25.8
3070 FW		
Cohesion (psf)	200	280
Ø (degrees)	4.4	5.5

Unconsolidated Undrained (UU) Triaxial Test (ASTM D4767, Saturated)

UU triaxial tests (two points each set) were performed on the same material as the CU triaxial tests. Each of the samples was considered completely hydrated and was sheared at lateral pressures of approximately 0.3 and 0.5 tsf. The results from the UU triaxial tests demonstrate a cohesion of 520 psf with an internal friction angle of zero degrees for the 2080 FW formulation and 300 psf with an internal friction angle of zero degrees for the 3070 FW formulation (See test results below).

UU Triaxial Test Results

	2080 FW	3070 FW
Cohesion (psf)	520	300
Ø (degrees)	0.0	0.2

Unconfined Compression (UC) Test (ASTM D2166)

One UC test was performed on a completely hydrated sample of each formulation using the same material as the triaxial tests. The result from the UC test indicated an apparent undrained shear strength of 220 psf for the 2080 FW formulation and 360 psf for the 3070 FW formulation (See test results below). Theoretically, these results should be equivalent to their respective shear strengths determined in the UU triaxial tests. Since UC tests are commonly performed on fine-grained homogenous materials and AquaBlok is a mixture of fine grained material and aggregate, it is suggested that results from the UU triaxial test may provide a more reliable undrained shear strength value and should be used for most preliminary stability analyses when using AquaBlok product as capping material.

Observations and Conclusions

The results from the triaxial tests corroborate that a leaner mixture formulation (i.e., smaller percent clay to aggregate by dry weight ratio) provides higher shear strengths. Furthermore, the triaxial test results tend to suggest that the shear strength of the 3070 FW formulation is similar to the characteristics of pure bentonite soil (probably due to the relatively larger percentage of the bentonite component).

This test report should not replace a detailed laboratory testing program or stability calculations, but can be used for most preliminary stability analyses. It is recommended that a detailed engineering design be performed to verify mix designs using site specific parameters. This should also include additional shear strength testing of AquaBlok considered representative of the material that will be used on the project.

AquaBlok® Composite Particle System

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Test reports also available on the website.

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