

Technical Note

***FREEZE–THAW TESTING OF
HYDROTURF® ADVANCED REVETMENT TECHNOLOGY***

HydroTurf® is well suited for use in regions that experience below-freezing temperatures. Extensive independent, third party testing has been performed on HydroTurf Revetment Technology (HydroTurf), including freeze-thaw cycle testing. A description of freeze-thaw testing procedures and test results are provided in this document. Additional testing and evaluations performed on HydroTurf include hydraulic jump, steady state and wave overtopping hydraulic performance and multiple non-hydraulic tests. Those testing descriptions and results are available in separate documents. Please contact Watershed Geosynthetics for additional information.

FREEZE-THAW

When installed in areas experiencing below-freezing temperatures, HydroTurf can be installed using HydroBinder® infill enhanced with a Penetrating Colloidal Concrete Treatment (PCCT). HydroTurf with HydroBinder infill and PCCT has been tested for freeze-thaw performance in accordance with ASTM C 666, *Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing*. Performance was measured by percentage weight loss of HydroBinder infill and visual inspection for cracking and scaling at specified intervals.

HydroTurf freeze-thaw testing was conducted by Testing, Engineering and Consulting Services, Inc. (TEC Services) which is an AASHTO R18, ANS/ISO/IEC 17025:2005 and Army Corps of Engineers accredited laboratory. Testing in accordance with ASTM C 666 utilized completely submerged HydroTurf samples measuring 48 square inches. Temperature alternated between 40 and 0° Fahrenheit approximately every five hours for 100, 200 and 300 cycles. Performance was measured upon completion of 100, 200 and 300 cycles by loss of HydroBinder infill and visual inspection for cracking and scaling. Average HydroBinder infill loss values are presented in Table 1. Pre-test and post-test photos are presented in Figure 1 and Figure 2, respectively.

Table 1. HydroTurf® Freeze-Thaw Testing, ASTM C 666

	<u>Number of Freeze Thaw Cycles</u>		
	100	200	300
HydroBinder w/ PCCT % Loss	0.2	2.0	2.7

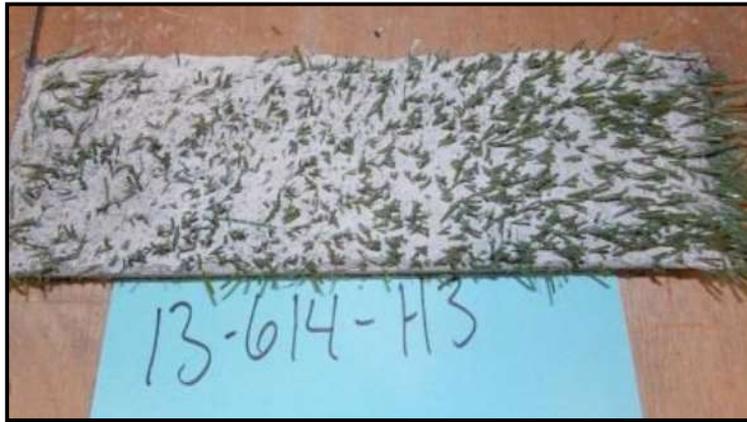


Figure 1. HydroTurf® Pre-test Freeze-thaw Sample

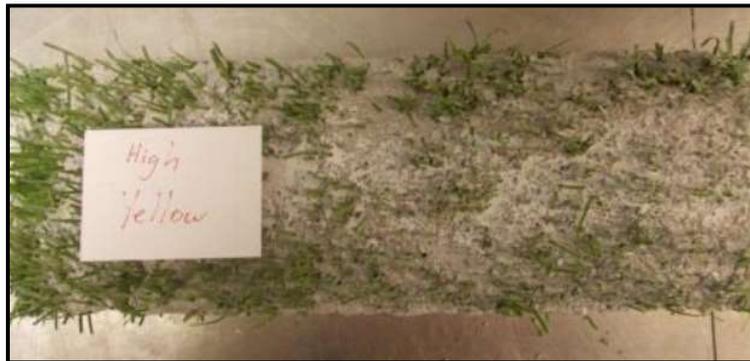


Figure 2. HydroTurf® Post-test Freeze-thaw Sample

HydroTurf® incorporating PCCT performed extremely well on a percentage loss basis and a visual inspection basis. After 300 cycles, samples had “a few small cracks and a little scaling”. An alternative freeze-thaw test is the test commonly used for Articulated Concrete Block revetment (ACB), ASTM C 1262, *Standard Test Method for Evaluating the Freeze-Thaw Durability of Dry-Cast Segmental Retaining Wall Units and Related Concrete Units*.

However, during ASTM C 1262 testing, “test specimens are not subjected to freezing-thawing cycles in a fully saturated state [so] the ASTM C 1262 procedure ... is believed to be less severe than ASTM C 666”.¹

Noteworthy differences in the two standard tests include:

- ASTM C 666 requires fully submerged samples while ASTM C 1262 requires only one side be submerged 3/8-inch, resulting in only a small portion of the block subjected to wet freezing and thawing;
- ASTM C 666 requires multiple cycles per day (minimum 24 cycles in 5 days); ASTM C 1262 may have one freeze-thaw cycle in the same 5 days; and
- ASTM C 666 requires 300 cycles; ASTM C 1262 has no minimum number of cycles.

As previously stated, ASTM C 1262 does not have a prescribed number of cycles. However, the Unified Facilities Guide Specifications for Department of Defense contractors requires 100 cycles of ASTM C 1262 for Articulating Concrete Block Revetments, with no more than 1.0% material loss at 100 cycles². HydroTurf[®] results after ASTM C 666 testing demonstrate HydroBinder[®] infill with PCCT lost 0.2% at 100 cycles in the more aggressive test. Based on these results, HydroTurf with HydroBinder infill and PCCT will resist freeze-thaw damage decidedly better than the typical ACB revetment system.

LIMITATIONS

HydroTurf[®] is a U.S. registered trademark which designates a product from Watershed Geosynthetics LLC. This product is the subject of issued U.S. and foreign patents and/or pending U.S. and foreign patent applications. All information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, this information should not be used or relied upon for any specific application without independent professional examination and verification of its accuracy, suitability and applicability. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Watershed Geosynthetics LLC as to the effects of such use or the results to be obtained, nor does Watershed Geosynthetics LLC assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein is to be construed as permission or as a recommendation to infringe any patent.

¹ Service d'Expertise en Matériaux, Inc. 2004. *Frost Durability of Roller-Compacted Concrete Pavements*, Research and Development Bulletin RD135, Portland Cement Association, Skokie, Illinois, USA, 2004, 148 pages.

² Unified Facilities Guide Specifications. 2008. Division 35 – Waterway and Marine Construction, Section 35 31 19.20 Articulating Concrete Block Revetments. Specification active July, 2018.