Architectural Testing

SURFACE PROPERTY TEST REPORT

Rendered to:

LIQUIDOMES, LLC

PRODUCT: Detectable Warning / ADA Non-Skid Coating

Report Number: A3758.01-106-31
Report Date: 11/08/10
Expiration Date: 10/04/14
Revision 2: 07/05/11

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Architectural Testing

SURFACE PROPERTY TEST REPORT

Rendered to:

LIQUIDOMES, LLC
101 North US HWY 1
Suite 214
Fort Pierce, Florida 34950

Report No:	A3758.01-106-31
Test Date:	08/30/10
Through:	10/04/10
Report Date:	11/08/10
Expiration Date:	10/04/14
Revision 2:	07/05/11

Product: Detectable Warning / ADA Non-Skid Coating

Project Summary: Architectural Testing, Inc. was contracted by Liquidomes, LLC to evaluate their detectable warning / non-skid coating. The properties tested, as well as the results obtained, are as documented in the following report.

Test Procedures: The detectable warning / non-skid coating was tested and evaluated in accordance with the following test methods and requirements that are found in the Florida Department of Transportation, Standard Specifications for Road and Bridge Construction - 2010, Section 527, Detectable Warnings on Walking Surfaces. All samples were prepared by Liquidomes, LLC and submitted directly to Architectural Testing. See test photographs for setup and failure details.

ASTM C 1028-07, *Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.*

ASTM C 501-84(2002), *Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.*

ASTM D 570-98(2005), *Standard Test Method for Water Absorption of Plastics.*

ASTM C 482-02, *Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement.*

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Test Results Summary: The following table contains the average results of those tests performed:

Property	FDOT Requirement	Result	Status
Slip Resistance	Dry Coefficient = 0.80 Wet Coefficient = 0.65	Dry = 0.96 Wet = 0.71	Meets Requirement
Wear Resistance	Wear Depth ≤0.030" after 1000 cycles	Average = 0.026" Maximum = 0.045"	Meets Requirement
Water Absorption	≤5 %	≤ 0.77 %	Meets Requirement
Bond Strength [1]	≥50 psi	908.9 psi	Meets Requirement
Light Reflectance Values (Y Value)	Safety Yellow = 25-45	43.177	Meets Requirement
	Brick Red = 5-15	11.273	Meets Requirement
	Black = 0-5	4.589	Meets Requirement

Test Procedures Summary: The slip resistance evaluation was performed using a Chatillon Push/Pull Force Gage (ATI ICN 004695) and a calibrated 50 pound weight (ATI ICN Y001080). Three 12" by 12" samples were tested in both dry and wet conditions. The materials were rotated in 90° increments to represent 0°, 90°, 180°, and 270° positions.

The wear resistance evaluation was performed utilizing a Taber Model 5130 Abraser (ATI ICN Y001522). Three 4" by 4" panels were tested. The height of each non-skid dome was measured before and after being subjected to 1000 cycles under a load of 1000 grams using H-22 Calibrase wheels.

The water absorption evaluations were performed using three nominal 2" by 2" samples of the non skid material. Seven different sets of conditions including room temperature, elevated temperature, boiling, and long term immersion were conducted.

The bond strength evaluation was performed using a SATEC Model 50UD universal test machine (ATI ICN Y002011). Five 6" by 6" by 2" thick concrete blocks having the non-skid surface and raised domes applied to them were tested. The samples were restrained on a long side to the base of the test equipment. A shear load parallel to the face of the sample was applied to the raised dome at a loading rate of 200 psi per minute until failure was observed.

[1] *Bond strength requirement is found in Ceramic Tile Institute of America, Field Report 69-5 (R-98) Section 3.4*

Test Procedures Summary: (Continued) The light reflectance specimens were evaluated in accordance with ASTM C 609-07, *Standard Test Method for Measurement of Light Reflectance Value and Small Color Differences Between Pieces of Ceramic Tile*. The detectable coatings were read on an X-rite Color i5 Spectrophotometer (ATI ICN 004725). The color equation used was CIE - L*a*b* (1976) with a 10° observer and the D65 (daylight) illuminant.

Test Results: The individual test results are contained in the following tables.

Calibration Data
Sled Assembly Weight (*W*) = 51.55 lbs
(3" Neolite Pad, Force Gage 004695)

Dry Calibration	
Pull #	**Value (lbs)**
1	42
2	43
3	41
4	41
Average (R_D)	41.75
X_D	**0.0501**

Wet Calibration	
Pull #	**Value (lbs)**
1	47
2	28
3	28
4	29
Average (R_W)	33.00
X_W	**-0.1302**

Calibration calculation (Dry) is: $X_D = 0.86 - \frac{R_D}{NW}$

Calibration calculation (Wet) is: $X_W = 0.51 - \frac{R_W}{NW}$

Where R is the total value of the pulls conducted, N equals the total number of pulls (i.e. 4) and W is the weight of the sled assembly (See Sections 7 and 9 in ASTM C 1028-07 for further detail).

The calculation for the Coefficient of Friction is: $F_D = \left(\frac{R_D}{NW}\right) + X_D$

Where R is the total value of the pulls conducted, N equals the total number of pulls (i.e. 12), W is the weight of the sled assembly and X is the calibration adjustment factor. (See Sections 8 and 10 in ASTM C 1028-07 for further detail).

Test Results: (Continued)

Coefficient of Friction - ASTM C 1028

Sample No. 1			
Surface Condition	**Sample Number**	**Pull Orientation**	**Value (lbs)**
Dry	**1**	0°	46
		90°	48
		180°	46
		270°	47
	2	0°	43
		90°	47
		180°	49
		270°	47
	3	0°	49
		90°	45
		180°	49
		270°	47
	Average (R_D)		47
	Coefficient of Friction (F_D)		**0.96**
Wet [1]	**1**	0°	43
		90°	44
		180°	44
		270°	45
	2	0°	41
		90°	44
		180°	44
		270°	41
	3	0°	43
		90°	43
		180°	42
		270°	43
	Average (R_W)		43
	Coefficient of Friction (F_W)		**0.71**

[1] *When interpreting wet test results, note that the surface profile and texture of the material make it difficult to saturate the surfaced to be tested. This is representative of end use conditions.*

Test Results: (Continued)

Wear Resistance - ASTM C 501

Sample No. 1	Pre-Cycling Thickness (in)	Post-Cycling Thickness (in)	Change (in)
a	0.364	0.337	0.027
b	0.367	0.338	0.029
c	0.349	0.335	0.014
d	0.331	0.304	0.027
		Average	**0.024**

Sample No. 2	Pre-Cycling Thickness (in)	Post-Cycling Thickness (in)	Change (in)
a	0.346	0.323	0.023
b	0.346	0.317	0.029
c	0.368	0.323	0.045
d	0.355	0.322	0.033
		Average	**0.033**

Sample No. 3	Pre-Cycling Thickness (in)	Post-Cycling Thickness (in)	Change (in)
a	0.343	0.318	0.025
b	0.337	0.316	0.021
c	0.355	0.339	0.016
d	0.343	0.318	0.025
		Average	**0.022**

Test Results: (Continued)

Water Absorption - ASTM D 570

Twenty-Four Hour Continuous Immersion

Sample No.	Pre-Immersion Weight (g)	Post-Immersion Weight (g)	Change (%)
1	16.0645	16.1081	**0.27**
2	15.5655	15.6077	**0.27**
3	16.0293	16.0595	**0.19**
			0.24

Two Hour Immersion

Sample No.	Pre-Immersion Weight (g)	Post-Immersion Weight (g)	Change (%)
1	15.5951	15.6116	0.11
2	15.2721	15.2877	0.10
3	15.9215	15.9440	0.14
		Average	**0.12**

Twenty-Two Hour Repeated Immersion (Post Two Hour Immersion)

Sample No.	Pre-Immersion Weight (g)	Post-Immersion Weight (g)	Change (%)
1	15.5951	15.6339	0.25
2	15.2721	15.3067	0.23
3	15.9215	15.9708	0.31
		Average	**0.26**

Long Term Immersion

Sample No.	Pre-Immersion Weight (g)	Post-Immersion Weight (g)	7 Day Change (%)
1	16.0645	16.1333	0.43
2	15.5655	15.6317	0.43
3	16.0293	16.0976	0.43
		Average	**0.43**

Long Term Immersion

Post-Immersion Weight (g)	2 Week Change (%)	Post-Immersion Weight (g)	3 Week Change (%)
16.1852	0.75	16.1862	0.76
15.6707	0.68	15.6859	0.77
16.1352	0.66	16.1552	0.79
Average	**0.70**	**Average**	**0.77**

Test Results: (Continued)

Water Absorption - ASTM D 570
(Continued)

Two Hour Boiling Water Immersion

Sample No.	Pre-Immersion Weight (g)	Post-Immersion Weight (g)	Change (%)
1	15.8814	15.9562	0.47
2	15.5145	15.5889	0.48
3	15.6017	15.6746	0.47
		Average	**0.47**

Thirty Minute Boiling Water Immersion

Sample No.	Pre-Immersion Weight (g)	Post-Immersion Weight (g)	Change (%)
1	15.7199	15.7501	0.19
2	15.8171	15.8500	0.21
3	15.7963	15.8261	0.19
		Average	**0.20**

Forty Eight Hours at 50ºC Water Immersion

Sample No.	Pre-Immersion Weight (g)	Post-Immersion Weight (g)	Change (%)
1	15.1388	15.2446	0.70
2	17.0736	17.2171	0.84
3	15.7080	15.8275	0.76
		Average	**0.77**

Bond Strength - ASTM C 482

Sample No.	Peak Load (lbf)	Raised Dome Surface Area (in^2)	Bond Strength (psi)
1	464.6	0.534	870.0
2	410.9	0.555	740.4
3	502.1	0.544	922.9
4	546.9	0.538	1016.5
5	470.4	0.473	994.5
		Average	**908.9**

Test Results: (Continued)

Light Reflectance Values - ASTM C 609

Sample Color	Y Value
Safety Yellow	43.177
Brick Red	11.273
Black	4.589

Data sheets, representative samples of test specimens, a copy of this report, or other pertinent project documentation will be retained by Architectural Testing, Inc. for a period of four years from the original test date. At the end of this retention period such materials shall be discarded without notice and the service life of this report by Architectural Testing will expire. Results obtained are tested values and were secured by using the designated tested methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to specimens tested. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC.:

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Joseph M. Brickner - Laboratory Supervisor
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Attachments (pages)
Appendix A - Photographs (6)

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	11/08/10	N/A	Original report issue
1	11/19/10	All	Addition of Light Reflectance Data
2	07/05/11	Page 1	Company moved, requested address change

APPENDIX A

Photographs

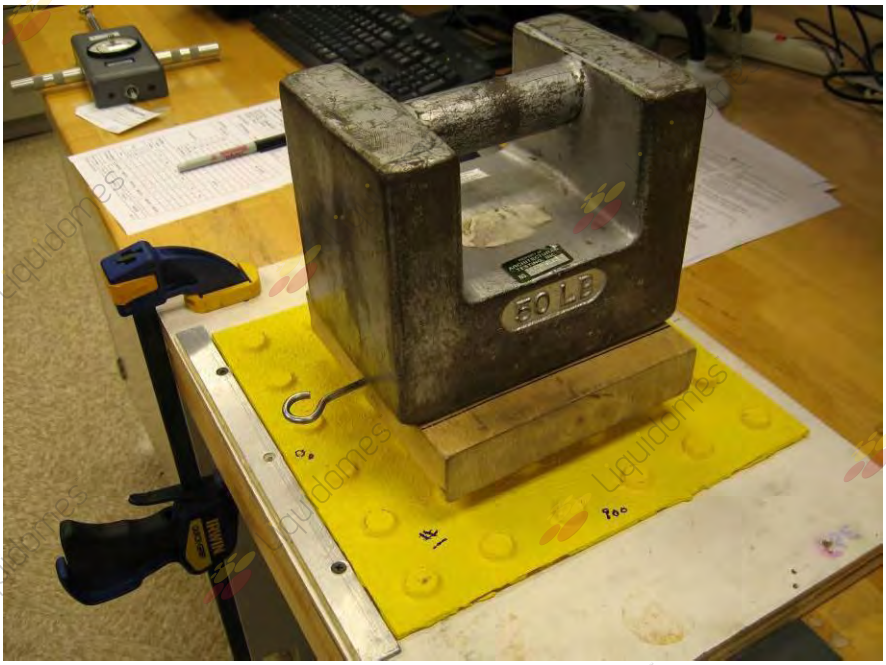

Photo No. 1
Slip Resistance Setup

Photo No. 2
Wear Resistance Setup

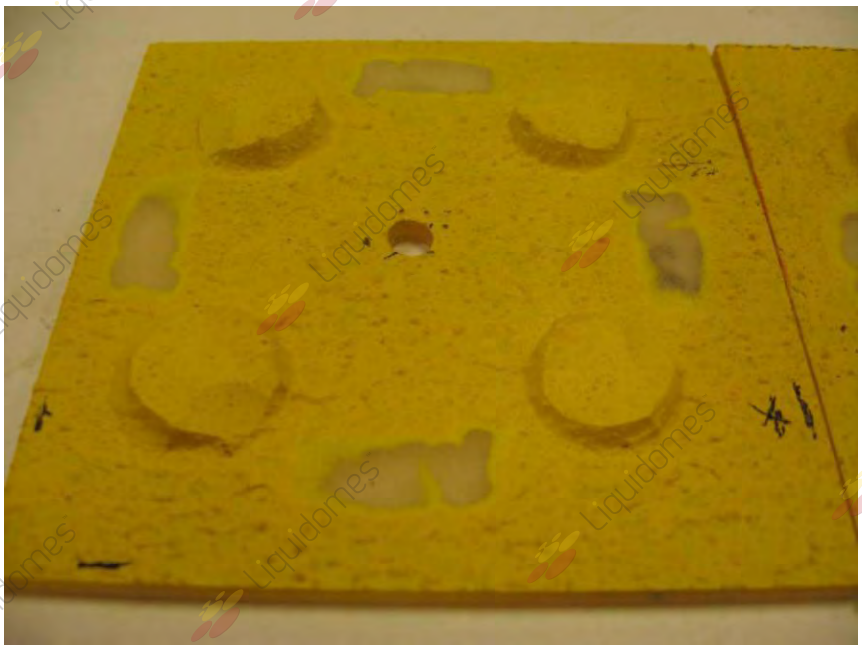

Photo No. 3
Wear Resistance Detail

Photo No. 4
Bond Strength Detail

Photo No. 5
Bond Strength Failure Detail

Photo No. 6
Color Details

Photo No. 7
Color Measurement Details