Architectural Testing

# SURFACE PROPERTY TEST REPORT

**Rendered to:**

**VANGUARD ADA SYSTEMS OF AMERICA**

**PRODUCT: Detectable Warning/ADA Non-Skid Coating**

| | |
|---|---|
| **Report Number:** | **62583.03-106-31** |
| **Report Date:** | **10/03/06** |
| **Expiration Date:** | **09/25/10** |
| **Revision 1:** | **09/26/07** |

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Architectural Testing

# SURFACE PROPERTY TEST REPORT

Rendered to:

VANGUARD ADA SYSTEMS OF AMERICA
20628 Broadway Avenue
Snohomish, Washington 98296

| | |
|---|---|
| Report No: | 62583.03-106-31 |
| Test Date: | 02/06/06 |
| Through: | 09/25/06 |
| Report Date: | 10/03/06 |
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| Revision 1: | 09/26/07 |

**Product**: Detectable Warning/ADA Non-Skid Coating

**Project Summary**: Architectural Testing, Inc. (ATI) was contracted by Vanguard ADA Systems of America 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 Procedure**: The detectable warning/non-skid coating was tested and evaluated in accordance with the following test methods and requirements found in document 527000.D01 as provided by Vanguard ADA Systems of America. All samples were prepared by Vanguard ADA Systems of America and submitted directly to Architectural Testing, Inc. See test photographs for setup and failure details.

ASTM F 1679-04e1, *Standard Test Method for Using a Variable Incidence Tribometer (VIT).*

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.*

ASTM G 155-05, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials.*

ASTM D1148-07a, *Standard Test Method for Rubber Deterioration-Discoloration from Ultraviolet (UV) and Heat Exposure of Light-Colored Surfaces.*

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

| Property | Requirement | Result | Status |
|---|---|---|---|
| **Slip Resistance** | Dry Coefficient ≥ 0.80<br>Wet Coefficient ≥ 0.65 | Dry = 0.81<br>Wet = 0.74 | Meets Requirement |
| **Wear Resistance** | Wear Depth ≤0.030" after 1000 cycles | Average = 0.012<br>Maximum = 0.028 | Meets Requirement |
| **Water Absorption** | ≤5% | ≤1.04% | Meets Requirement |
| **Bond Strength** [1] | ≥50 psi | 250 psi | Meets Requirement |
| **Xenon Arc Resistance/Color** | Maintain 70% Contrast (ASTM D 1148) | 99% Retention | Meets Requirement |

**Test Procedures Summary**: The slip resistance evaluation was performed using an English XL Tribometer (ATI ICN Y002874). Two 6" by 36" 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). Four 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 4" 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.

The fade resistance evaluation was performed by exposing the non-skid material panels to 2000 hours of natural daylight in a Xenon Arc Weatherometer (ATI ICN Y002572). Six 3" by 5" panels were measured as color standards and stored on a Gretag Macbeth Color i 5 Spectrophotometer (ATI ICN 004725). Color measurements were taken using a CIELab equation, D65 illuminant and a 10° observer. Contrast retention of the samples was calculated using only the change in L values, per ASTM D 1148.

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

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

## Slip Resistance - ASTM F 1679

**Dry**

| Direction | Test #1 | Test #2 | Test #3 | Test #4 | Test #5 | Average |
|---|---|---|---|---|---|---|
| **0º** | 0.70 | 0.80 | 0.85 | 0.80 | 0.90 | **0.81** |
| **90º** | 0.90 | 0.95 | 0.90 | 0.70 | 0.80 | **0.85** |
| **180º** | 0.85 | 0.85 | 1.00 | 0.95 | 1.00 | **0.93** |
| **270º** | 1.00 | 0.95 | 1.00 | 1.00 | 1.00 | **0.99** |
| **Overall Rating [2]** | | | | | | **0.81** |

**Wet**

| Direction | Test #1 | Test #2 | Test #3 | Test #4 | Test #5 | Average |
|---|---|---|---|---|---|---|
| **0º** | 0.70 | 0.75 | 0.65 | 0.75 | 0.85 | **0.74** |
| **90º** | 0.90 | 0.75 | 0.80 | 0.65 | 0.70 | **0.76** |
| **180º** | 0.75 | 0.80 | 0.80 | 0.80 | 0.80 | **0.79** |
| **270º** | 0.85 | 0.75 | 0.75 | 0.80 | 0.80 | **0.79** |
| **Overall Rating [2]** | | | | | | **0.74** |

[2] *Overall rating is the least of the four average test values.*

## Wear Resistance - ASTM C 501

| Sample #1 | Pre-Cycling Thickness (in) | Post-Cycling Thickness (in) | Change (in) |
|---|---|---|---|
| **a** | 0.215 | 0.197 | 0.018 |
| **b** | 0.401 | 0.391 | 0.010 |
| **c** | 0.228 | 0.200 | 0.028 |
| **d** | 0.383 | 0.373 | 0.010 |
| **Average** | **0.307** | **0.290** | **0.017** |

| Sample #2 | Pre-Cycling Thickness (in) | Post-Cycling Thickness (in) | Change (in) |
|---|---|---|---|
| **a** | 0.407 | 0.400 | 0.007 |
| **b** | 0.400 | 0.393 | 0.007 |
| **c** | 0.389 | 0.372 | 0.017 |
| **d** | 0.391 | 0.380 | 0.011 |
| **Average** | **0.397** | **0.386** | **0.011** |

**Test Results**: (Continued)

**Wear Resistance - ASTM C 501**
(Continued)

| Sample #3 | Pre-Cycling Thickness (in) | Post-Cycling Thickness (in) | Change |
|---|---|---|---|
| **a** | 0.383 | 0.375 | 0.008 |
| **b** | 0.404 | 0.396 | 0.008 |
| **c** | 0.377 | 0.371 | 0.006 |
| **d** | 0.380 | 0.371 | 0.009 |
| **Average** | **0.386** | **0.378** | **0.008** |

| Sample #4 | Pre-Cycling Thickness (in) | Post-Cycling Thickness (in) | Change |
|---|---|---|---|
| **a** | 0.375 | 0.371 | 0.004 |
| **b** | 0.406 | 0.396 | 0.010 |
| **c** | 0.408 | 0.392 | 0.016 |
| **d** | 0.382 | 0.362 | 0.020 |
| **Average** | **0.393** | **0.380** | **0.013** |

**Water Absorption - ASTM D 570**

**Twenty-Four Hour Continuous Immersion**

| Sample | Pre-Immersion Weight (g) | Post-Immersion Weight (g) | Change (%) |
|---|---|---|---|
| **1** | 18.556 | 18.590 | 0.18 |
| **2** | 19.484 | 19.510 | 0.13 |
| **3** | 17.434 | 17.454 | 0.11 |
| **Average** | **18.491** | **18.518** | **0.14** |

**Two Hour Immersion**

| Sample | Pre-Immersion Weight (g) | Post-Immersion Weight (g) | Change (%) |
|---|---|---|---|
| **1** | 16.841 | 16.850 | 0.05 |
| **2** | 19.095 | 19.109 | 0.07 |
| **3** | 17.946 | 17.957 | 0.06 |
| **Average** | **17.961** | **17.972** | **0.06** |

**Test Results**: (Continued)

**Water Absorption - ASTM D 570**
(Continued)

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

| Sample | Pre-Immersion Weight (g) | Post-Immersion Weight (g) | Change (%) |
|---|---|---|---|
| **1** | 16.841 | 16.858 | 0.10 |
| **2** | 19.095 | 19.113 | 0.09 |
| **3** | 17.946 | 17.964 | 0.10 |
| **Average** | **17.961** | **17.978** | **0.10** |

**Long Term Immersion**
***All % Changes are Calculated Based on the Original Pre-Immersion Weight***

| Sample | Pre-Immersion Weight (g) | 7 Day Post-Immersion Weight (g) | 7 Day Change (%) |
|---|---|---|---|
| **1** | 17.867 | 17.889 | 0.12 |
| **2** | 19.713 | 19.744 | 0.16 |
| **3** | 17.173 | 17.204 | 0.18 |
| **Average** | **18.251** | **18.279** | **0.15** |

| Sample | 14 Day Post-Immersion Weight (g) | 14 Day Change (%) | 21 Day Post-Immersion Weight (g) | 21 Day Change (%) |
|---|---|---|---|---|
| **1** | 17.940 | 0.41 | 17.967 | 0.56 |
| **2** | 19.802 | 0.45 | 19.842 | 0.65 |
| **3** | 17.250 | 0.45 | 17.274 | 0.59 |
| **Average** | **18.331** | **0.44** | **18.361** | **0.60** |

| Sample | 28 Day Post-Immersion Weight (g) | 28 Day Change (%) | 35 Day Post-Immersion Weight (g) | 35 Day Change (%) |
|---|---|---|---|---|
| **1** | 18.000 | 0.74 | 17.997 | 0.73 |
| **2** | 19.889 | 0.89 | 19.885 | 0.87 |
| **3** | 17.305 | 0.77 | 17.312 | 0.81 |
| **Average** | **18.398** | **0.80** | **18.398** | **0.80** |

**Two Hour Boiling Water Immersion**

| Sample | Pre-Immersion Weight (g) | Post-Immersion Weight (g) | Change (%) |
|---|---|---|---|
| **1** | 19.471 | 19.535 | 0.33 |
| **2** | 20.755 | 20.810 | 0.26 |
| **3** | 15.542 | 15.583 | 0.26 |
| **Average** | **18.589** | **18.643** | **0.28** |

**Test Results**: (Continued)

## Water Absorption - ASTM D 570
(Continued)

### Thirty Minute Boiling Water Immersion

| Sample | Pre-Immersion Weight (g) | Post-Immersion Weight (g) | Change (%) |
|---|---|---|---|
| **1** | 22.709 | 22.739 | 0.13 |
| **2** | 16.604 | 16.612 | 0.05 |
| **3** | 18.434 | 18.439 | 0.03 |
| **Average** | **19.249** | **19.263** | **0.07** |

### Forty Eight Hours at 50ºC Water Immersion

| Sample | Pre-Immersion Weight (g) | Post-Immersion Weight (g) | Change (%) |
|---|---|---|---|
| **1** | 20.310 | 20.521 | 1.04 |
| **2** | 22.733 | 22.951 | 0.96 |
| **3** | 21.306 | 21.512 | 0.97 |
| **Average** | **21.450** | **21.661** | **0.99** |

## Bond Strength - ASTM C 482

| Sample | Peak Load (lbf) | Raised Dome Surface Area ($in^2$) | Bond Strength (psi) |
|---|---|---|---|
| **1** | 188 | 0.5972 | 315 |
| **2** | 107 | 0.5635 | 190 |
| **3** | 152 | 0.6055 | 251 |
| **4** | 130 | 0.5972 | 218 |
| **5** | 163 | 0.5849 | 279 |
| **Average** | **148** | **0.5897** | **251** |

**Test Results**: (Continued)

**Fade Resistance (Xenon Arc) - ASTM G 155**

| | Color Change | | | Contrast Retention (%) |
|---|---|---|---|---|
| **Panel** | $L_{unexposed}$ | $L_{exposed}$ | **ΔL** | |
| **1** | 70.13 | 70.40 | 0.27 | 99 |
| **2** | 70.55 | 70.73 | 0.18 | 99 |
| **3** | 69.65 | 70.17 | 0.52 | 99 |
| **4** | 70.80 | 70.70 | -0.10 | 99 |
| **5** | 71.29 | 71.34 | 0.05 | 99 |
| **6** | 71.63 | 71.55 | -0.08 | 99 |
| | | | **Average** | **99** |

Data sheets, representative samples of test specimens, and a copy of this test report 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 using the designated test 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 the 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
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Attachments (pages) This report is complete only when all attachments listed are included
Appendix A - Photographs (4)

## Revision Log

| Rev. # | Date | Page(s) | Revision(s) |
|---|---|---|---|
| 0 | 10/03/06 | N/A | Original report issue |
| 1 | 09/26/07 | 1, 2, 3, 7 | Revised weathering data per requirements of ASTM D 1148 as found in document 527000.D01 |

# APPENDIX A

## Photographs

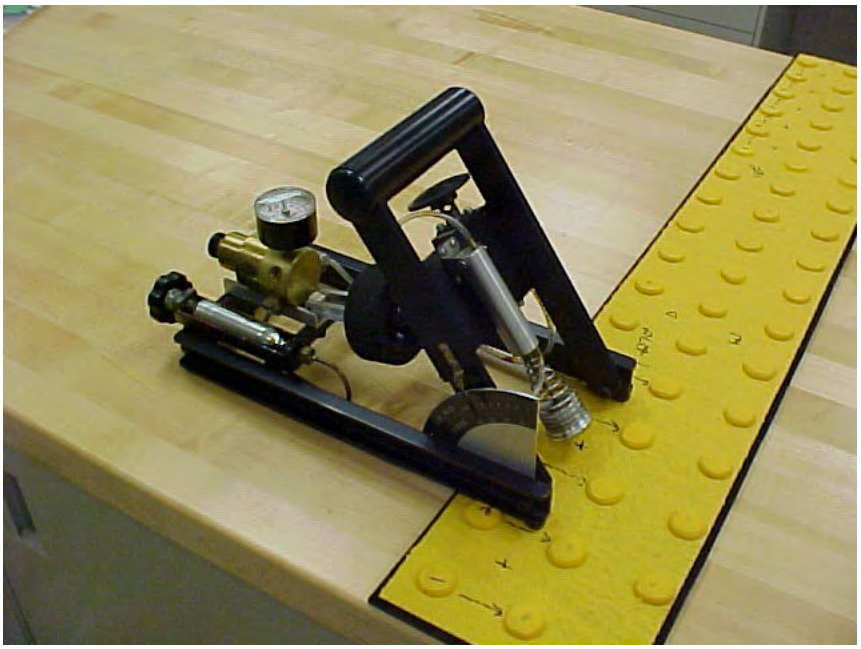

**Photo No. 1**
**Slip Resistance (VIT) Setup**

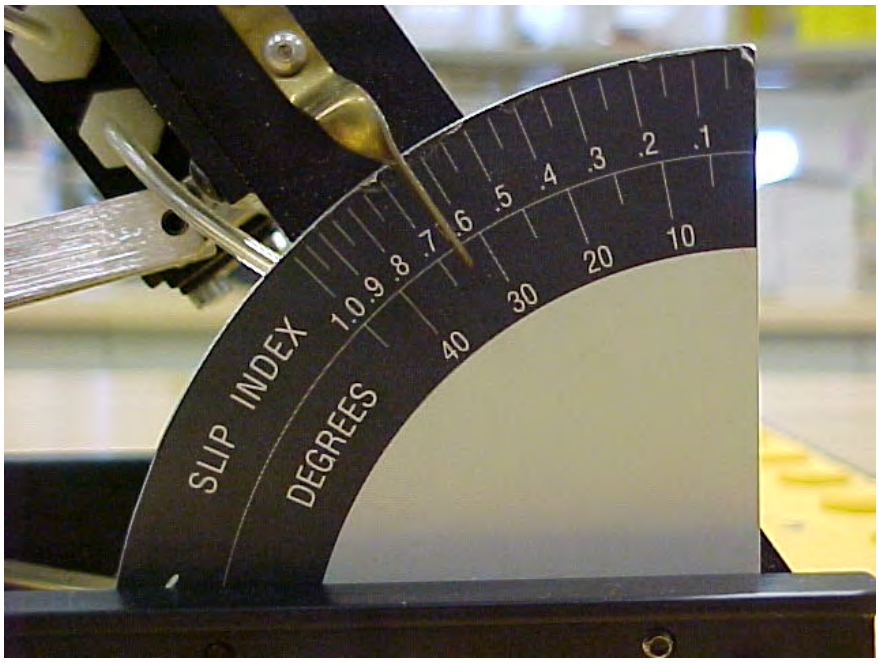


**Photo No. 2**
**Slip Index Detail**


**Photo No. 3**
**Wear Resistance Setup**

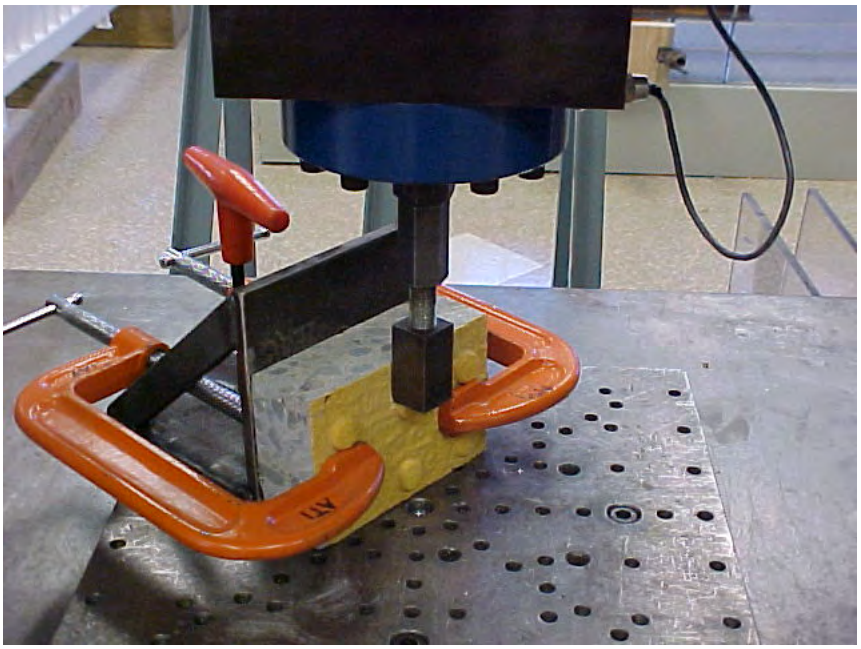

**Photo No. 4**
**Bond Strength Setup**

**Photo No. 5**
**Bond Strength Detail**

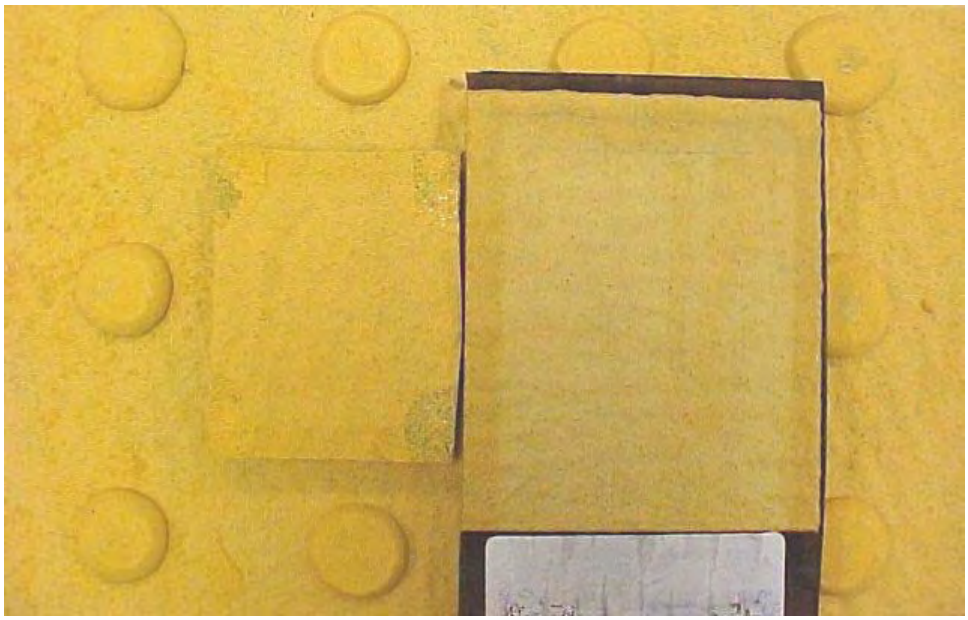

**Photo No. 6**
**2000 Hour Weathering Detail**
**(Left - Xenon Arc, Right - QUV, Background - Control)**