Laboratory Report A8940SC.02.08

Physical Properties Testing
of
SlopeShield®
in accordance with
ICC-ES AC48 and AC207

Date of Issuance:
February 21, 2008

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TL-199 Certified

TRINITY|ERD REFERENCE: Project #2007.A8940SC

SAMPLES: SlopeShield is a triple-layer spunbond polypropylene roofing underlayment.

SAMPLE DELIVERY: Trinity|ERD personnel sampled all test materials on December 7, 2007 in accordance with Section 3.1 of AC85. The named client arranged for shipment of said materials to TRINITY | ERD's laboratory for testing.

TEST DATE(S): December 2007 - February 2008

ERD TECHNICIANS: Charles Phillips, Larry Good

PROPERTIES:

Tensile Strength:	AC48; ASTM D1682
Water Vapor Transmission:	AC48; ASTM E96 and AC207
Pliability:	AC48, Section 4.3 and AC207
Water Ponding:	AC48, Section 4.4
Accelerated Aging:	AC48, Section 4.7 and AC207
Ultraviolet Resistance:	AC48, Section 4.8 and AC 207
Liquid Water Transmission:	AC207; ASTM D4869
Rupture Resistance:	AC207; ASTM D3462

STANDARDS:

AC85, *Acceptance Criteria for Test Reports,* © 2003, ICC-ES, Inc.
AC48, *Acceptance Criteria for Roof Underlayment For Use In Severe Climate Areas*, © 2007, ICC-ES, Inc.
AC207, *Acceptance Criteria for Polypropylene Roof Underlayments*, © 2005, ICC-ES, Inc.
ASTM D1682-64 (1975) – *Standard Test Methods for Breaking Load and Elongation of Textile Fabrics*, © 1975, ASTM.
ASTM E96/E96M-05 – *Standard Test Methods for Water Vapor Transmission of Materials*, © 2005, ASTM
ASTM D4869-88(1993) – *Standard Specification for Asphalt-Saturated Organic Felt Shingle Underlayment Used in Roofing*, © 1993, ASTM
ASTM D3462-05 – *Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules*, © 2005, ASTM

EQUIPMENT:

Tensile Strength:	Satec T-5000 #2110
Water Vapor Transmission:	Cup, Balance, ECL, Desiccant
Pliability:	SoLo Freezer, Mandrel
Water Ponding:	Cylindrical Tube, Sealant
Accelerated Aging:	Fischer Oven, Water Bath
Ultraviolet Resistance:	Trinity | ERD QUV Booth
Liquid Water Transmission:	Trinity | ERD LWT Apparatus
Rupture Resistance:	Satec T-5000 #2110
Tear Resistance:	Elmendorf Tearing Apparatus

1. TENSILE STRENGTH, AC48, SECTION 4.1 (ASTM D1682):

1.1 Specimen Preparation:

1.1.1 A minimum of ten specimens, per condition, five in machine direction, five in cross machine direction, measuring 4 x 6 inches were cut from supplied samples. Post conditioning samples are allowed to condition for 24 hours at 75°F, prior to testing.

1.2 Procedure:

1.2.1 The specimen is removed for conditioning, and placed in grips of Satec T-5000. Each specimen is loaded at a rate which will produce failure after 20 ± 3 seconds, until failure is reached. Ultimate load is recorded.

1.3 Results:

Table 1: Tensile Strength
SlopeShield

Condition	Test	Breaking Strength (lbf/in)		AC48 Criteria	Pass/Fail
		MD	XMD		
As Received	1	105.8	85.3	≥ 75 lbf/in	Pass
	2	113.0	81.4		
	3	106.4	83.5		
	4	101.0	85.7		
	5	107.2	83.0		
	Avg.:	106.7	83.8		
	Std. Dev.:	4.3	1.8		
After Accelerated Aging	1	110.2	83.8	≥ 75 lbf/in	Pass
	2	106.9	81		
	3	104.5	81.6		
	4	105.6	82		
	5	107.8	78.4		
	Avg.:	107.0	81.4		
	Std. Dev.:	2.2	2.0		
After UV Exposure	1	91.6	78.0	≥ 75 lbf/in	Pass
	2	95.1	76.8		
	3	97.4	76.6		
	4	101.6	76.9		
	5	100.6	75.0		
	Avg.:	97.3	76.7		
	Std. Dev.:	4.1	1.1		

2. WATER VAPOR TRANSMISSION, AC207 - SECTION 4.1 (ASTM E96, WATER METHOD):

2.1 Specimen Preparation:

2.1.1 The specimen is sealed to the open mouth of a test dish filled with water and placed in a test chamber in accordance with ASTM E96. For the duration of the test, the temperature and humidity of the chamber remain constant at 73°F and 50% respectively.

2.2 Procedure:

2.2.1 The dish assemblies are periodically weighed to determine the amount of water vapor leaving the test dish through the specimen.

2.3 Results:

Table 2: Test Results, Water Vapor Transmission and Permeance SlopeShield

Specimen	English Units		SI Units	
	WVT (grains/h-ft²)	Permeance (perms)	WVT(grams / hrs m²)	Permeance (grams / hrs m² Pa)
1	24.55	59.70	17.11	0.0123
2	23.99	58.34	16.72	0.0120
3	24.27	59.02	16.93	0.0122
Average:	**24.27**	**59.02**	**16.93**	**0.0122**

3. PLIABILITY, AC48 - SECTION 4.3 AND AC207 – SECTION 4.2:

3.1 Specimen Preparation:

3.1.1 A set of ten specimens, five in machine direction, five in cross machine direction, measuring 1 x 8 inches were cut from supplied samples and conditioned for 24 hours at 14°F.

3.2 Procedure:

3.2.1 The specimen is removed for conditioning, and bent 90° around a 1/8" radius mandrel. The specimen is then examined for cracks or delamination.

3.3 Results:

Table 3: Pliability SlopeShield

Specimen No.	Result		AC48 and AC207 Criteria	Pass/Fail
	MD	XMD		
1	**Pass**	**Pass**	No cracks or delamination when bent 90° over 1/8" radius mandrel	**Pass**
2	**Pass**	**Pass**		
3	**Pass**	**Pass**		
4	**Pass**	**Pass**		
5	**Pass**	**Pass**		

4. WATER PONDING, AC48 - SECTION 4.4:

4.1 Specimen Preparation:

4.1.1 Three control specimens and three aged specimens are prepared. A 2-inch diameter cylindrical tube with a 24-inch height of distilled water is sealed onto the surface of three control specimens and three aged specimens for a period of 48 hours. An additional specimen consisting of the cylinder sealed to a non-absorbent surface to is prepared to account for evaporation.

4.2 Procedure:

4.2.1 The drop in the water column is reported in hundredths of an inch and the presence of any moisture on the specimens is reported.

4.3 Results:

Table 4: Water Ponding
SlopeShield

Specimen No.	Drop in Water Column (in.)		AC48 Criteria	Pass/Fail
	Control	Aged		
1	0.15	0.15	≤0.24 inch After compensation for evaporation	Pass
2	0.13	0.18		
3	0.15	0.12		
Average:	**0.14**	**0.15**		
Loss from Evaporation	0.15	0.05		

5. ACCELERATED AGING, AC48 - SECTION 4.7 AND AC207 – SECTION 4.6:

5.1 Specimen Preparation:

5.1.1 A set of six specimens measuring 12 x 12 inches were cut from supplied samples and conditioned for 24 hours at 77°F.

5.2 Procedure:

5.2.1 The specimens were subjected to 25 cycles with each cycle consisting of heat exposure for three hours at 120°F, immersion in room temperature water for three hours, and air-drying at 73°F for eighteen hours. The specimens were then examined for damage.

5.3 Results:

5.3.1 At the end of conditioning, the underlayment specimens showed no signs of peeling, chipping, cracking, flaking, pitting or other damage. **Pass**

Table 5: Cycling for Accelerated Weathering SlopeShield

Cycle	Date	Oven Drying		Water Immersion		Air Drying	
		In	Out	In	Out	In	Out
1	1/3/08	08:00	11:00	11:00	14:00	14:00	08:00
2	1/4/08	08:00	11:00	11:00	14:00	14:00	08:00
3	1/7/08	08:00	11:00	11:00	14:00	14:00	08:00
4	1/8/08	08:00	11:00	11:00	14:00	14:00	08:00
5	1/9/08	08:00	11:00	11:00	14:00	14:00	08:00
6	1/10/08	08:00	11:00	11:00	14:00	14:00	08:00
7	1/11/08	08:00	11:00	11:00	14:00	14:00	08:00
8	1/14/08	08:00	11:00	11:00	14:00	14:00	08:00
9	1/15/08	08:00	11:00	11:00	14:00	14:00	08:00
10	1/16/08	08:00	11:00	11:00	14:00	14:00	08:00
11	1/17/08	08:00	11:00	11:00	14:00	14:00	08:00
12	1/18/08	08:00	11:00	11:00	14:00	14:00	08:00
13	1/21/08	08:00	11:00	11:00	14:00	14:00	08:00
14	1/22/08	08:00	11:00	11:00	14:00	14:00	08:00
15	1/23/08	08:00	11:00	11:00	14:00	14:00	08:00
16	1/24/08	08:00	11:00	11:00	14:00	14:00	08:00
17	1/25/08	08:00	11:00	11:00	14:00	14:00	08:00
18	1/28/08	08:00	11:00	11:00	14:00	14:00	08:00
19	1/29/08	08:00	11:00	11:00	14:00	14:00	08:00
20	1/30/08	08:00	11:00	11:00	14:00	14:00	08:00
21	1/31/08	08:00	11:00	11:00	14:00	14:00	08:00
22	2/1/08	08:00	11:00	11:00	14:00	14:00	08:00
23	2/4/08	08:00	11:00	11:00	14:00	14:00	08:00
24	2/5/08	08:00	11:00	11:00	14:00	14:00	08:00
25	2/6/08	08:00	11:00	11:00	14:00	14:00	08:00

6. ULTRAVIOLET EXPOSURE, AC48 - SECTION 4.8 AND AC207 – SECTION 4.7:

6.1 Specimen Preparation:

6.1.1 A set of two specimens measuring 18 x 48 inches were cut from supplied samples and conditioned for 24 hours at 77°F.

6.2 Procedure:

6.2.1 The specimens were exposed to ultraviolet light for 210 hours (10 hours a day for 21 days). The bulbs are Oshram 300W providing the UV characteristics called for in both AC48, 4.8.1 and in AC207, 4.7.1. The specimens were then examined for damage under 5x magnification.

6.3 Results:

6.3.1 At the end of conditioning, the underlayment specimens showed no signs of peeling, chipping, cracking, flaking, pitting or other damage. **Pass**

Table 6: Cycling for Ultraviolet Exposure
SlopeShield

Cycle	Date	Lamp On	Lamp Off	Hours
1	1/2/08	08:00	18:00	10
2	1/3/08	08:00	18:00	10
3	1/4/08	08:00	18:00	10
4	1/5/08	08:00	18:00	10
5	1/6/08	08:00	18:00	10
6	1/7/08	08:00	18:00	10
7	1/8/08	08:00	18:00	10
8	1/9/08	08:00	18:00	10
9	1/10/08	08:00	18:00	10
10	1/11/08	08:00	18:00	10
11	1/12/08	08:00	18:00	10
12	1/13/08	08:00	18:00	10
13	1/14/08	08:00	18:00	10
14	1/15/08	08:00	18:00	10
15	1/16/08	08:00	18:00	10
16	1/17/08	08:00	18:00	10
17	1/18/08	08:00	18:00	10
18	1/19/08	08:00	18:00	10
19	1/20/08	08:00	18:00	10
20	1/21/08	08:00	18:00	10
21	1/22/08	08:00	18:00	10
			Total Exposure:	**210**

7. LIQUID WATER TRANSMISSION, AC207 – SECTION 4.3 (ASTM D4869):

7.1 Specimen Preparation:

7.1.1 The sample material was mounted on a plywood board with the edges overlapping and folded over the board. The board and sample material was conditioned at 80°F and 30 to 55 % relative humidity for 24 hours prior to testing.

7.2 Procedure:

7.2.1 The test board was positioned at a 20° incline with a shower head directly overhead and 18 in. above the center of the test board. The water supplied was opened and regulated at a rate of 40 to 42 gal/h for 4 hours. The bottom surface of the test material and the top surface of the plywood board were examined for any signs of wetness.

7.3 Results:

7.3.1 After four hours of water impingement, specimens showed no signs of water transmission. **Pass**

8. RUPTURE RESISTANCE, AC207 –SECTION 4.4 (ASTM D3462):

8.1 Specimen Preparation:

8.1.1 A minimum of ten specimens, per condition, measuring 3-7/8 inches square were cut from supplied samples and clamped into the rupture apparatus. Post conditioning samples are allowed to condition at 73°F, prior to testing.

8.2 Procedure:

8.2.1 The end of the fastener protruding through the specimen was placed in grips of Satec T-5000. Each fastener is loaded at 100 lbf at an extension rate of 4 in/min. Ultimate load is recorded.

8.3 Results:

Table 7: Rupture Resistance (lbf)

Test	Control		Post Accelerated Weathering		Post UV Exposure	
	3/8" Nail Head	7/16" Crown Staple	3/8" Nail Head	7/16" Crown Staple	3/8" Nail Head	7/16" Crown Staple
1	39.4	23.9	33.6	29.5	34.8	28.5
2	39.0	33.4	35.6	26.5	40.9	22.3
3	39.0	32.6	37.4	25.1	34.5	32.7
4	41.9	26.9	39.0	24.7	41.7	20.6
5	39.3	26.7	38.1	28.5	41.7	21.7
6	41.8	21.3	35.1	28.7	39.0	26.7
7	39.9	30.9	39.8	23.5	40.5	24.6
8	42.2	35.6	33.1	29.1	40.6	23.0
9	44.8	20.8	35.1	25.4	38.3	28.0
10	39.3	28.0	34.7	26.7	36.7	27.1
Avg.:	**40.7**	**28.0**	**36.2**	**26.8**	**38.9**	**25.5**
Std. Dev.:	1.9	5.1	2.3	2.1	2.7	3.8
AC207:	≥ 25	≥ 17	≥ 25	≥ 17	≥ 25	≥ 17
Pass/Fail	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**

9. CONCLUSIONS:

9.1 Trinity|ERD has tested SlopeShield and sampled in accordance with AC85, in accordance with the AC48 and AC207 requirements noted in this report. Test results indicate compliance with the requirements for the properties tested.

Please contact our offices with any questions.

Sincerely,
TRINITY | ERD

Charles Phillips
Laboratory Systems Manager

Robert Nieminen, P.E.
Vice President