

B I R D I N C O R P O R A T E D

PLAINTIFF'S EXHIBIT

BIR-1008

Memo To: R. C. Maloof - BBP
Subject: BBH HISTORY OF LIGHTWEIGHT
MAT SHINGLES

From: V. Roelofs - BBH

Date: October 24, 1984

As per your memo of October 10 to Jim Jackson, I have reviewed available test data on lightweight mat shingles. We have never made a controlled study on a commodity shingle lower than 1.8# mat. We did make a Firebird at FW on a 1.45# mat. We have also tested competitors on mats as low as 1.5#. References and summaries are given below, with data tables attached.

From these limited samples, it appears that a shingle on 1.8# mat is not significantly lower in physical properties than a 2.0# mat shingle. A shingle on 1.6# mat is definitely lower in physical properties, more prone to tearing on application, and more prone to blow-offs.

From the October 11 Technical Meeting, projects are underway to study FW laminated shingles with 2.0, 1.8, and 1.6# mat; plus FO and FK commodity shingles with 1.9# mat, and FM ply sheet with 1.95# Type IV mat.

Of course, weatherability of these lightweight mat shingles will not be known for several years. We have not yet correlated lab physical or chemical testing with field performance on weathering. Lab physical data is well correlated for application problems and blow-off resistance.

1. May 1983 FM Mill Trial, Report #007-7, 7/15/83, V. Roelofs, Summary presented at management meeting.
 - A. Total tear for 1.8# mat 11% lower than standard 2.1# mat.
 - B. Except for Handling Index at 63%, 1.8# mat consistently gives a slightly weaker shingle than the 2.1# mat. The data is an average of six samples across the weight and backcoating range.

- C. All of these samples have physical properties below an FB W/S 80 or FO F/S. In other words, even though there was not much difference between 1.8 and 2.1# mat, both samples were below the physical properties of a "good" fiberglass shingle.
- 2. April 1983 Trial on FM Firelines, Reports #009-85, 6/1/83, R. Jagocki and #007-12, 5/23/83, C. Patenaude.
 - A. Random samples of 1.8# mat equal in physical properties to 2.0# mat, 13% less total tear than 2.2# mat, 23% less total tear than 2.4# mat.
 - B. 2.2# mat shingle had the highest Handling Index. In toughness (ASTM Tear) the 1.8# mat and 2.0# shingles were about equal, but well below the 2.2# mat shingles and 2.4# mat shingles.
- 3. June 1983 Trial on FW Firebird, Report #007-15, 9/20/83, C. Patenaude
 - A. JM 1.45# mat had 24% less total tear than Bird 2.0# mat.
 - B. Firebird shingles showed dramatically less physical properties for 1.45# mat. Both samples passed the BBH U/L Type Class A Burning Brand Test.
 - C. Wind Tunnel testing confirmed much less toughness, nail pull, and wind resistance for the 1.45# mat Firebird.
- 4. June 1984 Trial on FK Firescreen, Reports #4026-6, 7/2/84 and #4026-8, 8/7/84, R. Jagocki.
 - A. Random samples of FK 1.85# and 2.0# mat had equal physical properties.
 - B. There is no significant difference in physical properties between the FK F/S with 1.85# mat and 2.0# mat.
 - C. Samples are being exposed on test roofs in Florida and Massachusetts, as well as the test decks in Shreveport.
- 5. 1983 Competitive Survey - FK & FS, Report #4040-3, 7/26/84, V. Roelofs.

- A. Elk Sunseal (3 samples) had 1.5-1.6# mat with 61-64% filler versus FS F/S with 2.0-2.3# mat and 53-57% filler.
 - B. Handling Index and toughness (ASTM tear) was much lower for the Elk shingles. Unfortunately we do not have Nail Pull data for the Elk samples.
 - C. It was reported that Elk suffered significant blow-offs of their high filler, light mat products.
6. Wind Tunnel Test, Report #4072-2, 6/7/84, C. Patenaude.
- A. In terms of physical tests, the Elk products were well below a typical FK F/S or FB W/S 80.
 - B. 1.6-1.7# mat shingles cannot be as strong in Nail Pull or Toughness (ASTM Tear) as a 1.9-2.2# mat shingle. The Handling Index and Relative Wind Tunnel Failure also show this, but not to the same degree.
 - C. In the laminated products, the Elk Prestique II had very poor performance in the Wind Tunnel. A single layer of 1.5-1.6# mat, 64-66% filler Prestique II has about half the toughness (ASTM tear) of a single layer of a typical FK or FW Arch. 80.
7. 1984 FW Competitive Survey, Report #4040-5, 9/26/84, V. Roelofs.
- A. The lightweight mat (1.5-1.7#) shingles from Celotex had moderate filler, 54-60%. They had a moderate Handling Index, with a poor ASTM Tear (Toughness) and Nail Pull. They would probably have poor wind resistance.

VR/cm
Attachment

Distribution:

R. J. Carlson	- BBQ
J. W. Jackson	- BBH
W. C. Kinsey	- BRM
C. J. Patenaude	- BBH
C. E. Stapley	- BRPT
D. R. Suva	- BR
F. W. Wood	- BBP

V. Roelofs

RBH HISTORY OF LIGHTWEIGHT MAT SHINGLES

IDENTIFICATION	NUMBER	WT./SQ.	MAT WEIGHT	% FILLER	CALC. HANDLING INDEX	NAIL PULL	ASTM TEAR	MISCELLANEOUS
(Series D, EM Trial, Average of 6 Samples, Wt. Range 194-243)			1.8 2.1	51 51	54 56	9 9	900 1060	
(Series A, EM Trial, Average of 6 Samples, Wt. Range 194-240)			1.8 2.1	56 56	45 49	8 8	1140 1160	
(Series B, EM Trial, Average of 6 Samples, Wt. Range 193-246)			1.8 2.1	63 63	46 44	7 7	1000 1040	

EM F/L	83-256	254	1.8	41	37	8	1340	High Scrub Loss
EM F/L	83-257	274	1.8	48	42	8	1660	
EM F/L	83-259	276	2.0	48	38	9	1540	
EM F/L	83-261	271	2.2	48	51	9	1860	
EM F/L	83-263	283	2.4	48	41	9	1920	

FW FIREBIRD	83-532	247	1.45	54	(Observed) 25	(Double Thickness) 13	1440 2580 (Double)	Relative Wind Tunnel Failure - 57 mph
FW FIREBIRD	83-533	240	2.0	57	(Observed) 63	(Double Thickness) 27	1940 4780 (Double)	Relative Wind Tunnel Failure - 71 mph

FK E/S	84-407	206	1.85	58	64 (Tape)	16 (Tape)	1040	1 Week
					57 (No Tape)	8 (No Tape)		
					57 (Tape)	14 (Tape)	1230	1 Month
	84-406	213	2.0	57	48 (No Tape)	8 (No Tape)		
					63 (Tape)	16 (Tape)	1200	1 Week
					58 (No Tape)	9 (No Tape)		

FS E/S (1983 Annual)	83-129	218	2.3	57	51 (No Tape)	11	1180	
	83-193	195	2.0	53	61 (No Tape)	10	1180	
	83-194	210	2.1	57	48 (No Tape)	11	1100	
Elk Sunseal (1983 Annual)	83-296	200	1.5	64	49 (No Tape)		960	HI-52 (Tape)
	83-297	206	1.6	61	41 (No Tape)		960	HI-51 (Tape)
	83-298	206	1.5	62	53 (No Tape)		830	HI-49 (Tape)

BBH HISTORY OF LIGHTWEIGHT MAT SHINGLES
(Continued)

<u>IDENTIFICATION</u>	<u>NUMBER</u>	<u>WT./SQ.</u>	<u>MAT WEIGHT</u>	<u>Z FILLER</u>	<u>CALC. HANDLING INDEX</u>	<u>NAIL PULL</u>	<u>ASTM TEAR</u>	<u>MISCELLANEOUS</u>
FB 2/S (Wind Tunnel Standard)	84-111	224	2.2	53	75 (Tape) 66 (No Tape)	19 (Tape)	1600	Relative Wind Tunnel Failure - 66 mph average
EK F/S	84-21	221	1.9	53	63 (Tape) 59 (No Tape)	18 (Tape)	1220	Relative Wind Tunnel Failure - 64 mph
Elk Sunseal	84-234	219	1.6	57	36 (Tape) 34 (No Tape)	14 (Tape) 6 (No Tape)	990	Relative Wind Tunnel Failure - 60 mph
Elk Sunseal	84-235	204	1.7	57	42 (Tape) 41 (No Tape)	13 (Tape) 7 (No Tape)	760	Relative Wind Tunnel Failure - 51 mph
EK Arch 80	83-926	301	2.6	59		20 (Double)	1460 3080 (Double)	Relative Wind Tunnel Failure - 65 mph
EW Arch. 80	83-684	291	2.3	50		18 (Double)	1640 3340 (Double)	Relative Wind Tunnel Failure - 65 mph
Elk Prestique II	84-160	239	1.5	66 (Limestone)		13 (Double)	800 2200 (Double)	Relative Wind Tunnel Failure - 43 mph
	84-161	243	1.6	66 (Limestone)		11 (Double)	660 2120 (Double)	Relative Wind Tunnel Failure - 45 mph
	84-162	245	1.6	64 (Limestone)		13 (Double)	780 1620 (Double)	Relative Wind Tunnel Failure - 53 mph
Celotex	84-557	206	1.7	60	45 (Tape) 38 (No Tape)	12 (No Tape) 8 (No Tape)	1080	
FA/20 (FW Area)	84-558	200	2.1	54	52 (Tape) 46 (No Tape)	16 (Tape) 10 (No Tape)	1340	
	84-559	202	1.5	54	54 (Tape) 54 (No Tape)	14 (Tape) 10 (No Tape)	1200	

VR/cm
10/24/84