
**SUMMARY REPORT
EVALUATION OF COMPOSITE DECK BOARDS
FOR PERFORMANCE
IN GENERAL ACCORDANCE WITH ASTM D7032-21**

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1.0 INTRODUCTION

At the request of *The Millboard Company Ltd.*, Element Materials Technology Inc., was retained to evaluate composite deck board products for performance ratings, in accordance with ASTM D7032.

Upon receipt, the deck boards were assigned the following Element Sample numbers:

Client Sample Identification	Sample Received	Element Sample No.
WEATHERED OAK 200mm x 32mm x 3600 mm (7.75" x 1.25" x 141.5")	October 29, 2021	21-06-P0093-A
ENHANCED GRAIN 176mm x 32mm x 3600 mm (6.75" x 1.25" x 141.5")		21-06-P0093-B

Client Sample Identification	Sample Received	Element Sample No.
WEATHERED OAK 200mm x 31mm x 765 mm (7.75" x 1.25" x 30")	September 22, 2022	22-06-P0093-A
ENHANCED GRAIN 176mm x 31mm x 765 mm (6.75" x 1.25" x 30")		22-06-P0093-B
BULLNOSE 150mm x 31mm x 765 mm (6" x 1.25" x 30")		22-06-P0093-C

Client Sample Identification	Sample Received	Element Sample No.
ENHANCED GRAIN 127mm x 32mm x 3600mm (5 in. x 1.26 in. x 142 in.)	May 10, 2023	23-06-P0153

2.0 PROCEDURE

Test Standard /Method	Test Description
ASTM D7032-21	Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite and Plastic Lumber Deck Boards, Stair Treads, Guards, and Handrails.
ASTM D6109-19	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber and Related Products

ASTM D7032-21	Test Description
Section 4.4.1 and 4.4.2	Baseline Flexural test – Original Condition
Section 4.5 .1	Baseline Flexural test – Elevated Temperature Effect Samples conditioned to 125°F ± 4°F (52°C ± 2°C)
Section 4.5.1	Baseline Flexural test – Reduced Temperature Effect Samples conditioned to -20°F ± 4°F (-29°C ± 2°C)
Section 4.5.2	Baseline Flexural test – Moisture Effect Samples Immersed in Water for 7 days
Section 4.6	Baseline Flexural test – UV Resistance Effect Samples UV exposed for 2000 hours per ASTM G154
Section 4.7	Baseline Flexural test – Freeze-Thaw Effect Samples subjected to 5 freeze-thaw cycles
Not required as product formulation is not reported to contain biodegradable materials	Biodeterioration Tests – Fungal Decay and Termite Resistance
Section 5.4	Creep Recovery
Section 5.5 / ASTM D1761	Mechanical Fastener Holding
Section 4.9	Surface Burning Characteristics
Section 5.3.2	Deck Board Used as Stair Tread

3.0 RESULTS

A summary of test results is presented in Tables 1a – f, Tables 2, 3, 4 and 5. Imperial units were the primary unit of measure.

Table 1a: – Summary of Unadjusted Flexural Properties – Original Condition									
ASTM D 7032 / ASTM D6109									
Element Sample No.: 21-06-P0093 – A & B, 23-06-P0153									
Element Sample No. (Width)	Span Length	Width	Depth	Load at Span/180	Ultimate Load	Moment Capacity	Flexural Rigidity (EI)	Flexural Strength	Modulus of Elasticity
		in.	in.	lbf	lbf	in-lbf	in ² -lbf	psi	psi
WEATHERED OAK (7.75")									
21-06-P0093-A	16 in. (406 mm) Span	7.86	1.26	118	688	1,834	96,848	882	73,916
	12 in. (305 mm) Span	7.83	1.26	228	1,155	2,359	105,125	1,115	80,540
ENHANCED GRAIN (6.75")									
21-06-P0093-B	16 in. (406 mm) Span	7.03	1.25	132	805	2,145	108,469	1,173	94,799
	12 in. (305 mm) Span	6.98	1.26	220	1,144	2,288	107,319	1,239	92,234
ENHANCED GRAIN (5")									
23-06-P0153	16 in. (406 mm) Span	5.14	1.26	129	403	1076	93,286	797	109,760

Table 1b: – Summary of Flexural Properties – Elevated Temperature Effect

ASTM D 7032 / ASTM D6109

Element Sample No.: 21-06-P0093 – A & B

Sample ID	Width	Depth	Load at Span/180	Ultimate Load	Moment Capacity	Change Versus Original Condition	Flexural Rigidity (EI)	% Change Versus Original Condition
	in.	in.	lbf	lbf	in-lbf	%	in ² -lbf	%
WEATHERED OAK (7.75") 16 in. (406 mm) Span	7.84	1.26	105	590	1,573	- 14%	85,759	- 11%
ENHANCED GRAIN (6.75") 16 in. (406 mm) Span	7.04	1.25	147	646	1,723	- 20% *	120,610	+ 11%

Note - * Considered as most critical effect for both Enhanced Grain and Weathered Oak based on the same material composition.

Table 1c: – Summary of Flexural Properties – Reduced Temperature Effect

ASTM D 7032 / ASTM D6109

Element Sample No.: 21-06-P0093 – A & -B

Sample ID	Width	Depth	Load at Span/180	Ultimate Load	Moment Capacity,	% Change Versus Original Condition	Flexural Rigidity (EI)	% Change Versus Original Condition
	in.	in.	lbf	lbf	in-lbf	%	in ² -lbf	%
WEATHERED OAK (7.75") 16 in. (406 mm) Span	7.82	1.26	181	747	1,993	+ 9%	148,828	+ 54%
ENHANCED GRAIN (6.75") 16 in. (406 mm) Span	7.00	1.25	159	605	1,614	- 25% *	130,507	+ 20%

Note - * Outlier result as reduced temperature expected to increase strength.

Table 1d: – Summary of Flexural Properties – Moisture Effect

ASTM D 7032 / ASTM D6109

Element Sample No.: 21-06-P0093 – A & -B

Sample ID	Width	Depth	Load at Span/180	Ultimate Load	Moment Capacity	% Change Versus Original Condition	Flexural Rigidity (EI)	% Change Versus Original Condition
	in.	in.	lbf	lbf	in-lbf	%	in ² -lbf	%
WEATHERED OAK (7.75") 16 in. (406 mm) Span	7.88	1.26	93	749	1,996	+ 8%	75,988	-22%
ENHANCED GRAIN (6.75") 16 in. (406 mm) Span	6.98	1.25	116	668	2,150	0	94,389	- 13%

Table 1e: – Summary of Flexural Properties – Freeze-Thaw Effect

ASTM D 7032 / ASTM D6109

Element Sample No.: 21-06-P0093 – A & -B

Sample ID	Width	Depth	Load at Span/180	Ultimate Load	Moment Capacity	% Change Versus Original Condition	Flexural Rigidity (EI)	% Change Versus Original Condition
	in.	in.	lbf	lbf	in-lbf	%	in ² -lbf	%
WEATHERED OAK (7.75") 16 in. (406 mm) Span	7.90	1.26	106	765	2,041	+ 11%	87,071	+10%
ENHANCED GRAIN (6.75") 16 in. (406 mm) Span	6.99	1.25	116	668	1,781	- 17% *	94,951	- 12%

Note - * Considered as most critical effect for both Enhanced Grain and Weathered Oak based on the same material composition.

Table 1f: – Summary of Flexural Properties – UV Resistance Effect

ASTM D 7032 / ASTM D790

Element Sample No.: 21-06-P0093 – A & B

(9 in. (22.86 mm) Span)

Sample ID	Width	Depth	Ultimate Load	Deflection at Ultimate Load	Modulus of Rupture	% Change Versus Original Condition	Modulus of Elasticity	% Change Versus Original Condition
	in.	in.	lbf	in.	psi	%	psi	%
ENHANCED GRAIN * (6.75")								
Original Condition	1.28	1.25	152	0.17	1,111		65,567	
UV Aged	1.18	1.25	130	0.17	931	- 16 %	55,337	- 16 %

Note - * Enhanced Grain UV resistance performance is representative of Weathered Oak based on the same material composition.

Table 2: – Creep Recovery Test Results

ASTM D 7032, Section 4.9

Element Sample No.: 21-06-P0093 – A & B (Original Condition), 23-06-P0153

16-inch Support Span

Element Sample No. (Width)	Sample ID	Total Deflection (24 Hours With 200 psf Load On)	Recovered Deflection	Percent Recovery	Unrecovered Deflection
		mm	mm	>75%	<1.6mm
21-06-P0093-A (7.75")	Weathered Oak #1	2.77	2.53	91	0.24
	Weathered Oak #2	2.69	2.47	92	0.22
21-06-P0093-B (6.75")	Enhanced Grain #1	2.63	2.40	91	0.23
	Enhanced Grain #2	2.97	2.47	92	0.22
23-06-P0153 (5")	Enhanced Grain #3	1.65	1.51	91	0.14

Table 3: – Summary of Mechanical Fastener Holding Test Results

ASTM D 7032, Section 5.5

Element Sample No.: 21-06-P0093 – A & B (Original Condition)

Sample ID	Screw Head Pull Through, Ultimate Load, Single Screw	Screw Head Pull Through, Allowable Capacity with Safety Factor of Three, Single Screw,
	lbf	lbf
WEATHERED OAK	152	51
ENHANCED GRAIN	135	45

Table 4: – Summary of Surface Burning Characteristics Test Results

ASTM D 7032, Section 4.9, Referencing ASTM E84

Element Sample No.: 21-06-P0093 – A & B (Original Condition)

Sample ID	Flame Spread Index (FSI)	ASTM D7032 requirement
WEATHERED OAK	155	<200
ENHANCED GRAIN	155	<200

Table 5: – Summary of Stair Tread Performance

ASTM D 7032 Section 5.3.2

Element Sample No.: 22-06-P0093 – A & B & C, 23-06-P0153

Element Sample No.	Sample ID	Width	Depth	Deflection Under 399 lbf (300 lbf + 33% Effect Adjustments)	Deflection Requirements	Resistance Under 998 lbf (750 lbf + 33% Effect Adjustments)
		in.	in.	in.	in.	-
22-06-P0093-A	WEATHERED OAK 8 in. (203 mm) Span	7.75	1.25	0.103	< 0.125	Supported
22-06-P0093-B	ENHANCED GRAIN 8 in. (203 mm) Span	6.75	1.25	0.105	< 0.125	Supported
22-06-P0093-C	BULLNOSE 8 in. (203 mm) Span	6.00	1.25	0.102	< 0.125	Supported
23-06-P0153	ENHANCED GRAIN 8 in. (203mm) Span	5.00	1.26	0.107	< 0.125	Supported

Determination of Allowable Deck Board Load/Span Performance Ratings Per ASTM D7032-21

Based on the Original Condition flexural testing results from Table 1a, the following unadjusted allowable loads are applicable:

- The limiting average flexural strength corresponds to the Load at Span/180 determined using third point loading.
- Converting the third point loading to uniform loading determines the Unadjusted Allowable Uniform Load at the tested span.

Applying the effect adjustments on strength (Moment Capacity) from Tables 1b – 1e determines the adjusted Load/Span Performance Ratings. For the 5" Enhanced Grain deck board, the end use adjustments for the 6.75" Enhanced Grain deck board as detailed in this report were used to determine the Allowable Load/Span Performance Ratings. The resulting ratings are summarized in the table below.

Table 6: – Determination of Allowable Deck Board Load/Span Performance Ratings							
ASTM D 7032-21							
Element Sample No.: 22-06-P0093 – A & B, 23-06-P0153							
Element Sample No. (Width)	Sample ID	Load at Span/180	Unadjusted Allowable Load	Most Restrictive Temperature and Moisture Effect per Section 4.5.3	UV Resistance Effect in Excess of 10% per Section 4.6.3	Freeze-Thaw Resistance Effect in Excess of 10% per Section 4.7.2	Allowable Load/Span Performance Rating psf / span
		lbf	psf	%	%	%	in.
WEATHERED OAK							
22-06-P0093-A (7.75")	16 in. (406 mm) Span	118	180	- 20%	- 6 %	- 7%	121 / 16
	12 in. (305 mm) Span	228	466				312 / 12
ENHANCED GRAIN							
22-06-P0093-B (6.75")	16 in. (406 mm) Span	132	226	- 20%	- 6%	- 7%	151 / 16
	12 in. (305 mm) Span	220	534				358 / 12
ENHANCED GRAIN							
23-06-P0153 (5")	16 in. (406mm) Span	129	310	-20%	-6%	-7%	208/16

4.0 CONCLUSIONS

The 7.75" Weathered Oak, 6.75" Enhanced Grain, and 5" Enhanced Grain composite deck boards submitted by *The Millboard Company Ltd.* were tested in accordance with ASTM D7032-21 as detailed in this report. The results presented in Section 3 of this report indicate the following:

- When used as a deck board, the Load / Span Performance Rating exceeds 100 psf on a support spacing of 16 in. and 12 in.
- When used as a deck board, the Creep Recovery performance satisfies the Percent Recovery and Unrecovered Deflection requirements on a support span spacing of 16 in. and 12 in.
- When used as a stair tread, the Stair Tread performance satisfies the deflection and sustained load requirements on a support span spacing of 8 in.

5.0 REVISION HISTORY

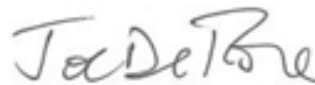
Date	Rev. No	Comments
2022-03-16	Original Document	N/A
2022-10-17	RV1	Addition of stair tread results.
2023-12-11	RV2	Addition of 5" Deck board results.

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