



RELIABLE ANALYSIS INC.

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PURCHASE ORDER	#1009
TEST DATE	6/23/08-6/29/08
REPORT DATE	7/1/08
TOTAL PAGE(S) NUMBER	1/10

REPORT FOR

True Harbor
2145 Cole Street
Birmingham, MI 48009
USA

Attn: Dick Cantely
Subject: Load Capacity Test on Marine Docking Panels

1.0 Work Requested

Reliable Analysis to test True Harbor supplied Interlocking Marine Docking Panels as described in reference quotation #820354.

2.0 Sample Description

Fourteen (14) Marine Docking Panels:

- Four (4) - 30% Glass Filled Structural Foam Panels
 - Two (2) Concentrated Load
 - One (1) Load at Rupture and L/180
 - One (1) Creep Relaxation
- Two (2) - 20% Glass Filled Structural Foam Panels
 - One (1) Concentrated Load
 - One (1) Load at Rupture and L/180
- Two (2) - 30% Glass Filled Assisted Web Panels
 - One (1) Concentrated Load
 - One (1) Load at Rupture and L/180
- Two (2) - 30% Glass Filled Assisted Web Panels
 - One (1) Concentrated Load
 - One (1) Load at Rupture and L/180
- Four (4) - Competitor Panels
 - One (1) Concentrated Load
 - Three (3) Load at Rupture and L/180



3.0 Test Procedure – Concentrated Load

Six (6) Panels were tested using an MTS Servo Hydraulics System in accordance with client’s instructions. Using a linear load applicator measuring 58.3mm long x 6.0mm wide (350mm²), a sustained load of 2.1 kN will applied for 15 minutes or until testing panel breaks in the mid-span region of the panel bearing over one (1) of the panel ribs and again in a different mid-span region over three (3) panel ribs. The testing parameters used for this test are outlined below:

Testing Position	Flatwise	Area Loading Nose	350mm ²
True Harbor Sample Size	48” x 48” x 1.2”	True Harbor # of Samples	5
Competitor Sample Size	48” x 12” x 1.25”	Competitor # of Samples	1
Support Span	15.75”	Testing Machine	MTS Servo Hydraulics





4.0 Test Results – Concentrated Load

Requirement: Panel must not show any signs of failure/breakage.

Concentrated Load - 0.542 in² Load Area					
Concentrated Load: Load Test of 2.1kN (472.1lbs) over and area of 350mm ² (0.54in ²)					
Position A: Along Long Continuous Rib					
Position B: Across three (3) ribs - Long Rib - Short Rib- Long Rib					
Ramp Speed of Hydraulics: Samples #1-4 A&B: 0.5 sec to 2.1kN; *Ramp Speed RA#1-1 A&B: 7 min to 2.1kN					
Sample ID	Load First Break (lbf)	Load (psi)	Maximum Load (lbf)	Load (psi)	First Break Deflection (in)
RA#1 Pos. A 30% Foam	386.7	712.8	480.2	885.2	1.65
RA#1 Pos. B 30% Foam	513.1	945.9	513.1	945.9	0.73
RA#1-1* Pos. A 30% Foam	361.7	666.8	435.7	803.1	0.39
RA#1-1* Pos. B 30% Foam	386.6	712.7	399.5	736.4	0.91
RA#2 Pos. A 20% Foam	316.2	582.8	368.8	679.8	0.71
RA#2 Pos. B 20% Foam	431.6	795.5	431.6	795.5	0.87
RA#3 Pos. A 30% Web	455.6	839.8	463.7	854.7	0.73
RA#3 Pos. B 30% Web	465.8	858.7	489.7	902.7	0.92
RA#4 Pos. A 20% Web	383.6	707.1	383.8	707.5	0.79
RA#4 Pos. B 20% Web	427.8	788.6	427.8	788.6	0.97
RA#10 Competitor: Across 3 longitudinal ribs, Ramp speed of 0.5 sec to 2.1kN (472lbs) and held for 15 min without any signs of breakage. Maximum Deflection: 0.238 in					

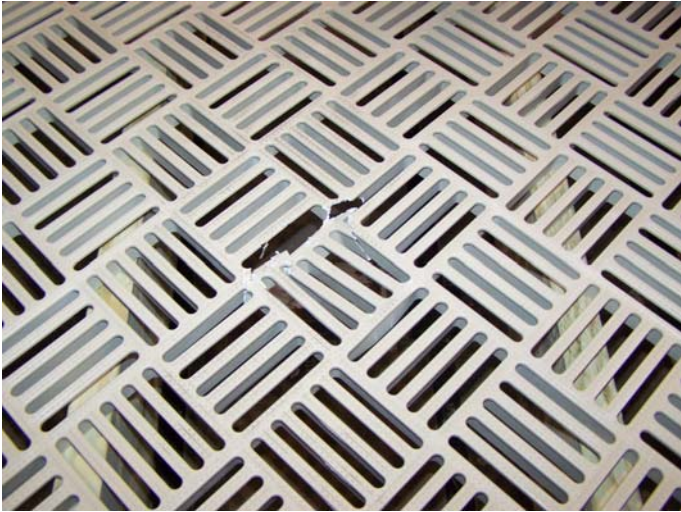





4.0 Test Results – Concentrated Load cont.

Set Up – True Harbor Panels	Set Up - Competitor
	
Testing Position A: Along Long Cont. Rib	Testing Position B: 3 Ribs Long-Short-Long
	



4.0 Test Results – Concentrated Load cont.

<p><u>Example of Typical Breakage:</u> <u>RA#1 30% Foam Pos A.</u></p>	<p><u>Example of Typical Breakage</u> <u>RA#1 30% Foam Pos. B</u></p>
	
<p>RA#10 Competitor: During Testing</p>	<p>RA#10 Competitor: Post Test</p>
	



5.0 Test Procedure – Load at Rupture and L/180

The baseline flexural properties were determined in accordance with ASTM D6109-05, Method A procedures modified for quarter point loading. A cylindrical 4” diameter by 11.5” length wood loading nose assembly attached to a calibrated MTS Servo Hydraulics system was used to apply a load on the test samples till the part either ruptured or reached the 3% strain limit. The testing parameters used for this test are outlined below:

Testing Position	Flatwise	Radius of Loading Nose	2”
True Harbor Sample Size	48” x 48” x 1.2”	True Harbor # of Samples	4
Competitor Sample Size	48” x 12” x 1.25”	Competitor # of Samples	3
Support Span	16”	Testing Machine	MTS Servo Hydraulics
Testing Speed – True Harbor	0.395”/min		
Testing Speed - Competitor	0.378”/min		



6.0 Test Results – Load at Rupture and L/180

Load At Rupture & L/180: 16" Support Span

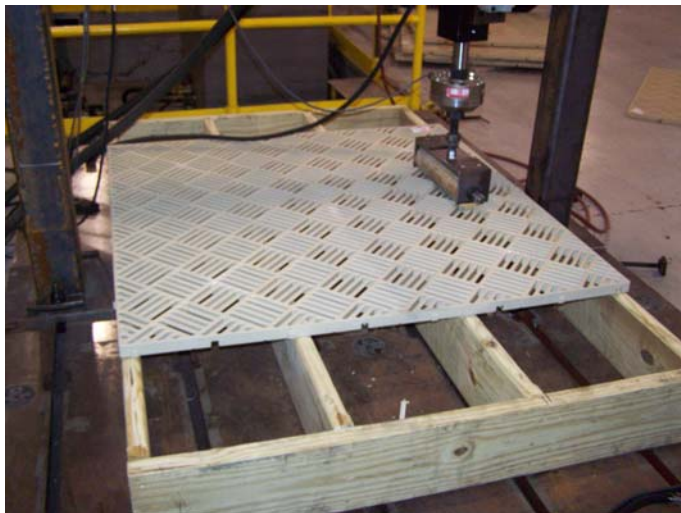
Load At Rupture: the point where the board samples either ruptured or reached the three percent strain limit.

3% Strain Limit: Competitor - 32.7mm

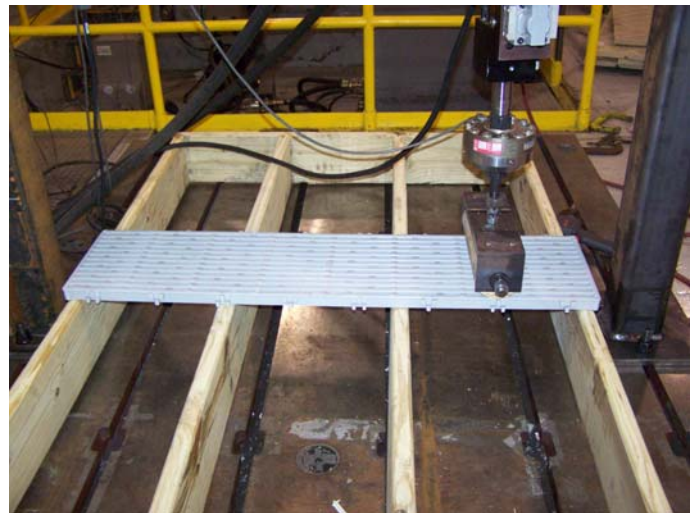
L/180: Load at the deflection corresponding to the support span (L) divided by 180 = 0.089 inches

Sample ID	Load at Rapture (lbf)	Load at L/180 (lbf)	Comments
RA#5 30% Foam: Not Bolted	602.6	70.9	Ruptured
RA#6 20% Foam: Not Bolted	600.2	36.8	Ruptured
RA#7 30% Web: Not Bolted	591.0	59.7	Ruptured
RA#8 20% Web: Not Bolted	586.9	31.9	Ruptured
RA#5-2 Competitor: Not Bolted	610.8	34.5	Ruptured
RA#6-2 Competitor: Not Bolted	444.8	116.3	Strain Limit
RA#6-2 Competitor: Bolted	718.9	105.4	Strain Limit
RA#7-2 Competitor: Not Bolted	395.8	135.5	Strain Limit
RA#7-2 Competitor: Bolted	568.3	138.0	Strain Limit

True Harbor Panel Set Up

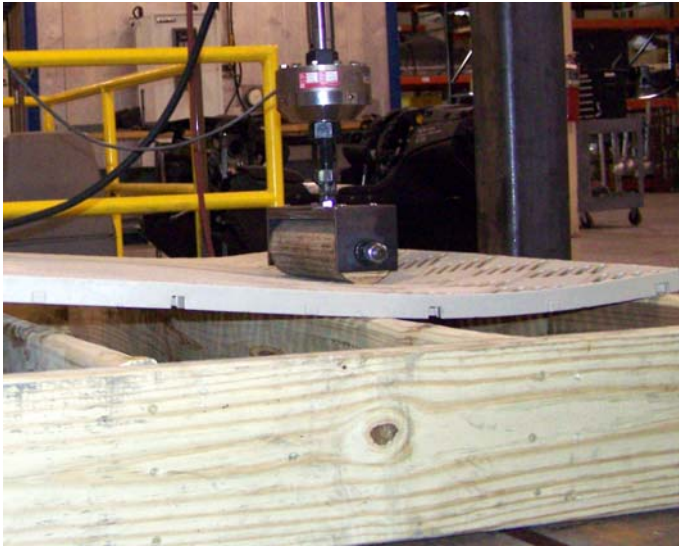
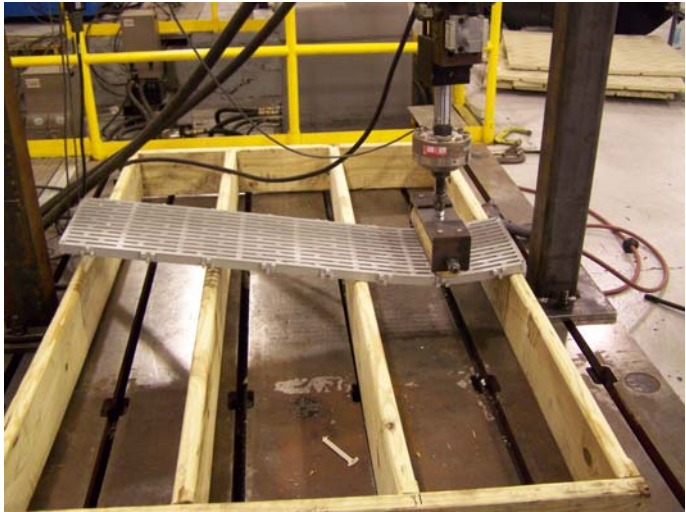




Competitor Panel Setup





6.0 Test Results – Load at Rupture and L/180 cont.

Typical True Harbor Panel Under Load	Typical Competitor Panel Under Load
	
RA#7 30% Web: Example of Typical Breakage	Typical Post Deformation of Competitor Panels
	



7.0 Test Procedure – Creep Relaxation Test

The baseline flexural properties were determined in accordance with ASTM D6109-05, Method A procedures modified for quarter point loading. A cylindrical 4” diameter by 11.5” length wood loading nose assembly attached to a calibrated MTS Servo Hydraulic system was used to produce a load corresponding to 100 psf, 140 psf, 160 psf, and 200 psf. The 200 psf load was left in place for 24 hours and the total deflection was recorded. The load was removed and deflection was recorded immediately. Deflection was recorded again after a 24 hr recovery period. The testing parameters used for the test are outlined below:

Testing Position	Flatwise	Radius of Loading Nose	2”
True Harbor Sample Size	48” x 48” x 1.2”	True Harbor # of Samples	1
Support Span	16”	Testing Machine	MTS Servo Hydraulics

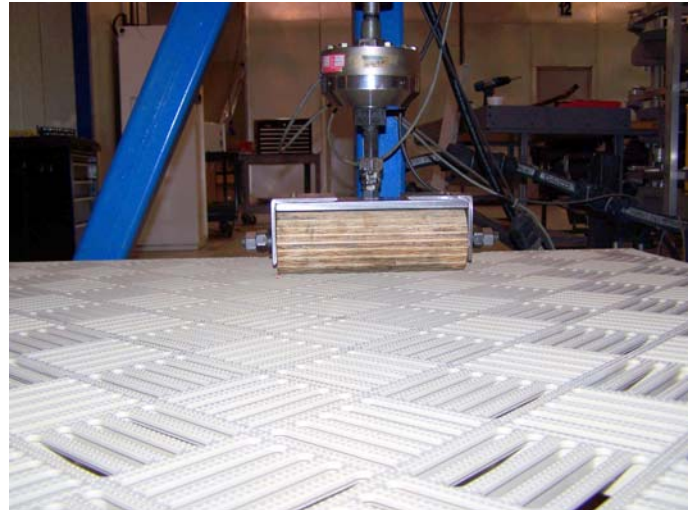
8.0 Test Results – Creep Relaxation Test

<u>Creep Relaxation</u>	
Surface area: 0.0598 ft ²	
Sample ID	Deflection (inches) RA#9 30% Foam
100 psf = 5.98lbs	0.0135
120 psf = 7.18lbs	0.0161
140 psf = 8.37lbs	0.0189
160 psf = 9.57lbs	0.0224
200 psf = 11.96lbs	0.0277
Total deflection with 200 psf for 24hrs	0.0817
Deflection after 200 psf was removed	0.0381
Permanent Set after 24hrs	0.0124
% Recovered Deflection	85%



8.0 Test Results – Creep Relaxation Test cont.

Set Up Photo: RA#9 30% Foam



9.0 Instrumentation and Calibration

Description	Manufacturer	Model Number	Asset Number	Cal. Due
Servo Rig #2	MTS	244.21	20019-B	5/14/09
Servo Rig #3	MTS	244.12	20019-C	5/14/09
Load Cell #2	Futek	L2902	20019-F	5/14/09
Load Cell #3	Futek	L2902	20019-E	5/14/09



10.0 Sample Disposition

The tested samples were retained at Reliable Analysis for customer pick up.

Reliable Analysis, Inc.

Winston Seto
Laboratory Manager

Tested by: David Mui
Written by: David Mui