

Bracket Up-lift Test

As requested, Testing Engineers, Inc. performed the subject testing on the prefabricated samples submitted on July 12, 1999. Testing was performed on a 400 kip Tinius Olsen universal testing machine (calibration traceable to N.I.S.T.)

SAMPLE DESCRIPTION

Each test assembly consisted of two (2) 30" long joist simulators (normal 2" x 6") attached to an 18" long deck board (normal 2" x 6") with Deckmaster Hidden Brackets". The joist spacing was 16". A total of twenty (20) samples were submitted. Ten (10) samples were fabricated using Douglas fir joists and redwood decking, five (5) with 1- ¼" long screws and five (5) with 1- ¾" long screws.

PROCEDURE

The joists of each test assembly were placed on steel supports on the bed of the test machine. An axial compressive load was applied to the center of underside of the deck board using a 6" x 6" x 0.187" thick bearing plate and swivel-head load applicator. The direction of loading simulates an up-lift force on the deck board. A dial indicator accurate to 0.001" was placed as close to the center of the decking board. A dial indicator vertical movement of the deck board with respect to the bed of the test machine was recorded at 100-pound interval until failure. Loading was applied at a gradual rate until failure. Please see attached photograph page 7 for test set-up.

The up-lift test was conducted using Pressure Treated Doug Fir, with a specific gravity of .46 -.50, wood species with lower specific gravities will generate lesser values.

RESULTS

The average ultimate loads: Doug fir to redwood with 1 ¼" screws is 1,012 lbs. Doug fir to redwood with 1 ¾" screws is 1,154 lbs. Pressure treated wood with 1 ¼" screws is 1,180 lbs. Pressure treated wood with 1 ¾" screws is 1,204 lbs. See attached tables 1 through 4 for complete test data.

Doug Fir with redwood decking using 1 ¼" screws

Sample #1		Sample #2	
Load (lbs)	Displacement (in.)	Load (lbs)	Displacement (in.)
0	0	0	0
100	0.016	100	0.017
200	0.032	200	0.03
300	0.044	300	0.042
400	0.055	400	0.051
500	0.063	500	0.06
600	0.072	600	0.073
700	0.082	700	0.084
800	0.092	800	0.095
900	0.101	900	0.108
1000	0.112	1000	0.12
1100	1.026	1100	0.135
1200	0.152	1200	0.157
1300	0.2	1300	0.2
Ultimate load (lbs)	1310	Ultimate load (lbs)	1290

Failure mode: one (1) screw pulled from wood - one (1) screw pulled through track

Failure mode: screws pulled from wood

Sample #3		Sample #4	
Load (lbs)	Displacement (in.)	Load (lbs)	Displacement (in.)
0	0	0	0

100	0.026
200	0.042
300	0.054
400	0.066
500	0.077
600	0.084
700	0.093
800	0.104
900	0.112
1100	0.126
Ultimate load (lbs)	1190

*Failure mode:
screws pulled from track*

Sample #5

Load (lbs)	Displacement (in.)
0	0
100	0.019
200	0.025
300	0.043
400	0.055
500	0.07
600	0.92
Ultimate load (lbs)	620

*Failure mode:
screws pulled through deck*

100	0.02
200	0.043
300	0.058
400	0.072
500	0.089
600	0.12
Ultimate load (lbs)	650

*Failure mode:
screws pulled through deck*

Doug Fir with redwood decking using 1 3/4" Screws

Sample #1

Load (lbs)	Displacement (in.)
0	0
100	0.015
200	0.026
300	0.038
400	0.048
500	0.06
600	0.071
700	0.085
800	0.01
900	0.114

Sample #2

Load (lbs)	Displacement (in.)
0	0
100	0.014
200	0.26
300	0.039
400	0.048
500	0.058
600	0.07
700	0.081
800	0.095
900	0.112

1000	0.13
1100	0.148
1200	0.182
1300	0.222
1400	0.274
Ultimate load (lbs)	1450
<i>Failure mode: screws pulled through track</i>	

Sample #3	
Load (lbs)	Displacement (in.)
0	0
100	0.014
200	0.028
300	0.03
400	0.051
500	0.082
600	0.076
700	0.093
800	0.126
Ultimate load (lbs)	870
<i>Failure mode: screws pulled through track</i>	

1000	0.131
1100	0.154
1200	0.178
Ultimate load (lbs)	1260
<i>Failure mode: screws pulled through track</i>	

Sample #4	
Load (lbs)	Displacement (in.)
0	0
100	0.02
200	0.043
300	0.058
400	0.072
500	0.089
600	0.12
700	0.075
800	0.94
Ultimate load (lbs)	850
<i>Failure mode: screws pulled through deck</i>	

Pressure treated joist and decking using 1 ¼" screws

Sample #1	
Load (lbs)	Displacement (in.)
0	0
100	0.025
200	0.048
300	0.069
400	0.087
500	0.1047
600	0.121
700	0.1475
800	0.168
900	0.188
1000	0.209
1100	0.228
1200	0.246

Sample #2	
Load (lbs)	Displacement (in.)
0	0
100	0.01
200	0.0256
300	0.039
400	0.053
500	0.065
600	0.077
700	0.091
800	0.106
900	0.12
1000	0.137
1100	0.163
1200	0.195

1300	0.275
Ultimate load (lbs)	1400

Failure mode: one (1) screw pulled from wood
- one (1) screw pulled through track

Sample #3

Load (lbs)	Displacement (in.)
0	0
100	0.03
200	0.059
300	0.078
400	0.096
500	0.114
600	0.12
700	0.145
800	0.166
900	0.185
1000	0.213
Ultimate load (lbs)	1010

Failure mode:
screws pulled from track

Sample #5

Load (lbs)	Displacement (in.)
0	0
200	0.033
400	0.056
600	0.082
800	0.113
1000	0.148
Ultimate load (lbs)	1080

Failure mode:
screws pulled through deck

Ultimate load (lbs)	1300
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Failure mode:
screws pulled from wood

Sample #4

Load (lbs)	Displacement (in.)
0	0
100	0.021
200	0.04
300	0.054
400	0.072
500	0.088
600	0.101
700	0.125
800	0.125
900	0.152
1100	0.195
Ultimate load (lbs)	1110

Failure mode:
screws pulled through deck

Pressure treated joist and decking using 1 3/4" screws

Sample #1

Load (lbs)	Displacement (in.)
0	0
100	0.012
200	0.023
300	0.037

Sample #2

Load (lbs)	Displacement (in.)
0	0
100	0.022
200	0.038
300	0.054

400	0.047
500	0.58
600	0.7
700	0.82
800	0.96
900	0.112
1000	0.127
1100	0.149
1200	0.173
1300	0.214
Ultimate load (lbs)	1350

Failure mode: screws pulled through track

400	0.068
500	0.074
600	0.083
700	0.093
800	0.104
900	0.119
1000	0.121
1100	0.145
1200	0.157
1300	0.202
Ultimate load (lbs)	1280

*Failure mode:
screws pulled through track*

Sample #3	
Load (lbs)	Displacement (in.)
0	0
100	0.02
200	0.035
300	0.049
400	0.059
500	0.072
600	0.087
700	0.096
800	0.11
900	0.122
1000	0.137
1200	0.173
1400	0.28
Ultimate load (lbs)	1400

*Failure mode:
screws pulled from track*

Sample #4	
Load (lbs)	Displacement (in.)
0	0
100	0.025
200	0.048
300	0.069
400	0.085
500	0.0101
600	0.115
700	0.127
800	0.14
900	0.156
1100	0.172
Ultimate load (lbs)	1220

*Failure mode:
screws pulled through deck*

Sample #5	
Load (lbs)	Displacement (in.)
0	0
200	0.045
400	0.078
600	0.121
800	0.222
Ultimate load (lbs)	810

Failure mode:
screws pulled through deck

Natural Wood Products

		Wood Type	Specific Gravity
IPE	solid	Hardwood	1.06
Philippine Mahogany	solid	Hardwood	0.43
Southern Yellow Pine	solid	Softwood	0.48
Western Red Cedar	solid	Softwood	0.32
Redwood	solid	Softwood	0.35

Wood - Plastic Composites*

Product	Form	Plastic Type	Relative Density/Specific Gravity
Fiberon	solid	polyethylene	1.11
EverGrain	solid	polyethylene	1.06
CorrectDeck	solid	polyethylene	1.15
Rhino Deck	solid	polyethylene	1.13
SmartDeck	solid	polyethylene	1.1
TimberTech	channeled	polyethylene	1.22
Trex	solid	polyethylene	0.92
WeatherBest	solid	polyethylene	1.2
WeatherBest	solid	polyethylene	1.2

Pure Plastic Components

Product	Form	Plastic Type	Relative Density/Specific Gravity
Bedford (reinforced)	solid	polyethylene	1.11
Bedford (unreinforced)	solid	polyethylene	0.97
Ecoboard	solid	polyethylene	0.85
Eon	solid	polyethylene	0.95
EverNew	channeled	polyethylene	1.44
Maxituf	hollow	polyvinyl chloride	1.94