Progressive Engineering Inc.

Step Load Cycle Test

Client: I-Stair Systems, Inc.

Test Specimen: 44" wide steps using 10" Treads and 7-1/2" Risers, cut from 23/32" OSB, with I-Stair brackets fastened at each end to sections of OSB. Adhesive was applied between the I-Stair brackets at the contact areas with the tread and risers, as well as, between the tread and top of the riser. An "L" shaped gang nail reinforcement was used on the underside of the tread-to-riser intersection. *The steps were provided to PEI assembled with the pneumatic load cycling equipment installed.*

Test Details: A concentrated load of 300 lbf was applied to the center of the tread depth and width using a 2" x 2" loading nose. The cycling was intended to evaluate the connection of the tread-to-riser gang nail brace. Each cycle consisted of: (1) 3 second of load application and (2) 3 second with the load removed. Deflection readings were taken from two dial indicators that were placed on the underside of the step, one (1) under the load point and the other approximately six inches in from the end and centered on the tread depth. Deflection was recorded with the full load applied and with the load removed, to monitor changes in the step performance. Notes and readings were recorded at the beginning and end of each weekday, unless an issue occurred in which data was recorded upon notice of issue. See notes below for deflection and cycle information.

Date	Time	Cycle Count	Temp	Hum	Center Defl	End Defl	Comments / Observations
5/6/2016	8:10 AM	1	66	47	0.000	0.000	Started step cycling test.
					0.053	0.006	
5/6/2016	10:40 AM	650	-	-	0.003	0.001	Installed new loading plate w/ welded nut onto cylinder to keep cycle counter in contact.
					0.053	0.006	
5/6/2016	11:15 AM	788	71	46	0.003	0.001	Stopped cycling over weekend.
					0.053	0.006	
5/9/2016	6:50 AM	788	67	48	0.002	0.002	Start of weekly progress readings.
5/13/2016	10:45 AM	50,417	68	59	0.010	0.000	Stopped cycling over weekend.
					0.062	0.005	
5/14/2016	2:00 PM	67,117	-	-	-	-	Start of weekly progress readings, readings not recorded.
					-	-	
5/20/2016	11:35 AM	152,305	69	38	0.020	0.005	End of weekly progress readings.
					0.073	0.009	
5/23/2016	7:00 AM	192,762	70	47	0.023	0.005	Start of weekly progress readings.
					0.076	0.012	
5/27/2016	1:40 PM	253,842	-	-	-	-	End of weekly progress readings.
					-	-	
5/31/2016	7:45 AM	253,842	70	56	0.020	0.001	Start of weekly progress readings.
					-	-	
6/3/2016	12:05 PM	263,929	-	-	0.022	0.003	End of weekly progress readings.
					0.076	0.008	

Progressive Engineering Inc.

Step Load Cycle Test

Client: I-Stair Systems, Inc.

Test Specimen: 44" wide steps using 10" Treads and 7-1/2" Risers, cut from 23/32" OSB, with I-Stair brackets fastened at each end to sections of OSB. Adhesive was applied between the I-Stair brackets at the contact areas with the tread and risers, as well as, between the tread and top of the riser. An "L" shaped gang nail reinforcement was used on the underside of the tread-to-riser intersection. *The steps were provided to PEI assembled with the pneumatic load cycling equipment installed.*

Test Details: A concentrated load of 300 lbf was applied to the center of the tread depth and width using a 2" x 2" loading nose. The cycling was intended to evaluate the connection of the tread-to-riser gang nail brace. Each cycle consisted of: (1) 3 second of load application and (2) 3 second with the load removed. Deflection readings were taken from two dial indicators that were placed on the underside of the step, one (1) under the load point and the other approximately six inches in from the end and centered on the tread depth. Deflection was recorded with the full load applied and with the load removed, to monitor changes in the step performance. Notes and readings were recorded at the beginning and end of each weekday, unless an issue occurred in which data was recorded upon notice of issue. See notes below for deflection and cycle information.

Date	Time	Cycle Count	Temp	Hum	Center Defl	End Defl	Comments / Observations
6/6/2016	8:45 AM	305,208	68	68	0.020	0.002	Start of weekly progress readings.
					0.073	0.006	
6/10/2016	11:25 AM	400,700	75	67	0.024	0.002	End of weekly progress readings.
					0.079	0.007	
6/13/2016	7:15 AM	441,416	72	44	0.026	0.005	Start of weekly progress readings.
					0.079	0.009	
6/17/2016	8:30 AM	499,582	70	60	-	-	End of weekly progress readings.
					-	-	
6/20/2016	1:50 PM	543,114	83	57	-	-	Start of weekly progress readings.
					-	-	
6/23/2016	2:50 PM	586,914	79	68	-	-	Stopped cycling over weekend.
					-	-	
6/27/2016	6:45 AM	586,914	72	66	-	-	Started step cycling test.
					-	-	
6/30/2016	11:15 AM	633,414	72	40	-	-	Adjusted 2x2 loading plate
					-	-	
7/1/2016	10:10 AM	647,164	71	60	-	-	Stopped cycling over weekend.
					-	-	
7/5/2016	6:50 AM	647,164	72	63	-	-	Started step cycling test.
					-	-	

Progressive Engineering Inc.

Step Load Cycle Test

Client: I-Stair Systems, Inc.

Test Specimen: 44" wide steps using 10" Treads and 7-1/2" Risers, cut from 23/32" OSB, with I-Stair brackets fastened at each end to sections of OSB. Adhesive was applied between the I-Stair brackets at the contact areas with the tread and risers, as well as, between the tread and top of the riser. An "L" shaped gang nail reinforcement was used on the underside of the tread-to-riser intersection. *The steps were provided to PEI assembled with the pneumatic load cycling equipment installed.*

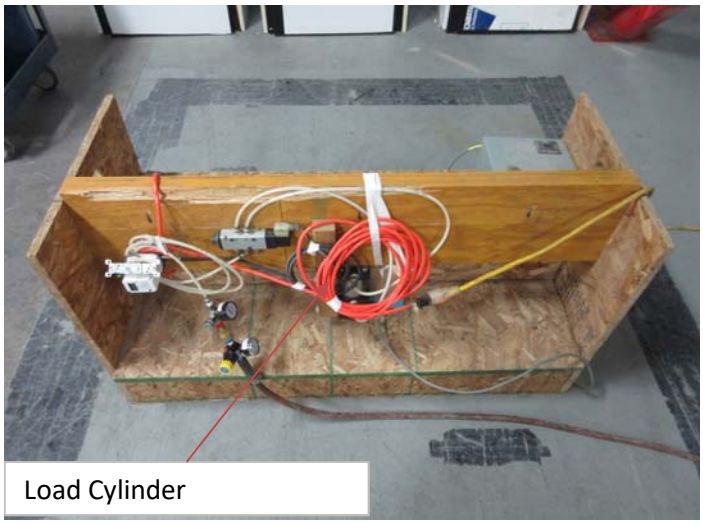
Test Details: A concentrated load of 300 lbf was applied to the center of the tread depth and width using a 2" x 2" loading nose. The cycling was intended to evaluate the connection of the tread-to-riser gang nail brace. Each cycle consisted of: (1) 3 second of load application and (2) 3 second with the load removed. Deflection readings were taken from two dial indicators that were placed on the underside of the step, one (1) under the load point and the other approximately six inches in from the end and centered on the tread depth. Deflection was recorded with the full load applied and with the load removed, to monitor changes in the step performance. Notes and readings were recorded at the beginning and end of each weekday, unless an issue occurred in which data was recorded upon notice of issue. See notes below for deflection and cycle information.

Date	Time	Cycle Count	Temp	Hum	Center Defl	End Defl	Comments / Observations
7/11/2016	10:30 AM	733,658	74	74	0.026	0.005	Discovered the setup had shifted on 6/17/16, so deflection gauges were reset. The permanent set deflection was set equal to the 6/13/16 values.
					0.072	0.010	
7/15/2016	11:30 AM	792,002	75	59	0.028	0.005	End of weekly progress readings.
					0.072	0.010	
7/22/2016	12:30 PM	893,408	76	48	0.031	0.005	End of weekly progress readings.
					0.075	0.011	
7/25/2016	7:30 AM	933,658	72	49	0.032	0.005	Start of weekly progress readings.
					0.076	0.011	
8/1/2016	7:00 AM	1,033,430	73	48	0.034	0.006	Stopped testing, cycling complete.
					0.080	0.013	

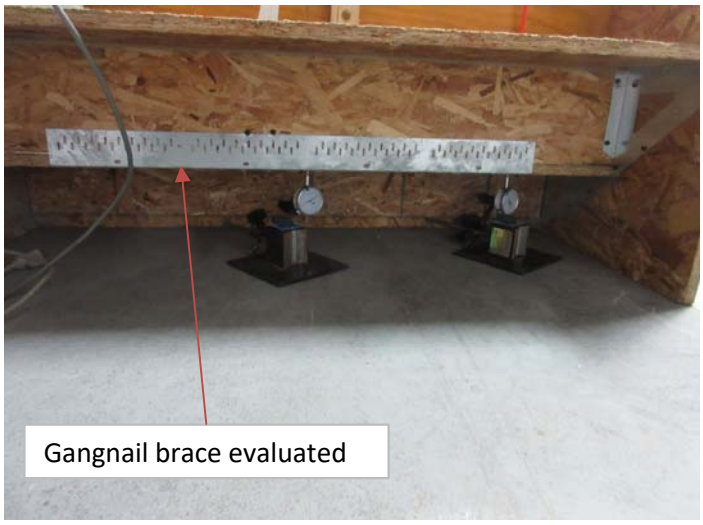
Shaded cell indicates deflection with 300 lbf applied

Shaded cell indicates deflection with no load applied

Conclusion: The stair-cycle test was a success, with no failures occurring, as well as no visual damage to the I-Stair brackets or gang nail brace. The tread surface in contact with the loading nose was slightly indented by 2x2 loading plate and had a few loose or frayed strands around the perimeter of the loading plate. The actual permanent set and deflection under load may vary from that shown at the completion of the test, due to the shifting in the sample on 6/17/16, however it was included to show that there was no significant material breakdown.

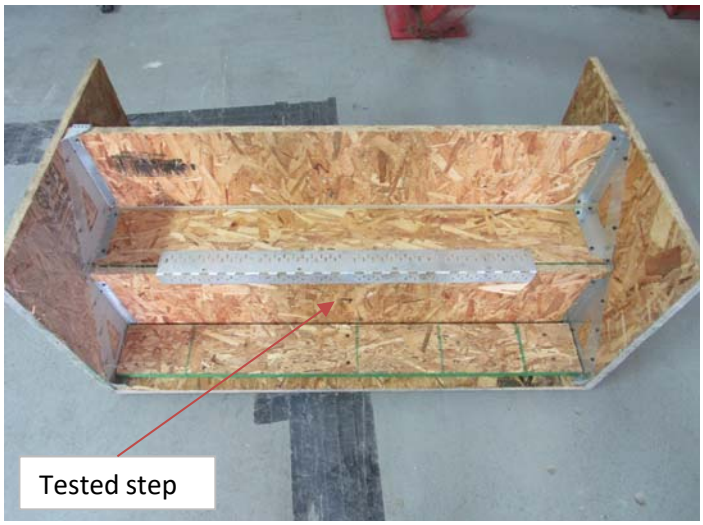


Test Setup



Test Setup - Dial Indicator Placement

2" x 2" loading nose



Underside view of test sample

Gangnail brace after 1,000,000+ cycles

I-Stair Brackets after 1,000,000+ cycles

Tread surface after 1,000,000 cycles