RICE ENGINEERING

ASTM E985 TEST REPORT

GR2457 HCB-10 Base Shoe and PG2475 Pad and Isolator

Rendered to:
R&B Wagner, Inc.
10600 W Brown Deer Rd
Milwaukee, WI 53224

Report Number:	R15-06-210
Set-up Date:	09/25/2015
Test Date:	09/25/2015
Report Date:	10/06/2015

Project Identification: GR2457HCB-10 base shoe with PG2475 pad and isolator ASTM E985 Testing

Project Scope: Rice Engineering was contacted by R&B Wagner, Inc. to witness testing of their GR2457 base shoe guardrail system, specifically the amount of deflection that would occur in 1/2" thick monolithic tempered glass when pulled to design loads as described in ASTM E985 "Standard Specification for Permanent Metal Railing Systems and Rails for Buildings". On September 25, 2015, Joseph Bauer of Rice Engineering witnessed testing for the three different configurations. The testing was performed on-site at the R&B Wagner facility and was conducted by Kelly Bauserman.

Conclusions: The monolithic glass lite was tested to a maximum deflection of 2.322" on the end and 1.743" at the center (ultimate test load of 365 lbf). The allowable deflection was 3.5" at the left and 2.25" at the center. The residual deflection (measured at 90 lbf) was 0.125". The allowable residual deflection was 0.45". There were no signs of deformation on the base shoe or any problems with the pad and isolators, therefore 1/2" monolithic glass passed the ASTM E985 test.

Prepared & Witnessed By:

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Joseph D. Bauer, Wisconsin P.E.

WAGNER COMPANIES

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MASTER TABLE

ZERO POINT FOR CALCULATIONS	
Height of Rail (h) (in.)	42
Length of Rail (l) (in.)	48
Max Left Deflection [h/12] (in.)	3.5
Max Mid Deflection [(h/24)+(l/96)] (in.)	2.25
Max Residual Deflection (20% of Max Mid) (in.)	0.45

Front

All inputs should be unadjusted read outs from test	Actual lbsf	Mid	Actual lbsf	Left *(If Applicable)*	Actual lbsf	Left 2 *(If Applicable)*
Deflection Reading @ 0 lbsf	0	4.427	0	4.686	0	4.652
Deflection Reading @ Pre-Load (180 lbsf)	183	3.084	180	3.031	184	2.949
Deflection Reading @ Released Test Load (1/2 Pre-load)	91	3.639	89	3.689	91	3.631
Deflection Reading @ 150 lbsf	150	3.258	156	3.174	151	3.212
Deflection Reading @ 200 lbsf	200	2.961	201	2.832	204	2.816
Deflection Reading @ 250 lbsf	250	2.663	253	2.439	254	2.443
Deflection Reading @ 300 lbsf	303	2.355	301	2.035	301	2.086
Deflection Reading @ Ultimate Test Load (365 lbsf)	367	1.925	364	1.532	366	1.602
Deflection Reading @ Released Test Load (1/2 Pre-load)	90	3.566	92	3.564	92	3.618

Back

All inputs should be unadjusted read outs from test	Actual lbsf	Mid	Actual lbsf	Left *(If Applicable)*	Actual lbsf	Left 2 *(If Applicable)*
Deflection Reading @ 0 lbsf	0	4.618	0	4.725	0	4.711
Deflection Reading @ Pre-Load (180 lbsf)	182	3.415	181	3.182	180	3.199
Deflection Reading @ Released Test Load (1/2 Pre-load)	90	3.987	90	3.936	92	3.888
Deflection Reading @ 150 lbsf	151	3.602	150	3.427	153	3.41
Deflection Reading @ 200 lbsf	202	3.285	200	3.027	202	3.014
Deflection Reading @ 250 lbsf	251	2.98	250	2.624	251	2.605
Deflection Reading @ 300 lbsf	305	2.634	300	2.21	302	2.168
Deflection Reading @ Ultimate Test Load (365 lbsf)	366	2.244	366	1.614	367	1.635
Deflection Reading @ Released Test Load (1/2 Pre-load)	90	3.955	91	3.915	91	3.903

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Railing System Load/Deflection Testing

Test Type:	Horizontal Load to 365 lbs per ASTM E985 per section 7.1.5	Submitted By:	KGB	Submitted On:	10/06/15
Test Focus (Part #s):	48" Long GR2457HCB-10, 1/2" Monolithic, PGISO50, PG2475				
Railing Type:	Shoe molding, 4 panel grips, with glass and unsupported sides				
Railing Specifications:	42" (TOR) No caprail. 12" C-C hole locations				
Test Method:	365 lbf load per ASTM standards				

Test Specifications per ASTM E985		Results				
	System Calculations	Load (lbsf)	Displacement (in.)			Test Avg.
			Midrail	Left	Left 2	
Pre Load	**180 (lbsf)**	Preload	0.555	0.658	0.682	0.6317
Released Test Load	**90 (lbsf)**	RTL	0	0	0	0.0000
		150	0.381	0.515	0.419	0.4383
Ultimate Test Load	**365 (lbsf)**	200	0.678	1	0.815	0.7833
		250	0.976	1.25	1.188	1.1380
Deflection Specifications Per ASTM E985		300	1.284	1.654	1.545	1.4943
Max Mid Deflection	**(h/24)+(l/96) = 2.25 in**	UTL	1.714	2.157	2.029	1.9667
Max Left Deflection	**(h/12) = 3.5 in**	RD	0.073	0.125	0.013	0.0703
Residual Deflection (At RTL)	**20% of MD = 0.45 in**					

Notes

Midrail at 0 lbf =4.1

Potentiometer cannot be zeroed, so calculations are done manually

Shoe mounted to steel

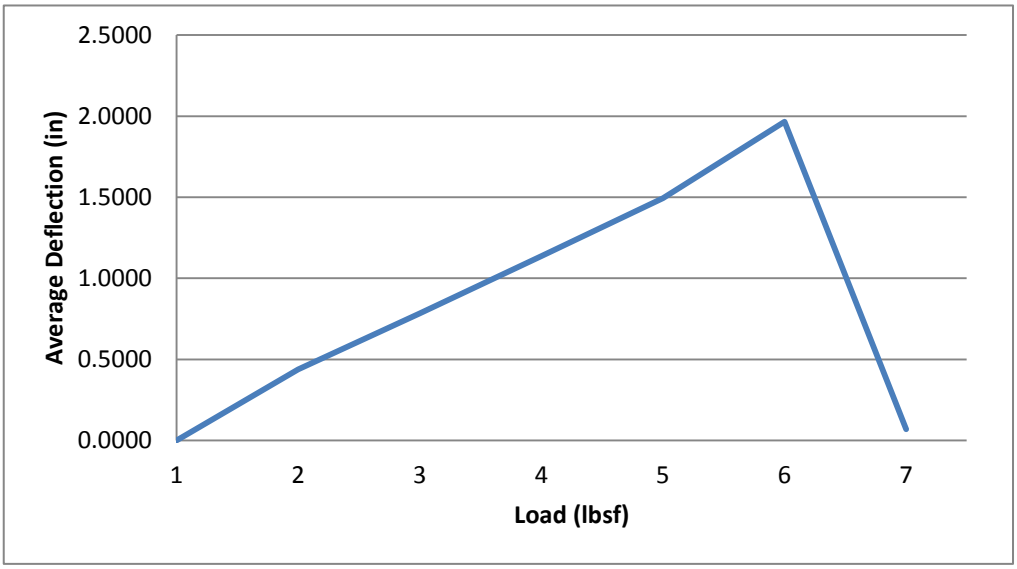
Conclusions

Rail meets ASTM Standard for Max. Allowed Deflection for Mid

Rail meets ASTM Standard for Residual Deflection

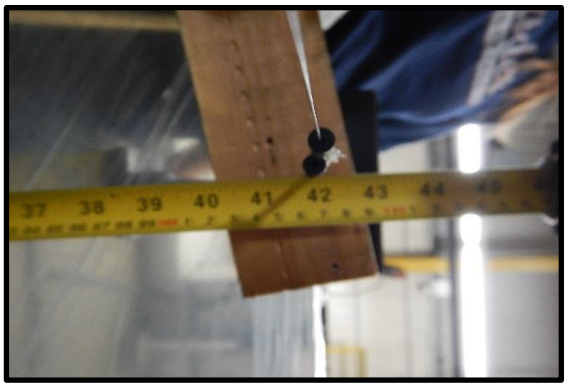
Rail meets ASTM Standard for Max. Allowed Deflection for Left 1

Rail meets ASTM Standard for Max. Allowed Deflection for Left 2

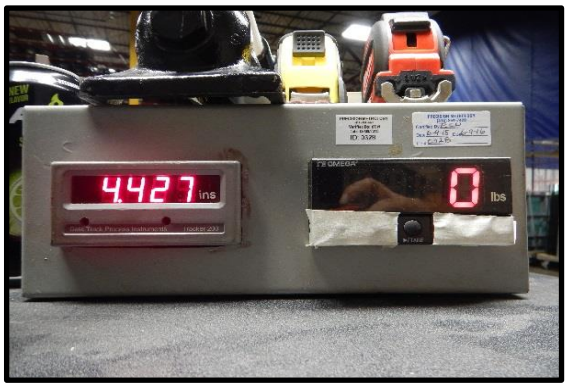


TEST PHOTOS

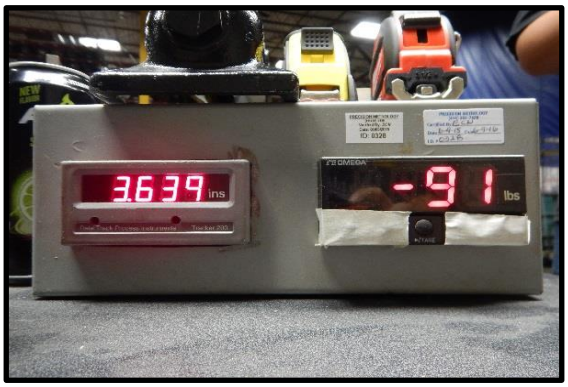
Initial Setup: Mid



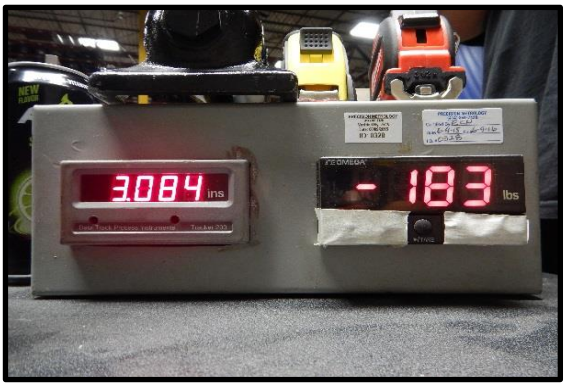
Preload of 180 lbsf



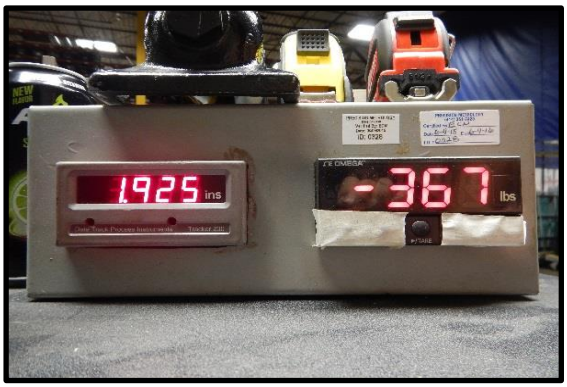
Release Test Load of 90 lbsf



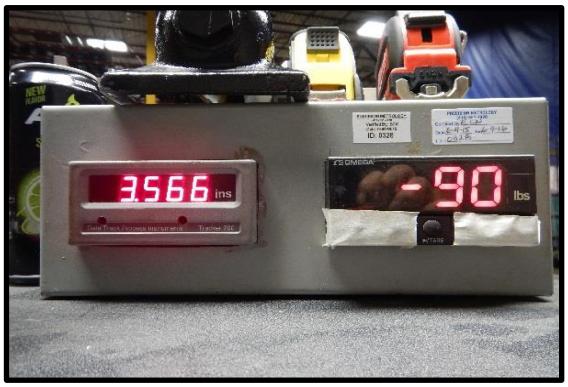
Preload of 180 lbsf
Actual Deflection of 0.555 in



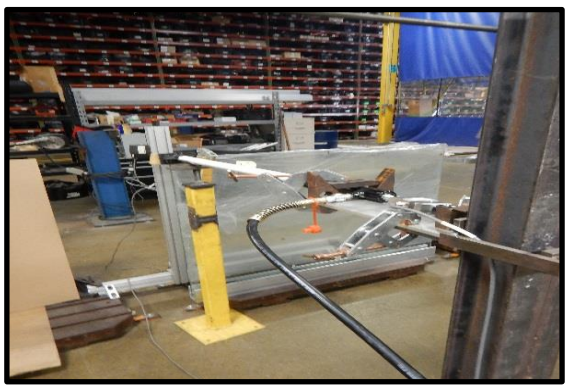
Ultimate Test Load of 365 lbsf
Actual Deflection of 1.714 in

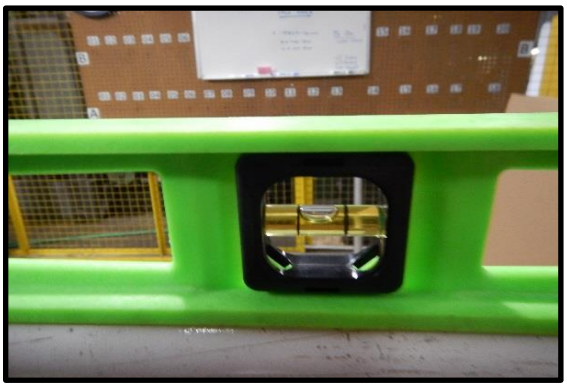


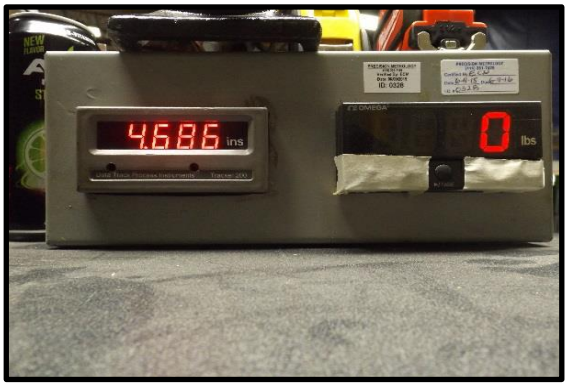
Residual Deflection at 90 lbsf



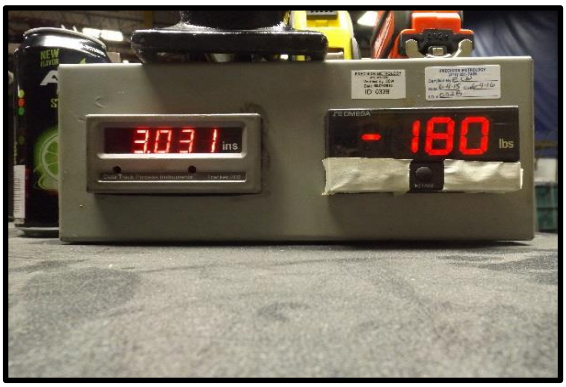
Initial Setup: Left 1







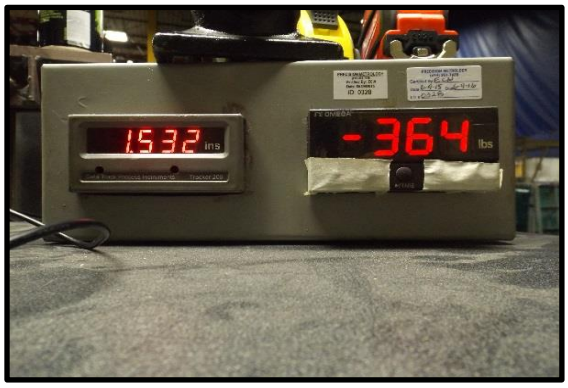
Preload of 180 lbsf
Actual Deflection of 0.658 in



Release Test Load of 90 lbsf

Ultimate Test Load of 365 lbsf

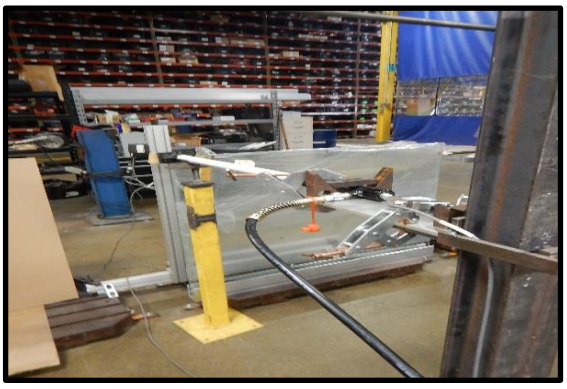
Actual Deflection of 2.157 in

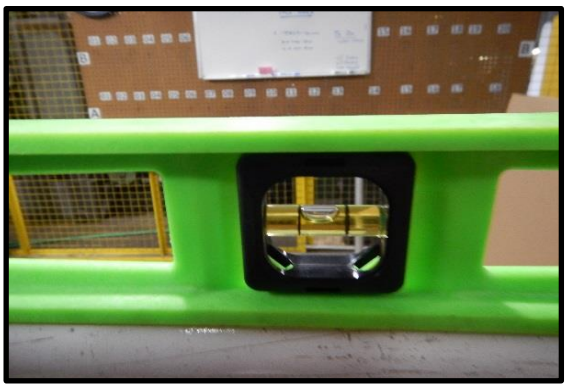


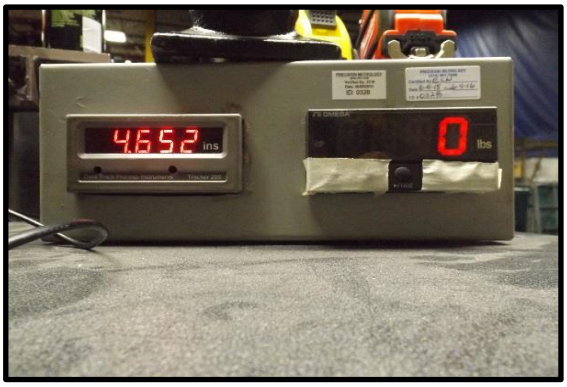
Residual Deflection at 90 lbsf

Actual Deflection of 0.125 in

Initial Setup: Left 2

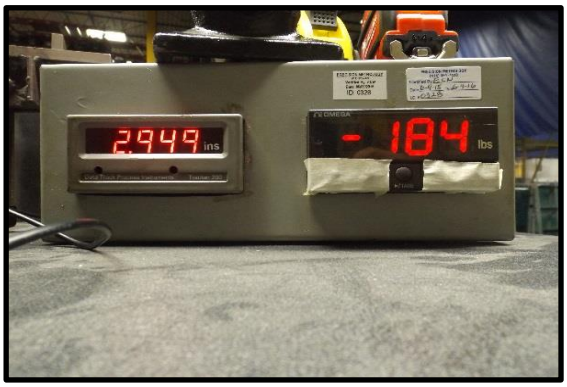






Preload of 180 lbsf
Actual Deflection of 0.682 in

Release Test Load of 90 lbsf



Ultimate Test Load of 365 lbsf

Actual Deflection of 2.029 in

Residual Deflection at 90 lbsf

Actual Deflection of 0.013 in

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Test Method:	365 lbf load per ASTM standards				

Test Specifications per ASTM E985	
	System Calculations
Pre Load	**180 (lbsf)**
Released Test Load	**90 (lbsf)**
Ultimate Test Load	**365 (lbsf)**
Deflection Specifications Per ASTM E985	
Max Mid Deflection	**(h/24)+(l/96) = 2.25 in**
Max Left Deflection	**(h/12) = 3.5 in**
Residual Deflection (At RTL)	**20% of MD = 0.45 in**

Results

Load (lbsf)	Displacement (in.)			Test AVG
	Midrail	Left	Left 2	
Preload	0.572	0.754	0.689	0.6717
RTL	0	0	0	0.0000
150	0.385	0.509	0.478	0.45733333
200	0.702	1	0.874	0.8283
250	1.007	1.312	1.283	1.2007
300	1.353	1.726	1.72	1.5997
UTL	1.743	2.322	2.253	2.1060
RD	0.032	0.021	-0.015	0.0127

Notes

Midrail at 0 lbf = 4.38 in

Potentiometer cannot be zeroed, so calculations are done manually

Shoe mounted to steel

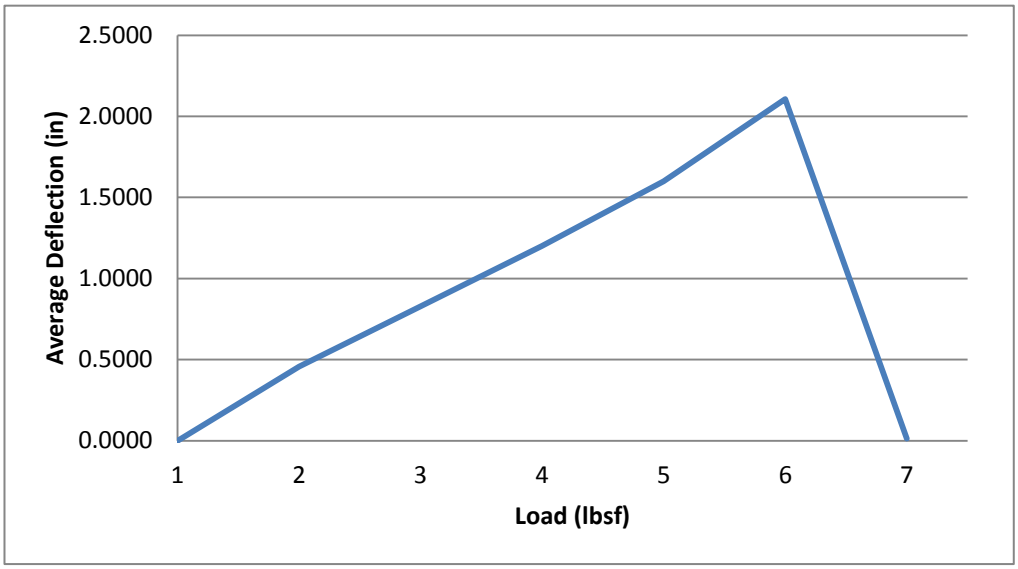
Conclusions

Rail meets ASTM Standard for Max. Allowed Deflection for Mid

Rail meets ASTM Standard for Residual Deflection

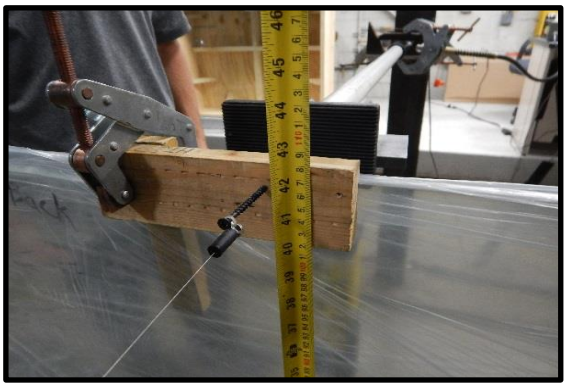
Rail meets ASTM Standard for Max. Allowed Deflection for Left 1

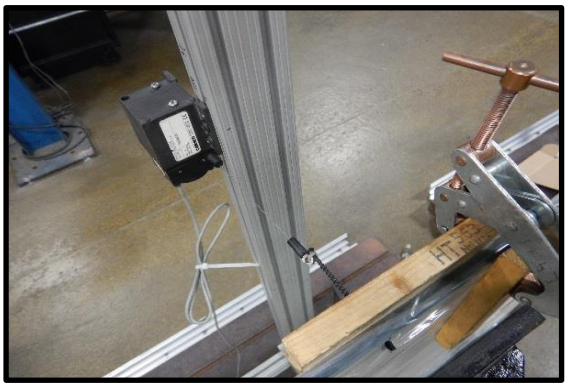
Rail meets ASTM Standard for Max. Allowed Deflection for Left 2



TEST PHOTOS

Initial Setup: Mid





Preload of 180 lbsf
Actual Deflection of 0.572 in

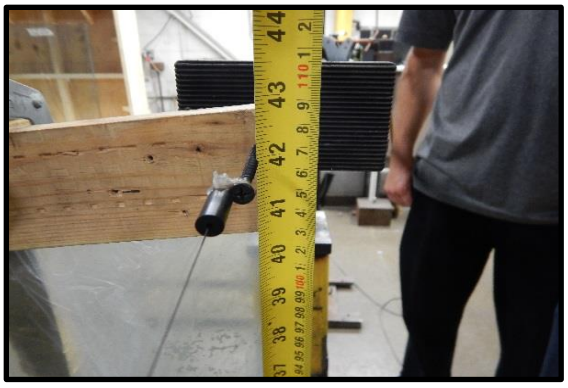
Release Test Load of 90 lbsf

Ultimate Test Load of 365 lbsf
Actual Deflection of 1.743 in

Residual Deflection at 90 lbsf

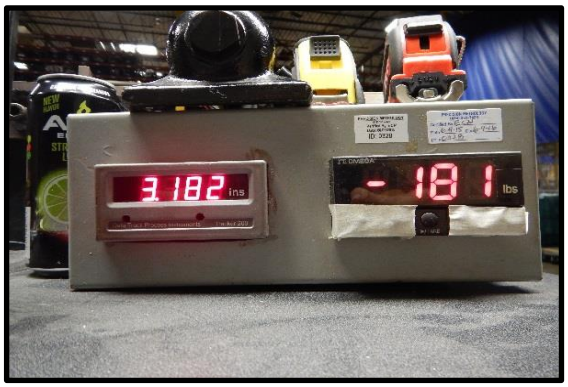
Actual Deflection of 0.032 in

Initial Setup: Left 1



Preload of 180 lbsf

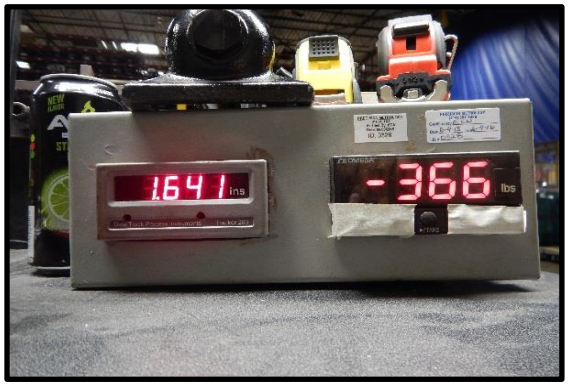
Actual Deflection of 0.754 in



Release Test Load of 90 lbsf

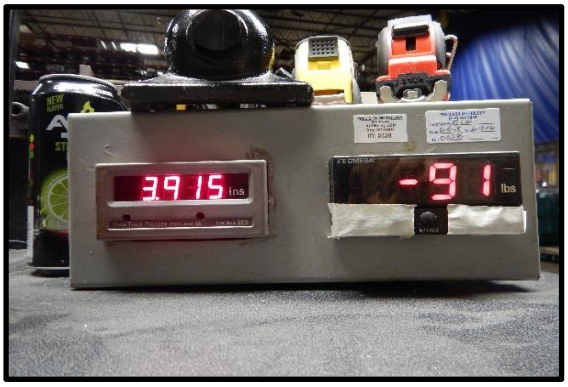
Ultimate Test Load of 365 lbsf

Actual Deflection of 2.322 in

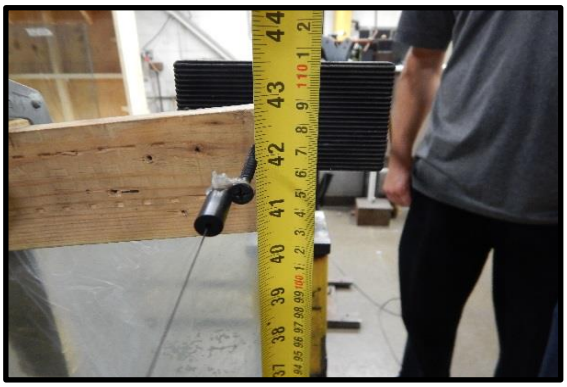


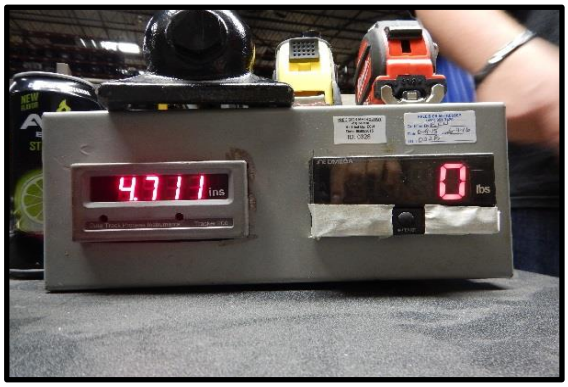
Residual Deflection at 90 lbsf

Actual Deflection of 0.021 in

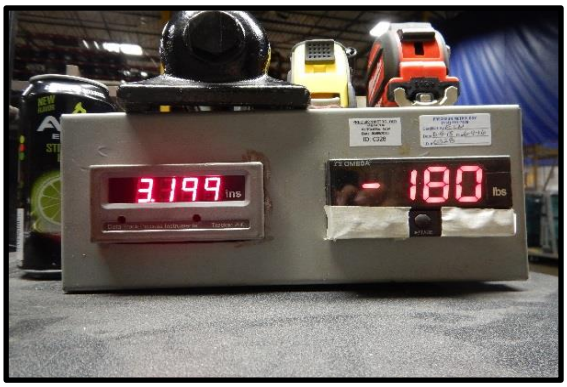


Initial Setup: Left 2





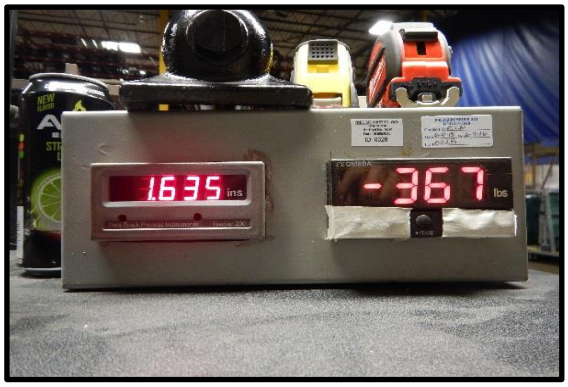
Preload of 180 lbsf
Actual Deflection of 0.689 in



Release Test Load of 90 lbsf

Ultimate Test Load of 365 lbsf

Actual Deflection of 2.253 in



Residual Deflection at 90 lbsf

Actual Deflection of -0.015 in