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:	06/30/2015
Test Date:	06/30/2015
Report Date:	07/02/2015

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 ¾" thick monolithic tempered glass, and 13/16" thick tempered SGP laminated glass when pulled to design loads as described in ASTM E985 "Standard Specification for Permanent Metal Railing Systems and Rails for Buildings". On June 30, 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 Justin Wesser.

Conclusions: The monolithic glass lite was tested to a maximum deflection of 0.97" at ultimate test load (365 lbf). The allowable deflection was 2.25". The residual deflection (measured at 90 lbf) was 0.068". 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 ¾" monolithic glass passed the ASTM E985 test.

The SGP laminated glass lite was tested to a maximum deflection of 1.2513" at ultimate test load (365 lbf). The allowable deflection was 2.25". The residual deflection (measured at 90 lbf) was 0.123". 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 the 13/16" SGP laminated glass passed the ASTM E985 test.

Prepared & Witnessed By:

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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:	KES	Date	07/02/15
Test Focus (Part #s):	50" Long GR2457HCB-10, 3/4" monolithic, PG2475 pad and isolator				
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 Tested using ID#0328 readout, load cell and string pot (calibration due 6/19/2016)				

Test Specifications per ASTM E985:		**Results:**				
	System Calculations:	**Load (lbf)**	**Displacement (in.)**			**Test AVG**
			Midrail	**Left 1**	**Left 2**	
Pre Load	**180 (lbf)**	Preload	0.219	0.323	0.317	0.2863
Released Test Load	**90 (lbf)**	RTL	0	0	0	0.0000
		150	0.153	0.219	0.204	0.192
Ultimate Test Load	**365 (lbf)**	200	0.33	0	0.383	0.3707
		250	0.436	0.586	0.571	0.5310
Deflection Specifications Per ASTM E985		300	0.604	0.795	0.769	0.7227
Max Deflection	**(h/24)+(l/96) = 2.25 in**	UTL	0.823	1.057	1.03	0.9700
		RD	0.13	0.032	0.042	0.068
Residual Deflection (At RTL)	**20% of MD = 0.45 in**					

NOTES:

Midrail at 0 lbf =2.491

Potentiometer cannot be zeroed, so calculations are done manually

Mounted to steel plate. Panel grips torqued to 120 in-lbs

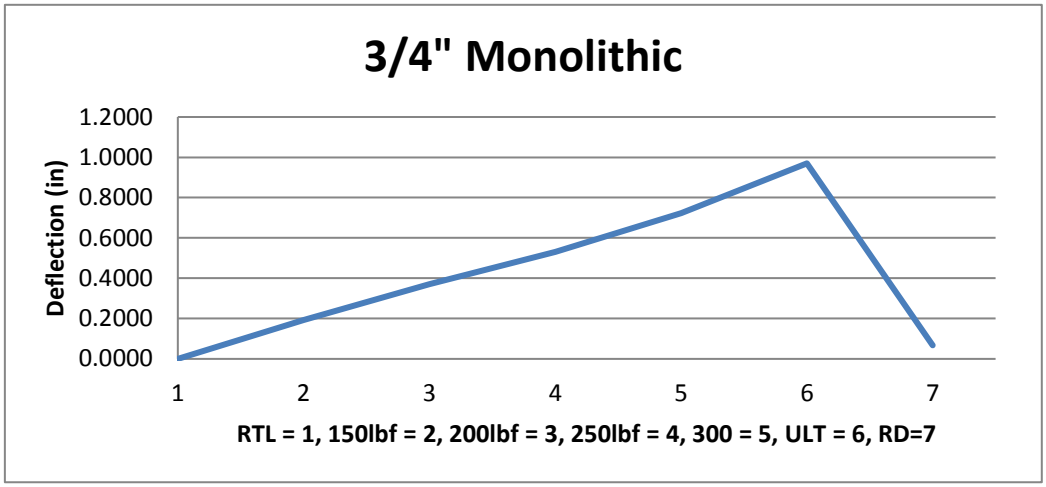
74.9 degrees F, 56% humidity

Glass wrapped in Uline 1.6 mil glass protective tape (P/N S-7588C clear) for safety during testing

CONCLUSIONS:

Rail meets ASTM Standard for Max Deflection

Rail meets ASTM Standard for Residual Deflection



Initial Setup

Preload of 180 lbf
Actual Deflection of
0.219 in

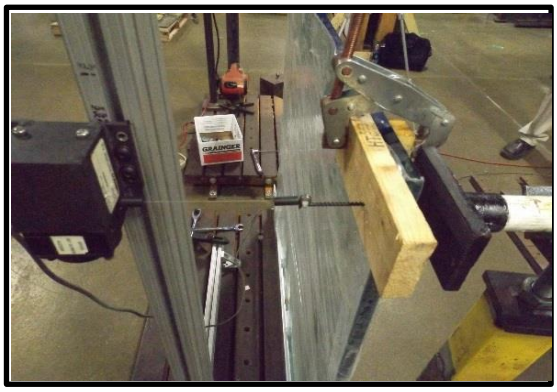
Release Test Load of 90 lbf

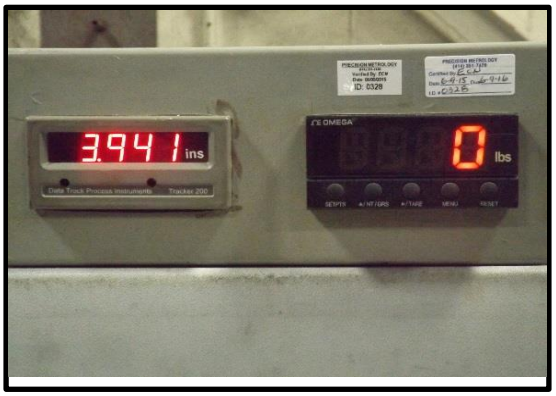
Ultimate Test Load of 365 lbf
Actual Deflection of
0.823 in

Deflection at ULT

Residual Deflection at 90 lbf
Actual Deflection of 0.13
in

Initial Setup
(Left 1)





Preload of 180 lbf
Actual Deflection of
0.323 in

Release Test Load of 90 lbf

Ultimate Test Load of 365 lbf
Actual Deflection of
1.057 in

Deflection at ULT

Residual Deflection at 90 lbf
Actual Deflection of
0.032 in

Initial Setup
(Left 2)

Preload of 180 lbf
Actual Deflection of
0.317 in

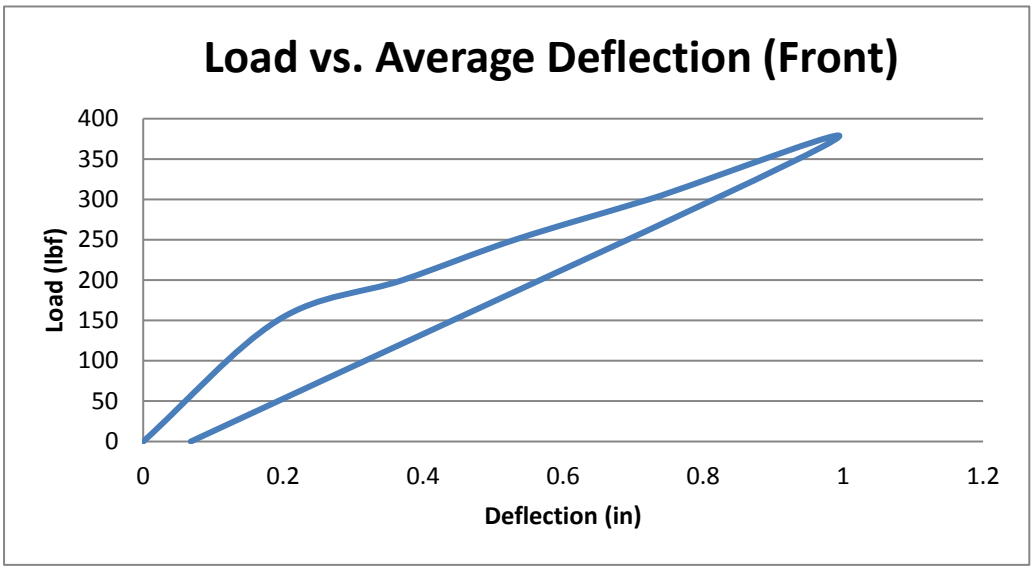
Release Test Load of 90 lbf

Ultimate Test Load of 365 lbf
Actual Deflection of 1.03
in

Deflection at ULT

Residual Deflection at 90 lbf
Actual Deflection of
0.042 in

Load	Average Deflection
0	0
150	0.192
200	0.3706667
250	0.531
300	0.7226667
365	0.97
0	0.068



WAGNER COMPANIES

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Test Method:	365 lbf load per ASTM standards Tested using ID#0328 readout, load cell and string pot (calibration due 6/19/2016)				

Test Specifications per ASTM E985:		Results:				
	System Calculations:	Load (lbf)	Displacement (in.)			Test AVG
			Midrail	Left 1	Left 2	
Pre Load	**180 (lbf)**	Preload	0.285	0.359	0.322	0.3220
Released Test Load	**90 (lbf)**	RTL	0	0	0	0.0000
		150	0.196	0.253	0.215	0.22133333
Ultimate Test Load	**365 (lbf)**	200	0.342	0	0.399	0.3900
		250	0.469	0.619	0.571	0.5530
Deflection Specifications Per ASTM E985		300	0.616	0.803	0.76	0.7263
Max Deflection	**(h/24)+(l/96) = 2.25 in**	UTL	0.82	1.059	1.005	0.9613
		RD	0.031	0.078	0.226	0.1117
Residual Deflection (At RTL)	**20% of MD = 0.45 in**					

NOTES:

Midrail at 0 lbf = 4.844 in

Potentiometer cannot be zeroed, so calculations are done manually

Potentiometer cannot be zeroed, so calculations are done manually

Mounted to steel plate. Panel grips torqued to 120 in-lbs

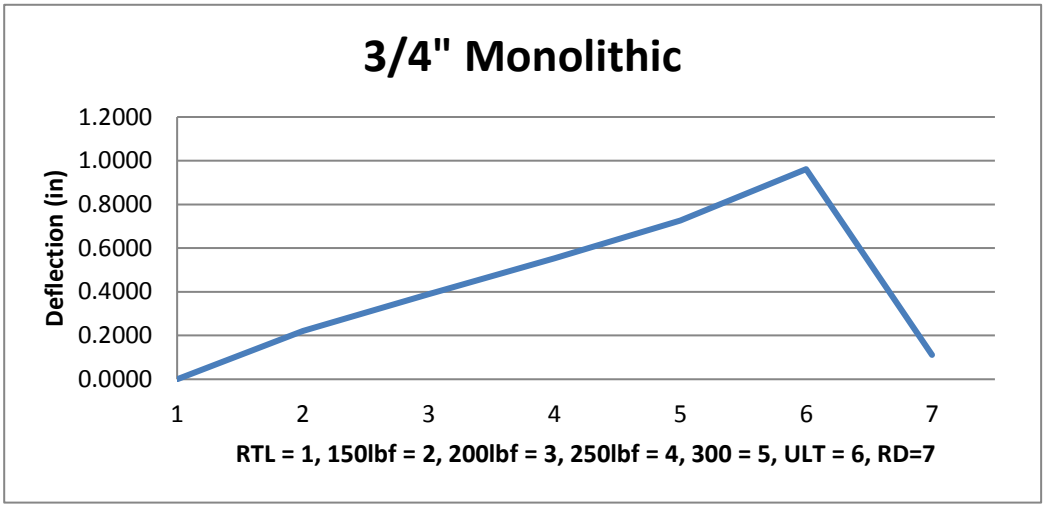
74.9 degrees F, 56% humidity

Glass wrapped in Uline 1.6 mil glass protective tape (P/N S-7588C clear) for safety during testing

CONCLUSIONS:

Rail meets ASTM Standard for Max. Allowed Deflection

Rail meets ASTM Standard for Residual Deflection



Initial Setup
(Middle)

Preload of 180 lbf
Actual Deflection of
0.285 in

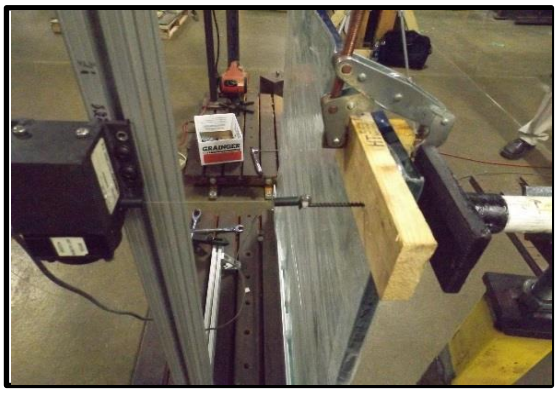
Release Test Load of 90 lbf

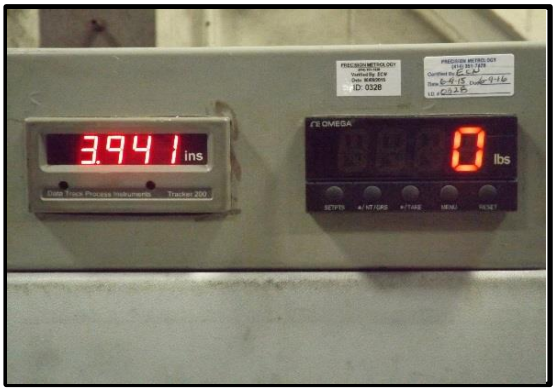
Ultimate Test Load of 365 lbf
Actual Deflection of 0.82
in

Deflection at ULT

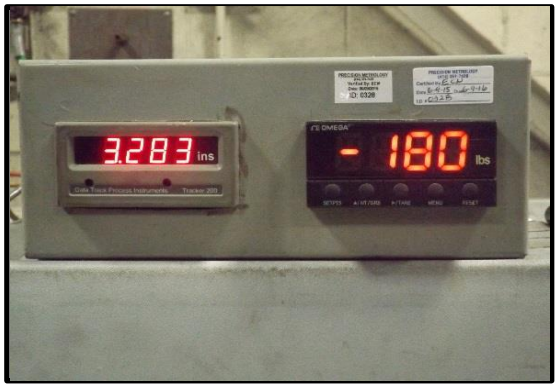
Residual Deflection at 90 lbf
Actual Deflection of
0.031 in

Initial Setup
(Left 1)





Preload of 180 lbf
Actual Deflection of
0.359 in



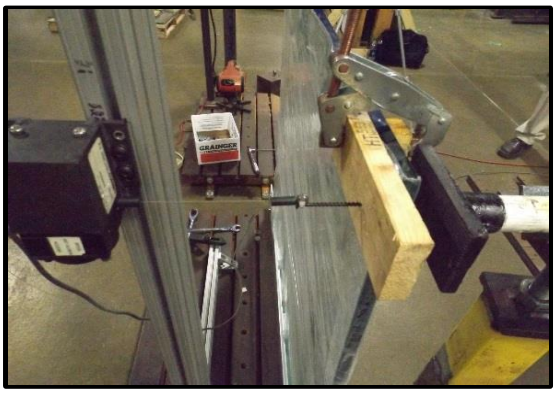
Release Test Load of 90 lbf

Ultimate Test Load of 365 lbf
Actual Deflection of
1.059 in

Deflection at ULT

Residual Deflection at 90 lbf
Actual Deflection of
0.078 in

Initial Setup
(Left 2)



Preload of 180 lbf
Actual Deflection of
0.322 in

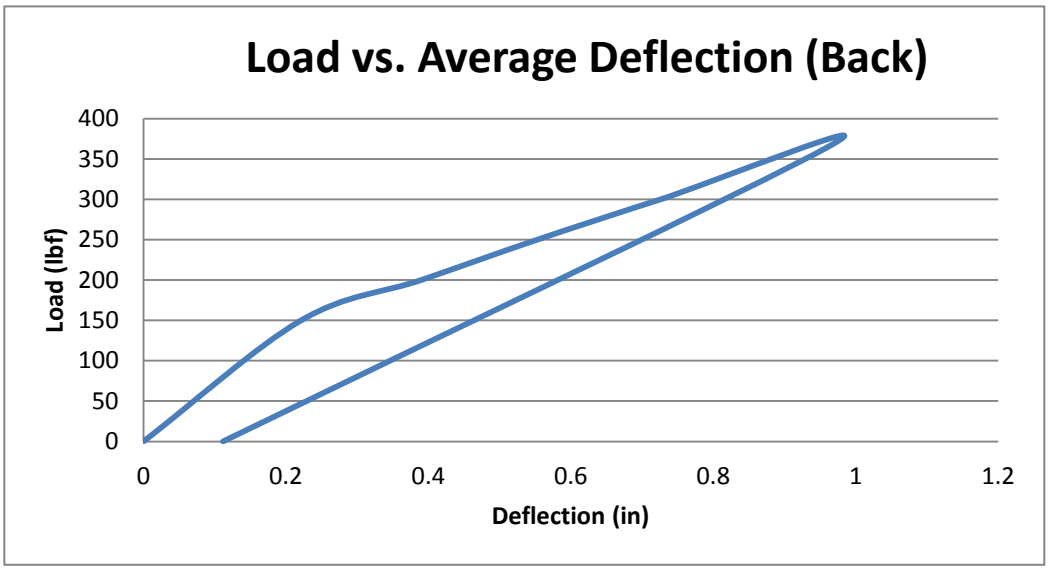
Release Test Load of 90 lbf

Ultimate Test Load of 365 lbf
Actual Deflection of
1.005 in

Deflection at ULT

Residual Deflection at 90 lbf
Actual Deflection of
0.226 in

Load	Average Deflection
0	0
150	0.2213333
200	0.39
250	0.553
300	0.7263333
365	0.9613333
0	0.1116667



Key

Master Table

Front

All Inputs should be unadjusted read outs from test	Mid	Left #1 (*If Applicable*)	Left #2 *(If Applicable)*
Deflection Reading @ 0 lbs	2.491	3.941	3.916
Deflection Reading @ Pre-Load	1.954	3.283	3.28
Deflection Reading @ Released Test Load (1/2 Pre-load)	2.173	3.606	3.597
Deflection Reading @150 lbsf	2.02	3.387	3.393
Deflection Reading @ 200 lbsf	1.843	3.207	3.214
Deflection Reading @ 250 lbsf	1.737	3.02	3.026
Deflection Reading @ 300 lbsf	1.569	2.811	2.828
Deflection Reading @ Ultimate Test Load	1.35	2.549	2.567
Deflection Reading @ Released Test Load (1/2 Pre-load)	2.043	3.574	3.555
Height of Rail (h)	42		
Length of Rail (l)	48		
Max Deflection [(h/24)+(l/96)]	2.25		
Max Residual Deflection (20% of Max)	0.45		

Zero Point for Calculations

Back

All Inputs should be unadjusted read outs from test	Mid	Left #1 *(If Applicable)*	Left #2 *(If Applicable)*
Deflection Reading @ 0 lbs	4.844	5.078	5.056
Deflection Reading @ Pre-Load	4.132	4.276	4.214
Deflection Reading @ Released Test Load (1/2 Pre-load)	4.417	4.635	4.536
Deflection Reading @150 lbsf	4.221	4.382	4.321
Deflection Reading @ 200 lbsf	4.075	4.206	4.137
Deflection Reading @ 250 lbsf	3.948	4.016	3.965
Deflection Reading @ 300 lbsf	3.801	3.832	3.776
Deflection Reading @ Ultimate Test Load	3.597	3.576	3.531
Deflection Reading @ Released Test Load (1/2 Pre-load)	4.386	4.557	4.31