Architectural Testing

TEST REPORT

Rendered to:

FAIRWAY BUILDING PRODUCTS, LP

For:

***Solutions* Aluminum Guardrail System with Glass Balustrades**

Report No: A3730.02-119-19
Report Date: 09/15/10
Revision 1: 09/23/10

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A3730.02-119-19
Original Issue: September 15, 2010
Revision 1: September 23, 2010

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Rendered to:

FAIRWAY BUILDING PRODUCTS, LP
53 Eby Chiques Road
Mount Joy, Pennsylvania 17552

Report No: A3730.02-119-19
Test Date: 08/30/10
Report Date: 09/15/10
Revision 1: 09/23/10

1.0 General Information

1.1 Product

Solutions Aluminum Guardrail System with Glass Balustrades

1.2 Project Description

Architectural Testing was contracted by Fairway Building Products, LP to perform structural testing on their 6 ft by 42 in *Solutions* aluminum guardrail (railing) system with glass balustrades. The system was evaluated for the design load requirements of the following building codes:

2009 *International Building Code*® (IBC), International Code Council

2009 *International Residential Code*® (IRC), International Code Council

Structural tests were performed according to Chapter 17 (Structural Tests and Special Inspections) of IBC 2009.

1.3 Limitations

All tests performed were to evaluate structural performance of the guardrail assembly to carry and transfer imposed loads to the supports (posts). The test specimen evaluated included the balusters, rails, rail brackets, and attachment to the supporting structure. The support posts were conventional construction and not within the scope of the evaluation. Posts were therefore not a tested component and were included in the test specimen only to facilitate anchorage of the rail brackets.

Anchorage of support posts to the supporting structure was not included in the scope of this testing and would need to be evaluated separately.

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1.4 Qualifications

Architectural Testing has demonstrated compliance with ANS/ISO/IEC Standard 17025 and is consequently accredited as a Testing Laboratory (TL-144) by International Accreditation Service, Inc. Architectural Testing is accredited to perform all testing reported herein.

1.5 Product Description

Solutions aluminum guardrail systems were comprised of aluminum top and bottom rails produced by an extrusion process. One baluster style was used in this guardrail assembly: a 4 in wide by 38 in long by 5/16 in thick rectangular tempered glass balustrade. Drawings are included in Appendix A to verify the overall dimensions and other pertinent information of the tested product, its components, and any constructed assemblies.

1.6 Product Sampling

A representative of Fairway Building Products, LP provided all material tested and reported herein.

1.7 Witnessing

A representative of Fairway Building Products, LP was present on 08/30/10, to witness the structural performance testing of assembled guardrail systems.

1.8 Conditions of Testing

Unless otherwise indicated, all testing reported herein was conducted in a laboratory set to maintain temperature in the range of 68 ± 4ºF and humidity in the range of 50 ± 5% RH. All test specimen materials were stored in the laboratory environment for no less than 40 hours prior to testing.

2.0 Structural Performance Testing of Assembled Guardrail Systems

2.1 General

Guardrail assemblies were tested in a self-contained structural frame designed to accommodate anchorage of a rail assembly and application of the required test loads. The specimen was loaded using an electric winch mounted to a rigid steel test frame. High strength steel cables, nylon straps, and load distribution beams were used to impose test loads on the specimen. Applied load was measured using an electronic load cell located in-line with the loading system. Deflections were measured to the nearest 0.01 in using electronic linear displacement transducers.

2.2 Guardrail Assembly Description

The *Solutions* guardrail systems consisted of aluminum top rail and bottom rail with spaced balusters between the rail members. Balusters are connected to top and bottom rails with a polycarbonate baluster connector shoe. The guardrail system had an overall top rail length (inside of post to inside of post) of 72 in with an overall rail height (deck surface to top of top rail) of 42 in. Top and bottom rails attached to preservative-treated 4x4 wood posts (Southern Yellow Pine) via contoured metal socket brackets. A simulated support block was located at the midspan of the bottom rail. See Section 2.4 Fastening Schedule for connection details. See drawings in Appendix A and photographs in Appendix B for additional details.

2.3 Component Descriptions

The scope of testing performed and reported herein was intended to evaluate the *Solutions* aluminum guardrail system consisting of the following components (see Appendix A for drawings):

Top Rail - 2-3/4 in wide by 2.0 in high by 0.080 / 0.090 in wall, bread loaf contoured profile, 6065-T5 aluminum extrusion

Bottom Rail - 1-7/16 in wide by 1.0 in high by 0.080 / 0.090 in wall, rectangular profile with rounded corners, 6065-T5 aluminum extrusion

Top Rail Bracket - 3.0 in wide by 3-1/8 in high by 1-1/2 in deep by 0.085 in wall, flanged socket, ADC 12 die casting with two 0.23 in dia. flange holes and one 0.185 in dia. hole into the bottom of the socket

Bottom Rail Bracket - 1-7/16 in wide

Baluster - 4 in wide by 38 in long by 5/16 in thick rectangular tempered transparent glass (TTG) panels

Baluster Connector Shoe - 3/4 in wide by 4-7/8 in long by 1 in high, injection molded polycarbonate flanged socket with two fastener holes

Support Block - Simulated with wood blocking for test

2.4 Fastening Schedule

Connection	Fastener
Rail Brackets to Post	Two #10-12 x 2-1/4 in, #2 square-drive, Type A point, painted pan head, stainless steel screws
Rail Brackets to Rail [1]	One #8-20 x 5/8 in, #2 square-drive, self-drilling, painted pan-head, plated steel screw
Baluster Connector Shoe to Top Rail	Two #8-8 x 1-/2 in, #2 square-drive, Type 17 point, flat head, plated steel screws
Baluster Connector Shoe to Bottom Rail	Two #6-32 x 3/4 in, Phillips flat head, Type F point, plated steel machine screws

[1] *Bottom Rail Bracket required 13/64 in pre-drill thru bottom of bracket*

2.5 Test Setup

The guardrail assembly was installed and tested as a single guardrail section by directly securing the 4x4 preservative-treated wood posts (Southern Yellow Pine) to a rigid test frame. The guardrail was assembled by an Architectural Testing technician and a representative from Fairway Building Products, LP. The 4x4 wood posts were included only to facilitate anchorage of the test specimen and were not tested components. Transducers mounted to an independent reference frame were located to record movement of reference points on the guardrail system components (ends and mid-point) to determine net component deflections. See photographs in Appendix B for test setups.

2.6 Test Procedure

Each test specimen was inspected prior to testing to verify size and general condition of the materials, assembly, and installation. No potentially compromising defects were observed prior to testing. An initial load, not exceeding 50% of design load, was applied and transducers were zeroed. Load was then applied at a steady uniform rate until reaching 2.0 times design load in no less than 10 seconds. After reaching 2.0 times design load, the load was released. After allowing a minimum period of one minute for stabilization, load was reapplied to the initial load level used at the start of the loading procedure, and deflections were recorded and used to analyze recovery. Load was then increased at a steady uniform rate until reaching 2.5 times design load (4.0 x design load for glass balustrades and their supports) or until failure occurred. The testing time was continually recorded from the application of initial test load until the ultimate test load was reached.

2.7 Test Results

Unless otherwise noted, all loads and displacement measurements were normal to the rail (horizontal). The test results apply only to the guardrail assembly between supports and anchorage to the support.

Key to Test Results Tables:

Load Level: Target test load

Test Load: Actual applied load at the designated load level (target)

Elapsed Time (E.T.): The amount of time into the test with zero established at the beginning of the loading procedure

Specimen No. 1 of 1
72 in by 42 in *Solutions* Aluminum Guardrail with Glass Balustrades
Tested to IBC and IRC Requirements

Test No. 1 - Test Date: 08/30/10 **Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Balustrades**						
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**			
			End	**Mid**	**End**	**Net [1]**
Initial Load	24	00:00	0.00	0.00	0.00	0.00
2.0 x Design Load	101	00:23	0.12	0.58	0.29	0.37
Initial Load	24	0152	0.01	0.09	0.17	0.00
100 % Recovery from 2.0 x Design Load						
4.0 x Design Load	200	02:34	Achieved Load without Failure			

[1] *Net displacement was the infill displacement relative to its top and bottom.*

Test No. 2 - Test Date: 08/30/10						
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**			
			End	**Mid**	**End**	**Net [1]**
Initial Load	24	00:00	0.00	0.00	0.00	0.00
2.0 x Design Load	101	00:35	0.04	0.48	0.04	0.44
Initial Load	24	02:22	0.00	-0.01	0.00	-0.01
100% Recovery from 2.0 x Design Load						
4.0 x Design Load	202	02:55	Achieved Load without Failure			

[1] *Net displacement was the bottom rail displacement relative to its ends.*

2.7 Test Results (Continued)

Specimen No. 1 of 1 (Continued)

Test No. 3 - Test Date: 08/30/10			
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Mid-Rail Displacement [1] (in)**
Initial Load	49	00:00	0.00
2.0 x Design Load	405	01:28	0.20
Initial Load	49	02:47	0.03
85 % Recovery from 2.0 x Design Load			
4.0 x Design Load	800	04:31	Achieved Load without Failure

Test No. 4 - Test Date: 08/30/10						
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**			
			End	**Mid**	**End**	**Net [1]**
Initial Load	49	00:00	0.00	0.00	0.00	0.00
2.0 x Design Load	400	00:36	0.16	0.70	0.10	0.57
Initial Load	49	02:06	0.00	0.04	-0.02	0.05
91 % Recovery from 2.0 x Design Load						
2.5 x Design Load	502	02:57	Achieved Load without Failure			

[1] *Net displacement was the top rail displacement relative to the supports (posts).*

Test No. 5 - Test Date: 08/30/10				
Load Level [1]	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**	
			End #1	**End #2**
Initial Load	50	00:00	0.00	0.00
2 x 2.0 x Design Load	801	00:56	0.47	0.41
Initial Load	50	02:34	0.10	0.08
78% Recovery from 2.0 x Design Load				
2 x 2.5 x Design Load	1001	03:41	Achieved Load without Failure	

[1] *Load was imposed on* both *ends of rail using a spreader beam; therefore, loads were doubled.*

2.8 Summary and Conclusions

The guardrail assembly reported herein met the structural performance requirements of the 2009 *International Building Code*® (IBC) and 2009 *International Residential Code*® (IRC) as installed between adequate supports with guardrail details and Occupancy Classification as shown in the following table:

Guardrail System	Guardrail Type	Baluster Type	Support Post [1]	Code Occupancy Classification
72 in by 42 in *Solutions*	Level	Glass Balustrade	Rigidly Restrained 4x4 Wood Post	IBC - Limited to Group R - Residential Use
				IRC - One- and Two-Family Dwellings

[1] The guardrail supports were not included within the scope of this testing, and these conclusions would apply only for a guardrail that is provided with adequate supports that provide equal or better substrate material (preservative-treated Southern Yellow Pine wood) for the fasteners used to anchor the rail brackets. Anchorage of support posts to the supporting structure was not included in the scope of this testing and would need to be evaluated separately.

3.0 Closing Statement

Detailed drawings, data sheets, representative samples of test specimens, a copy of this test report, and all other supporting evidence will be retained by Architectural Testing for a period of four years from the original test date. At the end of this retention period, said materials shall be discarded without notice, and the service life of this report by Architectural Testing shall expire. Results obtained are tested values and were secured using the designated test methods. This report neither constitutes certification of this product nor expresses an opinion or endorsement by this laboratory; it is the exclusive property of the client so named herein and relates only to the tested specimens. This report may not be reproduced, except in full, without the written approval of Architectural Testing.

For ARCHITECTURAL TESTING:

Digitally Signed by: Adam J. Schrum

Adam J. Schrum
Technician II
Structural Systems Testing

Digitally Signed by: David H. Forney

David H. Forney, P.E.
Senior Project Engineer
Structural Systems Testing

JMM:jmm/dhf/drm

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix A - Drawings (4)
Appendix B - Photographs (3)

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
DAVID HOWARD FORNEY
ENGINEER No. PE-19553E

2010.09.23 14:25:48 -04'00'

Revision Log

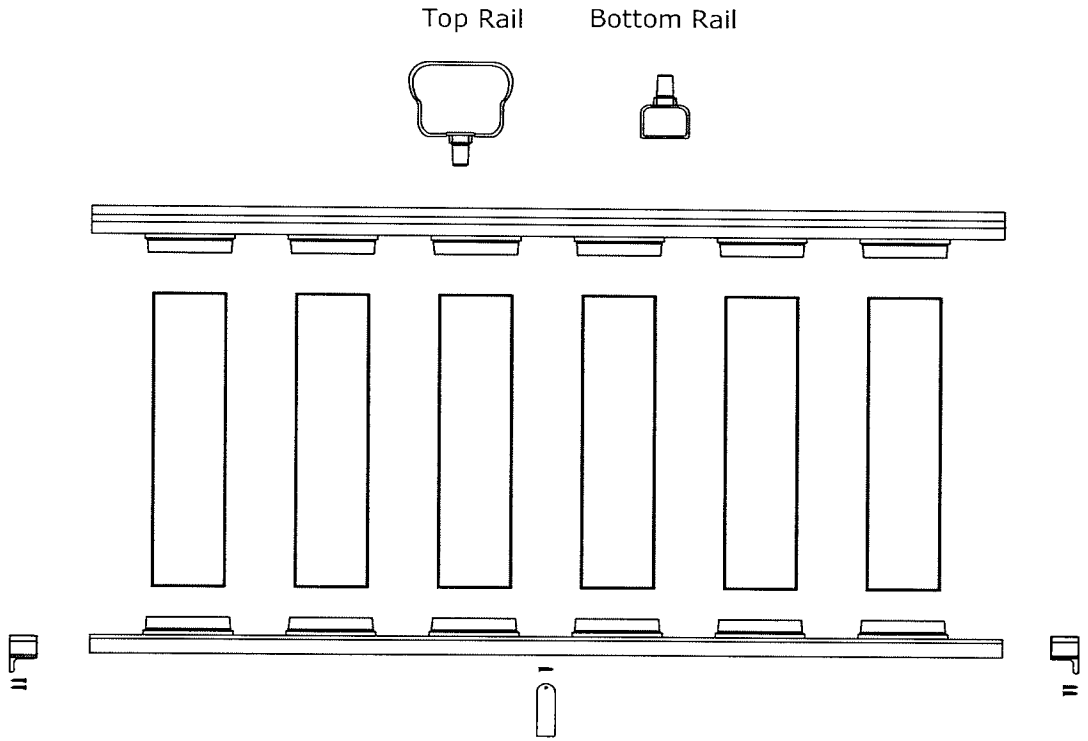
Rev. #	Date	Page(s)	Revision(s)
0	09/15/10	N/A	Original report issue
1	09/23/10	all	Editorial and nomenclature changes, Component and Fastener Descriptions expanded; P.E. review and seal

APPENDIX A

Drawings

Solutions Aluminum Railing

With Clear Glass Balusters



Kit Includes :

1 - Top Rail (with Glass Balusters Connector Shoes installed)
1 - Bottom Rail (with Glass Balusters Connector Shoes installed)
2 - Bottom Rail Mounting Brackets
4 - #8 x 3/4" Self Tapping Stainless Steel Screws
1 - Bottom Rail Support / Top Deck Mount

Architectural Testing

Test sample complies with these details.
Deviations are noted.

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Date 9/15/10 Tech AJS

5/16"x 4"x 32" or 38" Clear Glass Balusters

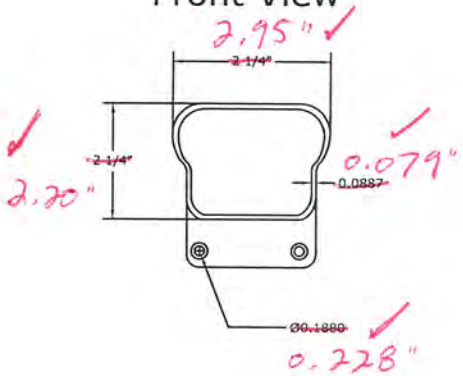
	Rail Length
4' Kit - 6 Balusters	4' Section - 46 3/4"
6' Kit - 9 Balusters	6' Section - 70 3/4"
8' Kit - 12 Balusters	8' section - 94 3/4"

NOTE : Top Mounting Brackets must be specified at time of ordering (PTP or OTP). Not included in kit.

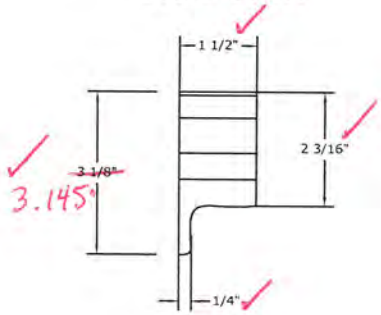
Mounting Brackets

Top Railing Bracket (PTP)
ADC 12 Castings

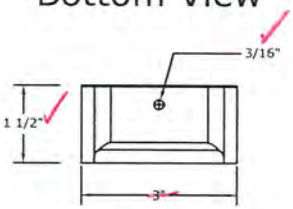
Front View



Side View



Bottom View



Architectural Testing

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Deviations are noted.

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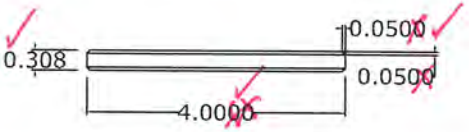
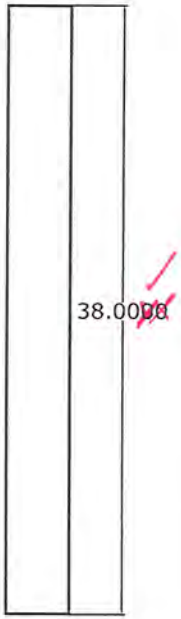
Solutions Glass In-Fill Baluster

(Solutions Aluminum Rail & FX2 Rail System)





Solutions-FBP LP 8mm
Single-Fully Tempered Glass
16 CRF1201, Part 11 Standard
ANSI297 1-1984 (R1994)
All Edges Beveled

Architectural Testing

Test sample complies with these details.
Deviations are noted.

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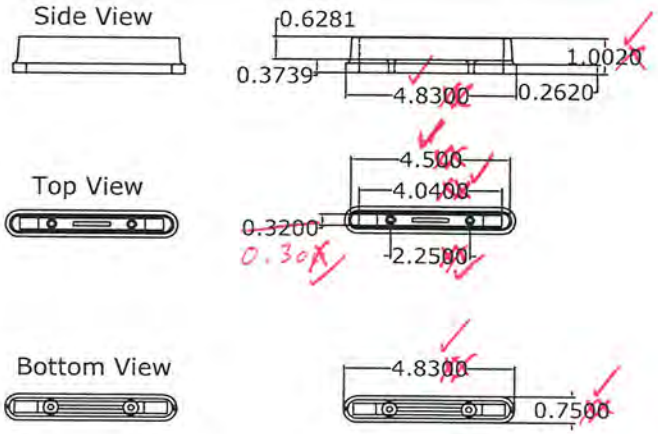
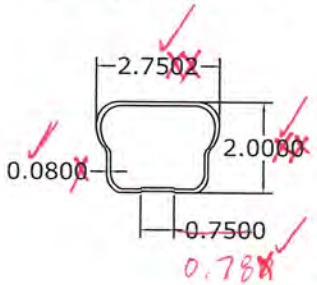
Solutions Glass Baluster Connector Shoe



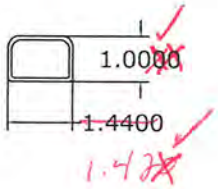
Material - Polycarbonate
Mounting Screws:
FX2 - 2 ea. #8 x 1" Flat Head Wood Screw
Solutions Alum. - 2 ea. #6-32 x 3/4" Flat Head Self Tapping S.S. Scr

Solutions Top & Bottom Rail (#6065-T5 Aluminum)

Top Rail



Bottom Rail



Rail Length

4' Section - 46 3/4"

6' Section - 70 3/4"

8' section - 94 3/4"

Architectural Testing

Test sample complies with these details.
Deviations are noted.

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APPENDIX B

Photographs

Photo No. 1
Load at Center of In-Fill

Photo No. 2
Load at Bottom of In-Fill

Photo No. 3
Horizontal Concentrated Load on the Top Rail

Photo No. 4
Vertical Concentrated Load on theTop Rail

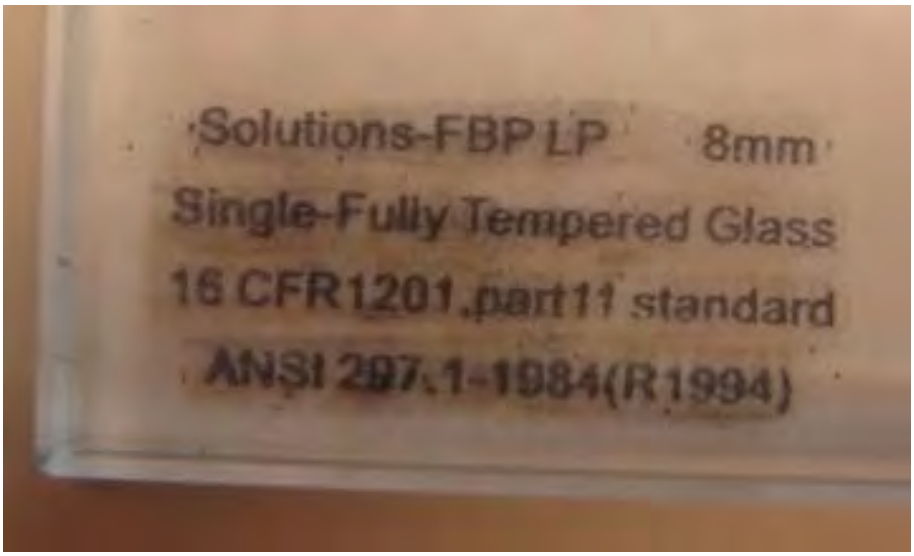

Photo No. 5
Glass Balustrade Etching