Intertek | Architectural Testing

TEST REPORT

Rendered to:

FAIRWAY BUILDING PRODUCTS, LLC

For:

SlimLine
Level Aluminum Railing System

Report No.: F3546.01-119-19
Report Date: 04/18/16
Test Record Retention Date: 03/24/20

130 Derry Court
York, PA 17406

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p. 717.764.7700
f. 717.764.4129

TEST REPORT

F3546.01-119-19
April 18, 2016

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TEST REPORT

Rendered to:

FAIRWAY BUILDING PRODUCTS, LLC
53 Eby Chiques Road
P.O. Box 37
Mount Joy, Pennsylvania 17552

Report No.:	F3546.01-119-19
Test Date:	03/24/16
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1.0 General Information

1.1 Product

SlimLine - 8 ft Wide by 42 in High Level Aluminum Railing System

1.2 Project Description

Architectural Testing, Inc., an Intertek company ("Intertek-ATI"), was contracted by Fairway Building Products, LLC to conduct structural performance tests on their 8 ft wide by 42 in high *SlimLine* level aluminum railing system. The system was evaluated using similar methods as outlined in the following ASTM standards:

ASTM E935-13e1, *Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings*

ASTM E985-00 (2006), *Standard Specification for Permanent Metal Railing Systems and Rails for Buildings*

1.3 Qualifications

Intertek-ATI in York, Pennsylvania has demonstrated compliance with ISO/IEC International Standard 17025 and is consequently accredited as a Testing Laboratory (TL-144) by International Accreditation Service, Inc. (IAS). Intertek-ATI is accredited to perform all testing reported herein, except for ASTM E985.

1.4 Limitations

All tests performed were to evaluate structural performance of the guardrail / handrail assembly to carry and transfer imposed loads to the supporting structure. The test specimens evaluated included the rails, rail connections and support posts. Anchorage of support posts to the supporting structure is not included in the scope of this testing and would need to be evaluated separately.

Testing conducted on post mounts surface mounted on treated wood decking evaluated the post mount and bearing condition on treated wood decking only. Deck framing reinforcing and the attachment of the post mount to the wood deck was not included in the scope of this testing and would need to be evaluated separately.

1.5 Product Description

Fairway Building Products, LLC provided the railing system with the following details:

Top Sub Rail / Bottom Rail: 1-1/4 in high by 1-3/8 in wide by 0.07 in wall by "U" shaped aluminum (6063-T6) extrusion

Top Rail Cap: 2 in high by 2-7/16 in wide by 0.07 in wall contoured (bread loaf) aluminum (6063-T6) extrusion

Baluster: 3/4 in square by 0.045 in wall aluminum (6063-T6) extrusion with 0.02 in high by 0.19 in wide internal longitudinal ribs running the length of the baluster on each face and notched ends for securing to top and bottom rails

Post: 3 in square by 0.085 in wall aluminum (6063-T5) tube welded to a 5 in by 5-5/16 in, 3/8 in thick aluminum (6063-T5) base plate with four 7/16 in diameter holes - the continuous fillet weld connecting the tube to the base plate was approximately 5/16 in.

Brackets:
- Top Rail: 1.35 in high by 1.88 in wide by 1.24 long cast zinc (Z3) collar bracket
- Bottom Rail: 1.2 in high by 1.5 in wide by 1.15 in long cast zinc (Z3) collar bracket

Bottom Rail Support: 3/4 in square by 0.045 in wall by appropriate length aluminum (6063-T6) extrusion at mid-span bottom rail

Fasteners:
- Top and bottom rail bracket to post: Two #8-18 x 1-1/2 in (0.107 in minor diameter), flat head, square drive, stainless steel screws
- Top rail bracket to rail: Two #8-18 x 3/4 in (0.110 in minor diameter) pan head, square drive, stainless steel screws
- Bottom rail bracket to rail: Two #8-18 x 3/4 in (0.110 in minor diameter) flat head, square drive, stainless steel screws
- Bottom rail support to bottom rail: One #8-18 x 3/4 in (0.110 in minor diameter) pan head, square drive screw, self-drilling, stainless steel screws

See drawings in Appendix A for additional details.

2.0 Structural Performance Testing of Assembled Railing Systems

2.1 Scope

One specimen was tested according to the test methods described in ASTM E935. Testing was conducted in a laboratory set to maintain temperature in the range of 68 ± 4 ºF and humidity in the range of 50 ± 5% RH.

2.2 Test Load and Deflection Criteria

The test load criteria for the guardrail system was a 50 lb infill load, 365 lb concentrated load and 60 plf uniformly distributed load; as recommended by Fairway Building Products, LLC. The deflection criteria for top rail were as defined in ASTM E985, Section 7.2.

2.3 Test Equipment

The guardrail assembly was tested in a self-contained structural frame designed to accommodate anchorage of the 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. Electronic linear displacement transducers were used to measure deflections. Deflections were measured to the nearest 0.01 in using electronic linear displacement transducers.

2.4 Test Setup

The 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. The guardrail had an overall top rail length (inside of post to inside of post) of 96-1/2 in with an overall rail height (top of top rail to bottom of bottom rail) of 40-3/8 in. Anchorage of the specimen was accomplished by bolting the post base plate to a rigid steel test fixture (i.e. simulated concrete) at one end and surface mounting to treated wood decking on the other end using 3/8 hex head Gr 8 steel bolts with nut and washers. Transducers mounted to independent reference frames were located to record guardrail system deflection at the point(s) of loading. See photographs in Appendix B for individual test setups.

2.5 Test Procedure

Testing and evaluation was performed in accordance with Section 10 of ASTM E935. One specimen was used for all load tests which were performed in the order reported. Each design load test was performed using the following procedure:

1. A preload of 25% of test load was applied and deflection readings were zeroed
2. Increased load to specified test load in no less than ten seconds
3. Maintained test load for a period of at least 1 minute
4. Removed test load and allowed specimen to relax for a period of at least 1 minute
5. A load of 25% of test load was applied and deflection readings were recorded and used to analyze residual deflection

2.6 Test Results

The following tests were performed on the test specimens in accordance with the test load requirements of the referenced standards.

Key to Test Results Tables:

Load Level: Target test load expressed as percent of test load criterion and (lb)

Applied Load: Actual applied load - Where more than one value is reported, the applied load was the range (min. - max.) that was held during the time indicated for the test

Elapsed Time (E.T.): The length of time into the test with zero established at the beginning of the loading procedure - Where more than one value is reported, the time was the range (start-end) that the applied load was maintained.

Displacement: Total specimen displacement measured at or adjacent to point of load unless noted otherwise

Test No. 1 - Test Date: 03/24/16 **Test Load: 50 lb / 1 Square ft of In-Fill at Center of Two Pickets**			
Load Level [2]	**Applied Load (lb)**	**E.T. (min:sec)**	**Net Deflection [1] (in)**
0% (0 lb)	0	00:00	--
25% (13 lb)	13	00:12	**0.00**
100% (50 lb)	50 - 56	00:38 - 01:41	**0.16**
25% (13 lb)	13	03:07	**0.00**

[1] There is no deflection requirement for this test.

Test No. 2 - Test Date: 03/24/16 **Test Load: 50 lb / 1 Square ft of In-Fill at Bottom of Two Pickets**			
Load Level	**Applied Load (lb)**	**E.T. (min:sec)**	**Deflection [1] (in)**
0% (0 lb)	0	00:00	--
25% (13 lb)	13	00:24	**0.00**
100% (50 lb)	50 - 57	00:42 - 01:44	**0.38**
25% (13 lb)	13	02:51	**0.11**

[1] There is no deflection requirement for this test.

2.6 Test Results (Continued)

Test No. 3 - Test Date: 03/24/16 **Test Load: 60 plf x (96.5 in ÷ 12 in/ft) = 482.5 lb Horizontal Uniform Load on Top Rail [1]**			
Load Level [2]	**Applied Load (lb)**	**E.T. (min:sec)**	**Net Displacement (in)**
0% (0 lb)	0	00:00	--
25% (121 lb)	121	00:19	**0.00**
100% (483 lb)	483- 489	00:54 - 01:56	**1.25**
25% (120 lb)	121	03:22	**0.00**

Deflection Criteria per Section 7.2 of ASTM E 985:

Maximum Allowable Deflection at Test Load:

$$\frac{h}{24}+\frac{l}{96}=\frac{42}{24}+\frac{96.5}{96}=2.76>1.25\therefore \text{ok}$$

Maximum Allowable Residual Deflection at 25%:

$$20\%\times\left(\frac{h}{24}+\frac{l}{96}\right)=0.2\times 2.76=0.55>0.00\therefore \text{ok} \quad \text{or} \quad 1/2\text{ in}>0.00\ \therefore ok$$

[1] *Uniform load was simulated with quarter point loading.*

Test No. 4 - Test Date: 03/24/16 **Test Load: 60 plf x (96.5 in ÷ 12 in/ft) = 482.5 lb Vertical Uniform Load on Top Rail [1]**			
Load Level	**Applied Load (lb)**	**E.T. (min:sec)**	**Net Displacement (in)**
0% (0 lb)	0	00:00	--
25% (121 lb)	121	00:57	**0.00**
100% (483 lb)	487 - 506	01:45 - 02:48	**0.07**
25% (120 lb)	121	03:21	**0.02**

Deflection Criteria per Section 7.2 of ASTM E 985:

Maximum Allowable Deflection at Test Load:

$$\frac{l}{96}=\frac{96.5}{96}=1.01>0.07\therefore \text{ok}$$

Maximum Allowable Residual Deflection at 25%:

$$20\%\times\left(\frac{l}{96}\right)=0.2\times 1.01=0.20>0.02\therefore \text{ok} \quad \text{or} \quad 1/2\text{ in}>0.02\ \therefore ok$$

[1] *Uniform load was simulated with four equal point loads.*

2.6 Test Results (Continued)

Test No. 5 - Test Date: 03/24/16 Test Load: 365 lb Horizontal Concentrated Load at Midspan of Top Rail			
Load Level [2]	**Applied Load (lb)**	**E.T. (min:sec)**	**Net Displacement (in)**
0% (0 lb)	0	00:00	--
25% (91 lb)	91	00:23	**0.00**
100% (365 lb)	367 - 373	00:54 - 01:54	**1.50**
25% (91 lb)	91	03:10	**0.04**

Deflection Criteria per Section 7.2 of ASTM E 985:

Maximum Allowable Deflection at Test Load:

$$\frac{h}{24}+\frac{l}{96}=\frac{42}{24}+\frac{96.5}{96}=2.76>1.50\ \therefore \text{ok}$$

Maximum Allowable Residual Deflection at 25%:

$$20\%\times\left(\frac{h}{24}+\frac{l}{96}\right)=0.2\times 2.76=0.55>0.04\ \therefore \text{ok}\quad \text{or}\quad 1/2\text{ in}>0.04\ \therefore ok$$

Test No. 6 - Test Date: 03/24/16 Test Load: 365 lb Vertical Concentrated Load at Midspan of Top Rail			
Load Level [2]	**Applied Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**
0% (0 lb)	0	00:00	--
25% (91 lb)	91	00:33	**0.00**
100% (365 lb)	366 - 378	01:10- 02:11	**0.06**
25% (91 lb)	91	3:15	**0.01**

Deflection Criteria per Section 7.2 of ASTM E 985:

Maximum Allowable Deflection at Test Load: $\frac{l}{96}=\frac{96.5}{96}=1.01>0.06\ \therefore \text{ok}$

Maximum Allowable Residual Deflection at 25% Load:

$$20\%\times\left(\frac{l}{96}\right)=0.2\times 1.01=0.20>0.01\ \therefore \text{ok}\quad \text{or}\quad 1/2\text{ in}>0.01\ \therefore ok$$

2.6 Test Results (Continued)

Test No. 7 - Test Date: 03/24/16 265 lb Horizontal Concentrated Load on Top Rail Adjacent to End Post				
Load Level [1]	**Applied Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**	
			Left	**Right**
0% (0 lb)	0	00:00	--	--
25% (91 lb) x 2	183	00:37	0.00	0.00
100% (365 lb) x 2	723-742	01:10 - 02:14 [2]	**1.04**	**1.35**
25% (91 lb) x 2	183	03:26	**0.07**	**0.04**

Deflection Criteria per Section 7.2 of ASTM E 985:

Maximum Allowable Deflection at Test Load on Left: $\frac{h}{12} = \frac{42}{12} = 3.50 > 1.04 \therefore ok$

Maximum Allowable Deflection at Test Load on Right: $\frac{h}{12} = \frac{42}{12} = 3.50 > 1.35 \therefore ok$

Maximum Allowable Residual Deflection at 25% Load on Left:

$$20\% \times \left(\frac{h}{12}\right) = 0.2 \times 3.50 = 0.70 > 0.07 \therefore ok \quad \text{or} \quad 1/2 \text{ in} > 0.07 \therefore ok$$

Maximum Allowable Residual Deflection at 25% Load on Right:

$$20\% \times \left(\frac{h}{12}\right) = 0.2 \times 3.50 = 0.70 > 0.04 \therefore ok \quad \text{or} \quad 1/2 \text{ in} > 0.04 \therefore ok$$

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

[2] *The test load fell below the target load level for a total of 2 seconds while maintaining load.*

Test No. 8 - Test Date: 03/24/16 365 lb Vertical Concentrated Load on Top Rail Adjacent to End Post [1]				
Load Level [2]	**Applied Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**	
			Left	**Right**
0% (0 lb)	0	00:00	--	--
25% (91 lb) x 2	183	00:39	0.00	0.00
100% (365 lb) x 2	730 - 754	01:13 - 02:13	**0.05**	**0.05**
25% (91 lb) x 2	183	03:06	**0.01**	**0.01**

[1] *There is no deflection criterion when applying a vertical load adjacent to a post.*

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

2.6 Test Results (Continued)

Test No. 9 - Test Date: 03/24/16 265 lb Horizontal Concentrated Load at Top of Post (Installed on Surface Mount Wood at one end and Simulated Concrete at the other)				
Load Level [1]	**Applied Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**	
			Wood	**Concrete**
0% (0 lb)	0	00:00	--	--
25% (91 lb) x 2	183	00:47	0.00	0.00
100% (365 lb) x 2	738-748	01:31 - 02:33	**1.11**	**0.85**
25% (91 lb) x 2	183	03:45	**0.03**	**0.01**

Deflection Criteria per Section 7.2 of ASTM E 985:

Maximum Allowable Deflection at Test Load on Wood: $\frac{h}{12} = \frac{42}{12} = 3.50 > 1.11 \therefore \text{ok}$

Maximum Allowable Deflection at Test Load on Concrete: $\frac{h}{12} = \frac{42}{12} = 3.50 > 0.85 \therefore \text{ok}$

Maximum Allowable Residual Deflection at 25% Load on Wood:

$$20\% \times \left(\frac{h}{12}\right) = 0.2 \times 3.50 = 0.70 > 0.03 \therefore \text{ok} \quad \text{or} \quad 1/2 \text{ in} > 0.03 \therefore ok$$

Maximum Allowable Residual Deflection at 25% Load on Concrete:

$$20\% \times \left(\frac{h}{12}\right) = 0.2 \times 3.50 = 0.70 > 0.01 \therefore \text{ok} \quad \text{or} \quad 1/2 \text{ in} > 0.01 \therefore ok$$

2.7 Summary and Conclusions

The 8 ft by 42 in high *SlimLine* level aluminum railing system met all of the load and deflection criteria of the referenced standards for the static load tests on the fully assembled railing system for use with structural posts installed on surface mounted wood and concrete.

3.0 Closing Statement

Intertek-ATI will service this report for the entire test record retention period. Test records that are retained such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation will be retained by Intertek-ATI for the entire test record retention period.

Results obtained are tested values and were secured using the designated test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimens tested. This report may not be reproduced, except in full, without the written approval of Intertek-ATI.

For INTERTEK-ATI:

Digitally Signed by: Emily C. Riley

Emily C. Riley
Project Manager

Digitally Signed by: Virgal Thomas Mickley, Jr.

V. Thomas Mickley, Jr., P.E.
Senior Project Engineer

ECR:vtm/jas

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix A - Drawings (5)
Appendix B - Photographs (5)

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	04/18/16	N/A	Original report issue

APPENDIX A

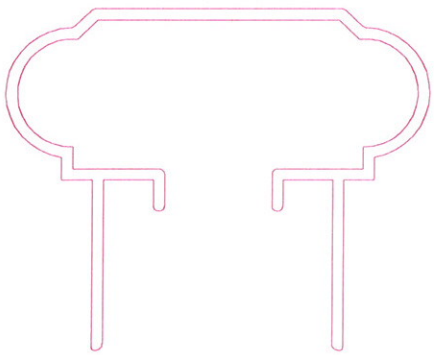
Drawings

Architectural Testing

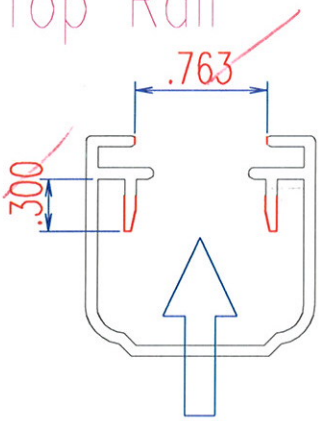
Test sample complies with these details.
Deviations are noted.

Report # F3546.01

Date 4/4/16 Tech EOL

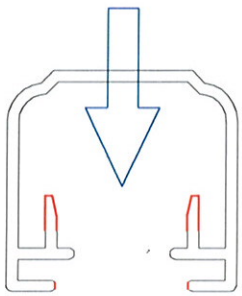


Top Rail

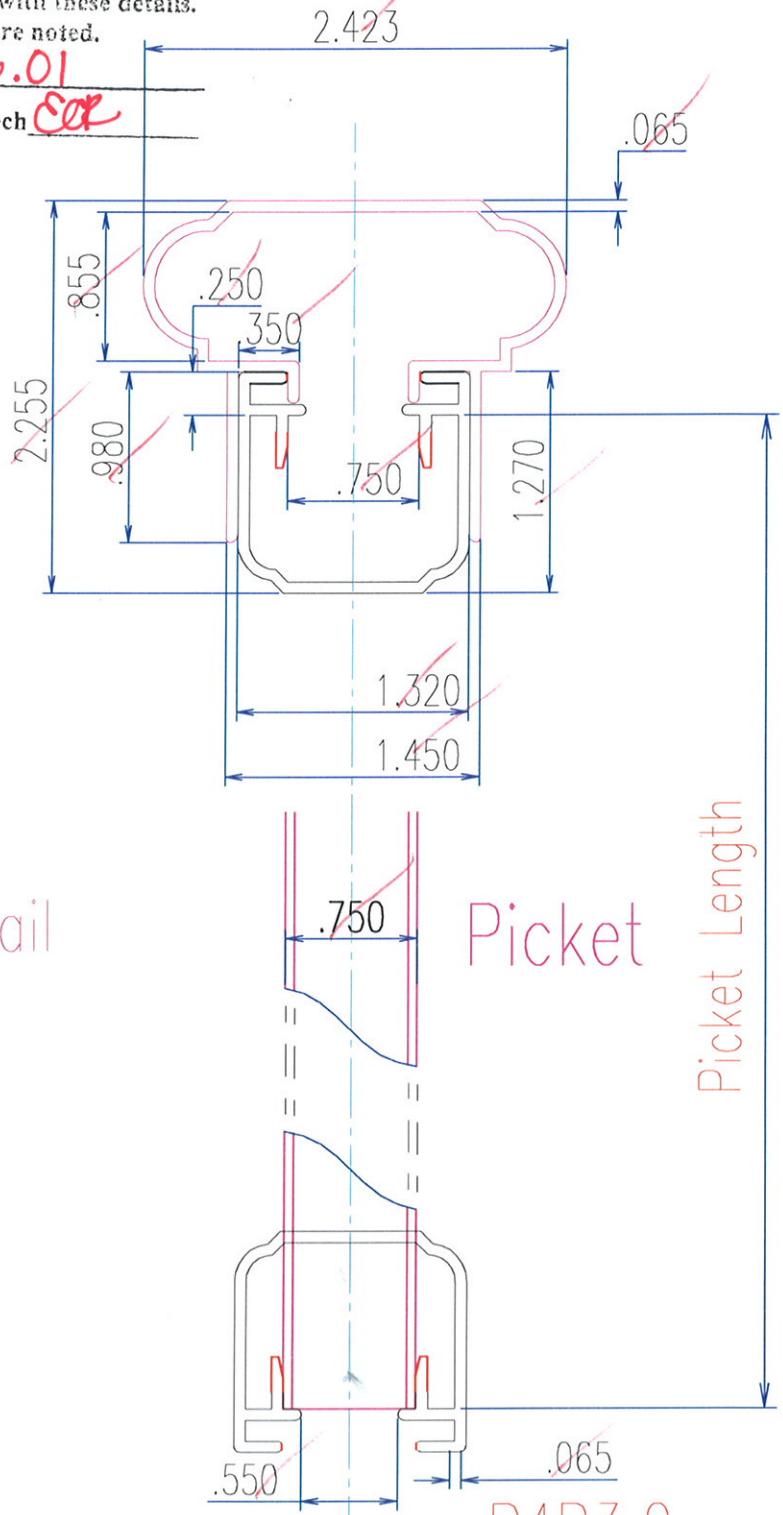


Sub Rail

Punch



Bottom Rail

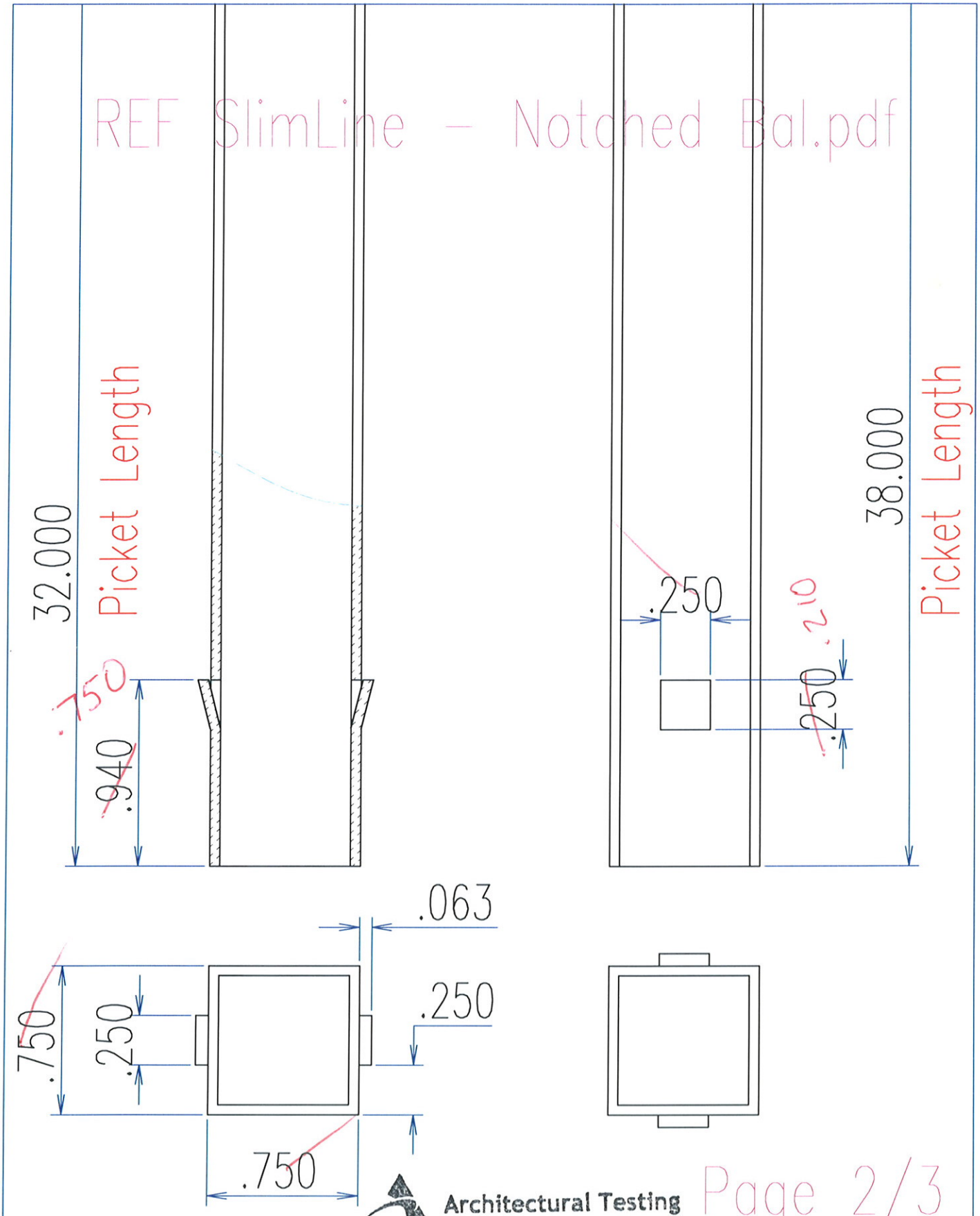


P4R3.2

12-212

20141015

REF SlimLine - Notched Bal.pdf



Architectural Testing

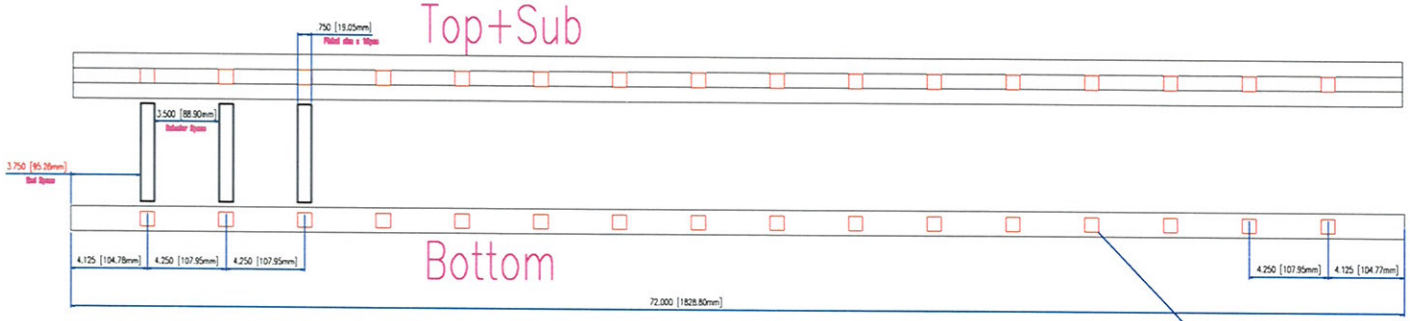
Test sample complies with these details.
Deviations are noted.

Report # F3546.01

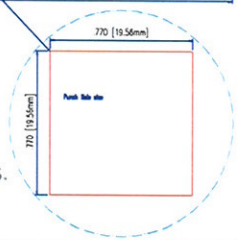
Date 4/4/16 Tech EOR

12-212

All holes must be punched on subrail and bottom rails.



6 Foot Rail with 16 picket



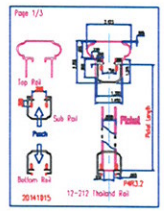
Architectural Testing

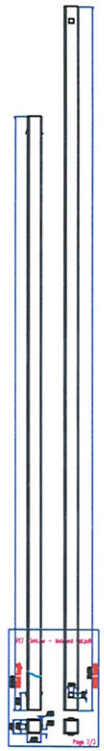
Test sample complies with these details.
Deviations are noted.

Report # F3546.01

Date 4/4/16 Tech SCR

REF 20140813





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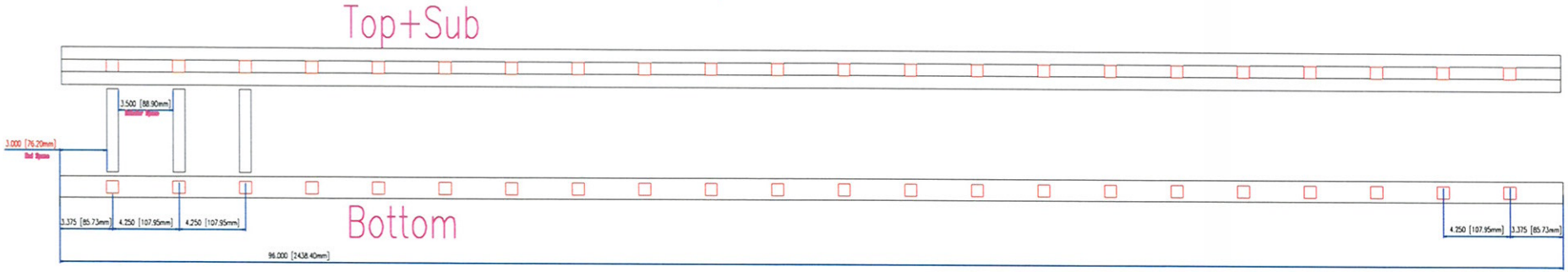
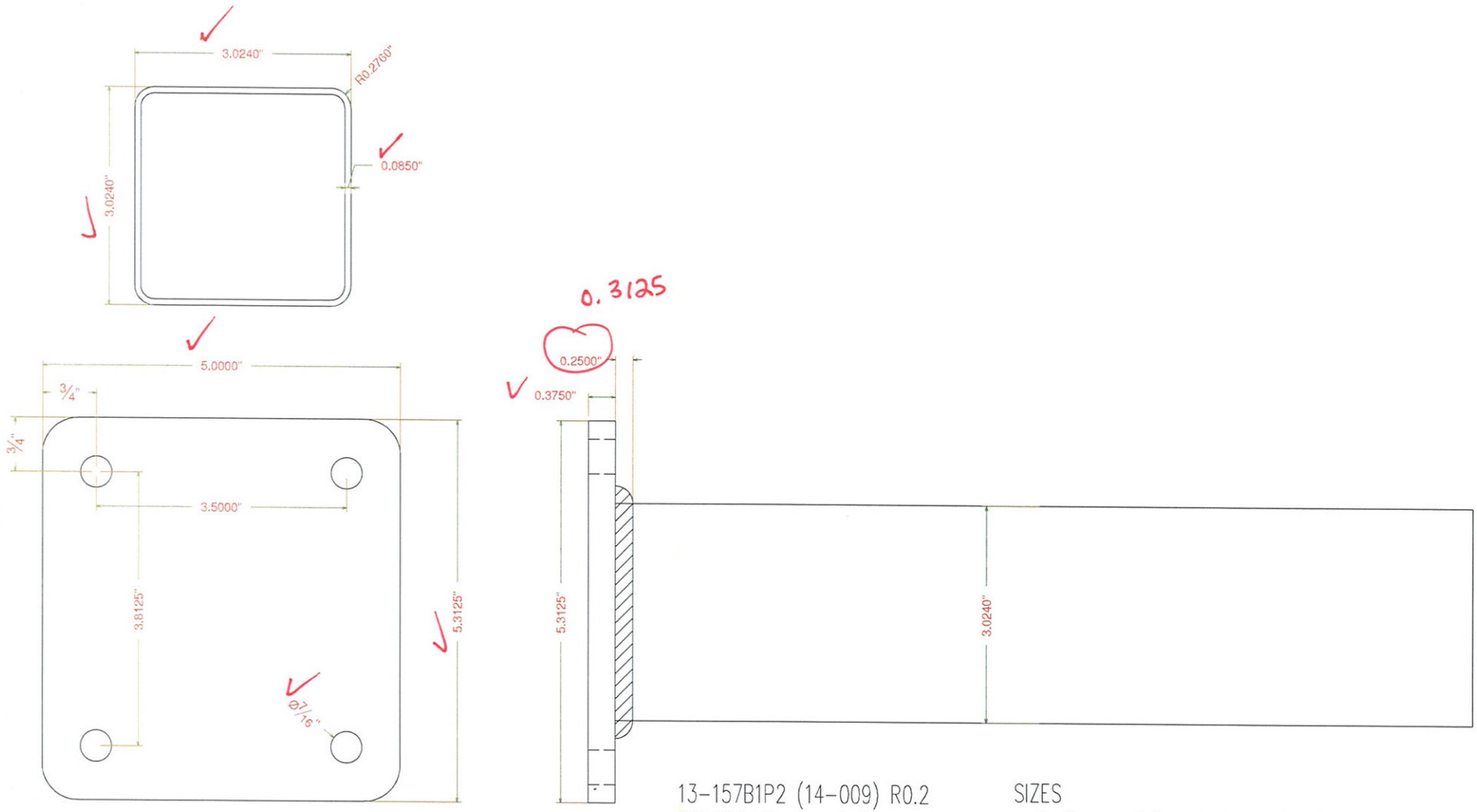


8 Foot Rail with 22 pickets



13-157B1P2 (14-009) R0.2
3IN Weld Post and Base
ALUMINUM 6063-5 Powder Coating

SIZES
3"X3"X39 5/8" FLANGE MOUNTING POST
3"X3"X44 5/8" FLANGE MOUNTING POST
3"X3"X54 5/8" FLANGE MOUNTING POST

Architectural Testing

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Date 4/4/16 Tech EOR

CARFARO
a division of FAIRWAY

SLIMLINE

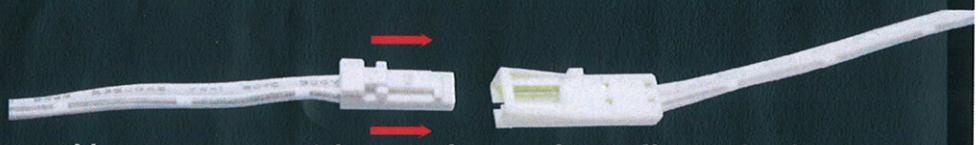
FAIRWAY

W/ LED IN-RAIL LIGHTING

901400 • LED Light Flush Pin

901407 • LED Light Connector Box

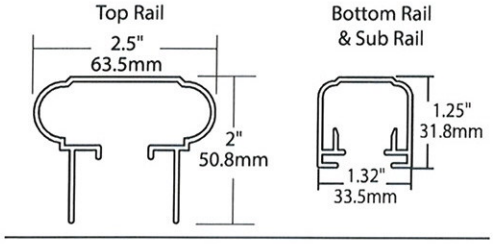
Extremely easy to install

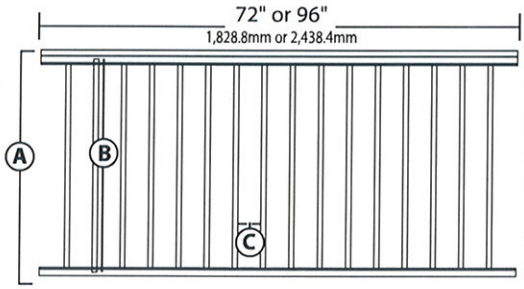


Designed to be installed by contractors and home owners with zero electrical installation background.

Fairway's connector based snap together 12V LED light system installs quickly, easily and is virtually "Goof Proof".

TECHNICAL SPECS





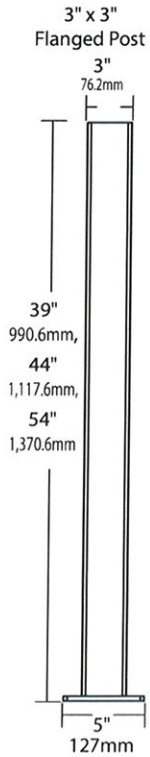
72" Level - 16 balusters

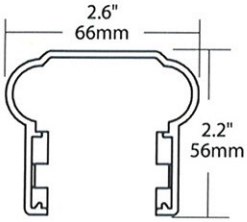
96" Level - 22 balusters

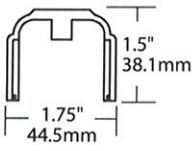
96" Stair - 21 balusters

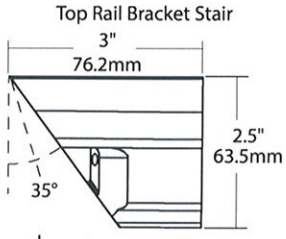
Level & Stair Rail Kit

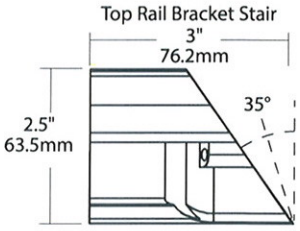
RAIL HEIGHT	36"	42"
A	36"	42"
B	32"	38"
C	3.5"	3.5"

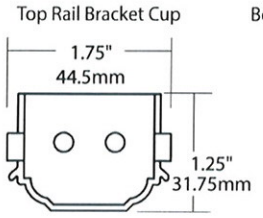


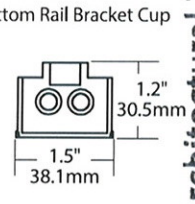


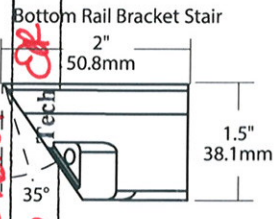


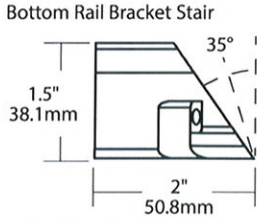






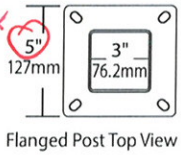






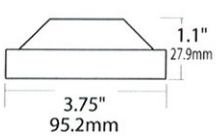
Architectural Testing

Test sample complies with these details.
Deviations are noted.
Report # F3544a.01
Date 4/4/16
Tech SR

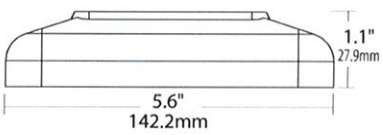


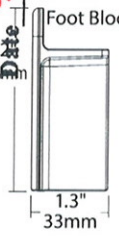
Flanged Post Top View

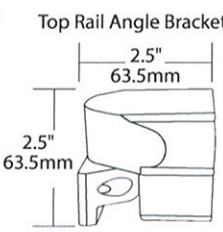
Post Cap

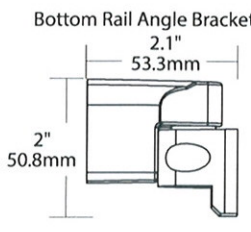


Post Trim









APPENDIX B

Photographs

Photo No. 1
Infill Loading at Center of Two Pickets

Photo No. 2
Infill Loading at Bottom of Two Pickets

Photo No. 3
Horizontal Uniform Load on Top Rail

Photo No. 4
Vertical Uniform Load on Top Rail

Photo No. 5
Horizontal Concentrated Load at Mid-Span of Top Rail

Photo No. 6
Vertical Concentrated Load at Mid-Span of Top Rail

Photo No. 7
Horizontal Concentrated Load on Top Rail Adjacent to End Post

Photo No. 8
Vertical Concentrated Load on Top Rail Adjacent to End Post

Photo No. 9
Horizontal Concentrated Load at Top of Post
(Surface Mount Wood at one end and Simulated Concrete at the other)