

TEST REPORT

Rendered to:

TUSCAN MANUFACTURING, LP

For:

Tuscan Composite Rail - Series #200

Report No: 65108.03-119-19
Report Date: 07/10/07
Revision 1: 08/01/07

TEST REPORT

Rendered to:

TUSCAN MANUFACTURING, LP
1219 Grant Street
York, Nebraska 68467

Report No: 65108.03-119-19
Test Date: 05/15/06
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1.0 General Information

1.1 Product

Tuscan Composite Rail - Series #200

1.2 Project Description

Architectural Testing, Inc. (ATI) performed structural testing on the Tuscan Series #200 composite guardrail (railing) system. The system was evaluated for the design load requirements of the following building codes and standards:

IBC & IRC -2003 / ICC - International Code Council

BOCA-1999 - Building Officials and Code Administrators (Reference ASCE 7-95)

ASCE 7-95 - American Society of Civil Engineers - Minimum Design Loads for Buildings and Other Structures.

IOTDC-1998 - International One- and Two-Family Dwelling Code

Structural tests are performed according to Chapter 17 (Structural Tests and Inspections) of BOCA-99 and IBC 2003.

Exception:

The test load of two times the design load is not held for 24-hours. The rationale is that railing systems are not subject to long term sustained loads such as snow loads and floor live loads.

1.3 Limitations

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

1.4 Product Description

The railing systems are comprised of wood-plastic composite rails and posts produced by an extrusion process and PVC balusters. The square PVC balusters were produced by an extrusion process, and the turned PVC balusters were produced by a blow-molding process. Composite rails and posts are co-extruded with a PVC cap stock layer. Testing utilized one product color (clay) for composite members and one product color (white) for PVC members.

1.5 Product Sampling

All samples used for the testing reported herein were provided by Tuscan Manufacturing.

1.6 Conditions of Testing

Unless otherwise indicated, the conditions of testing were laboratory ambient conditions with temperature in the range of $68 \pm 4^{\circ}\text{F}$.

2.0 Structural Performance Testing of Assembled Railing Systems

2.1 General

Railing 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" using electronic linear displacement transducers.

2.2 Railing Assembly Description

The Tuscan - Series #200 composite guardrail system consisted of extruded composite top and bottom rails with spaced balusters inserted into routed holes in the rail members providing approximately 3-3/4" clear space between balusters. The railing system had an overall top rail length (inside of post to inside of post) of 96" with an overall rail height of 42" (deck surface to top of top rail). Top and bottom rails attached to traditional 4x4 wood posts (Southern Pine) sleeved by composite post covers via plastic socket brackets. Two (2) #10 by 2" stainless steel pan-head Hi-Lo wood screws attached the bracket to the support, and two (2) #10 by 3/4" stainless steel pan-head sheet metal screws attached the bracket to the rail. A single PVC support block was located at the midspan of the bottom rail and was attached with one (1) #10 by 3/4" stainless steel pan-head sheet metal screw. See drawings in Appendix A and photographs in Appendix B for additional details.

2.3 Series/Model

The scope of testing performed and reported herein was intended to evaluate the Tuscan Series #200 composite railing system consisting of the following components (see Appendix A for drawings):

Top and Bottom Rail - 3-5/16" wide by 2-1/8" high extruded composite rail

Rail Connection Condition - PVC socket bracket

Balusters - 1-3/8" by 1-3/8" square PVC baluster

1-3/8" by 1-3/8" turned PVC baluster

PVC Foot Block - 1-1/2" square support with adjustable height

2.4 Test Setup

The railing assembly was installed and tested as a single railing section by directly securing the composite-sleeved 4x4 traditional wood posts to a rigid test frame. The composite-sleeved 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 railing system components (ends and mid-point) to determine net component deflections. See photographs in Appendix B for test setups.

2.5 Test Procedure

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. One specimen was used for all load tests which were performed in the order reported. A preload was performed prior to each load test. The assembly was preloaded up to a level not exceeding the design load. After pre-loading, all load was released and any necessary fixture adjustments were made. The load test procedure for each design load had two parts with each portion intended to satisfy a different objective. The first sequence was designed to analyze the recovery performance of the assembly from a test load equal to two times the design load as required by the referenced building codes. The second load sequence was intended to satisfy the maximum test load required. Each design load test was performed using the following procedure:

1. Applied a small initial load and zero displacement transducers;
2. Increased load to 2.0x Design Load and recorded deflection;
3. Released load and allowed a minimum of one minute for relaxation;
4. Applied initial load and recorded deflection as permanent set to analyze recovery;
5. Released load and zeroed displacement transducers at zero load;
6. Increased load to 2.5x Design Load in no less than 10 seconds; and
7. Held 2.5x Design Load for no less than one minute.

2.6 Test Results

Unless otherwise noted, all loads and displacement measurements were normal to the rail (horizontal). Deflection and permanent set are component deflections relative to their end-points. They are not overall system displacement. The test results apply only to the railing 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). Where more than one value is reported, the test load was the range (min.-max.) that was held during the time indicated in the test.

Elapsed Time (E.T.): The amount 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 designated load level was reached and sustained.

Test No. 1 - 05/15/06						
Design Load: 50 lb / 1 Square Ft. of In-Fill at Center of Two Turned Balusters						
Load Level	Test Load (lb)	E.T. (min:sec)	Baluster Displacement (inches)			
			Top	Mid	Bottom	Net ¹
Initial Load	25	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	101 - 104	00:38 - 01:44	0.34	1.28	0.28	0.97
Initial Load	25	03:50	0.02	0.11	0.05	0.08
92% Recovery						
2.5x Design Load	125 - 129	04:27 - 05:35	<i>Sustained load equal to or greater than 125 lb for one minute</i>			

¹ Net displacement is the baluster displacement relative to its ends.

2.6 Test Results: (Continued)

Test No. 2 - 05/15/06						
Design Load: 50 plf Horizontal Uniform Load on Top Rail						
Load Level	Test Load (lb)	E.T. (min:sec)	Rail Displacement (inches)			
			End	Mid	End	Net ¹
Initial Load	99	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	799 - 812 ²	01:16 - 02:25	0.35	3.41	0.27	3.10
Initial Load	100	03:59	0.11	0.34	0.03	0.27
91% Recovery						
2.5x Design Load	970 - 1013 ³	05:41 - 06:55	<i>Sustained load equal to or greater than 1000 lb for one minute</i>			

¹ Net displacement is the rail displacement relative to the supports.

² During the 2.0x D.L. hold, the load dropped to 799 lb for two seconds.

³ During the 2.5x D.L. hold, the load dropped below 1000 lb, so the load was sustained for a longer duration to compensate.

Test No. 3 - 05/15/06			
Design Load: 200 lb Concentrated Load at One End of Top Rail (Bracket Loading)			
Load Level	Test Load (lb)	E.T. (min:sec)	Rail Displacement (inches)
Initial Load	25	00:00	0.00
2.0x Design Load	399 - 408 ¹	00:32 - 01:41	0.55
Initial Load	25	02:47	0.07
87% Recovery			
Design Load	201	03:15	0.29
2.5x Design Load	500 - 518	02:57 - 04:40	<i>Sustained load equal to or greater than 500 lb for one minute</i>

¹ During the 2.0x D.L. hold, the load dropped to 399 lb for one second.

Test No. 4 - 05/15/06						
Design Load: 50 lb / 1 Square Ft. of In-Fill at Center of Two Square Balusters (Alternate In-fill Test)						
Load Level	Test Load (lb)	E.T. (min:sec)	Baluster Displacement (inches)			
			Top	Mid	Bottom	Net ¹
Initial Load	25	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	100 - 103	00:27 - 01:35	0.31	0.98	0.22	0.71
Initial Load	26	03:45	0.01	0.04	0.05	0.01
99% Recovery						
2.5x Design Load	125 - 130	04:14 - 05:20	<i>Sustained load equal to or greater than 125 lb for one minute</i>			

¹ Net displacement is the baluster displacement relative to its ends.

3.0 Summary and Conclusions

The railing systems and components tested and reported herein sustained loads equal to or greater than 2.5 times the design loads specified by the referenced building codes. In addition, components subjected to flexural bending recovered greater than 75% of the deflection from 2.0 times the design load.

Detailed drawings, data sheets, representative samples of test specimens, a copy of this test report will be retained by Architectural Testing, Inc. for a period of four years from the original test date. At the end of this retention period such materials shall be discarded without notice and the service life of this report by Architectural Testing will expire. 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 Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC.

Justin M. Mann
Senior Technician

David H. Forney, P.E.
Senior Project Engineer

JMM:jmm/nlb

Attachments (pages):

Appendix A - Drawings (1)

Appendix B - Photographs (2)

This report is complete only when all attachments listed are included.

Revision Log

<u>Rev. #</u>	<u>Date</u>	<u>Page(s)</u>	<u>Revision(s)</u>
0	07/10/07	N/A	Original report issue
1	08/01/07	Appendix A	Replaced original drawing in Appendix A with revised drawing supplied by client.

APPENDIX A

Drawings

#200 Series Tuscan Composite Railing

With Vinyl Balusters



Test sample complies with these details.
Deviations are noted.

Report# 65108.03 Tech 716
Date 7/30/07

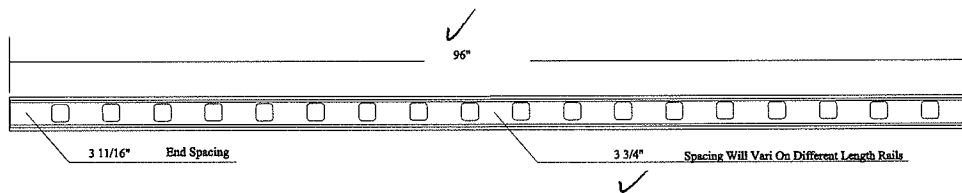
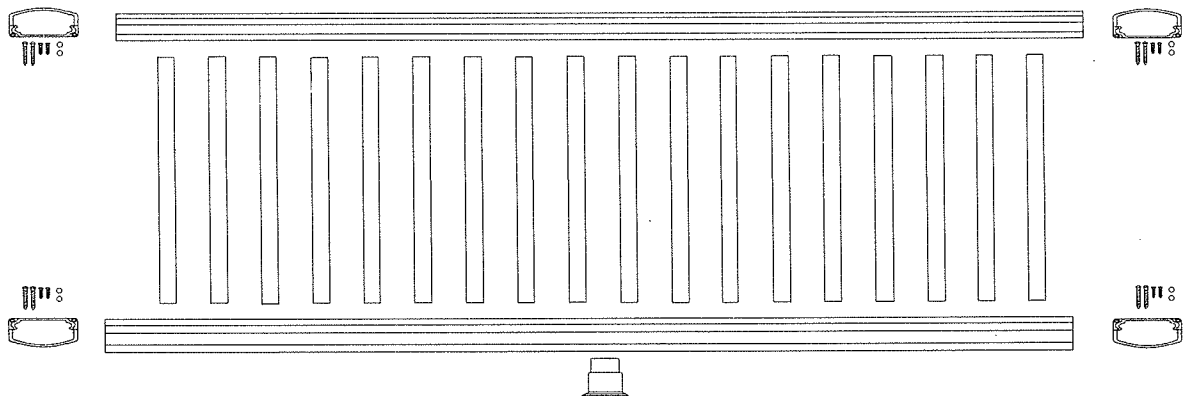
#200 Series Level Rail Kit Includes :

- 2 ea. Top or Bottom Rails
(Vari with length) 32 1/2" or 38 1/2" Turned or Square Balusters
- 4 ea. Top / Bottom Rail Mounting Brackets
- 8 ea. #10x 2" stainless steel screws - #2 square drive
- 8 ea. #10x 1 1/2" stainless steel self tapping screw - #2 square drive
- 8 ea. Screw Holes Covers
- 1 ea. Foot Block

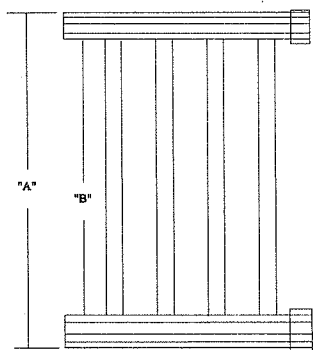
LENGTH OF SECTIONS - 6' & 8'

RAILING HEIGHT - 36" & 42"

Level Rail Kit

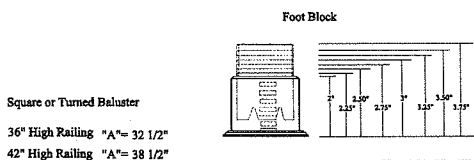
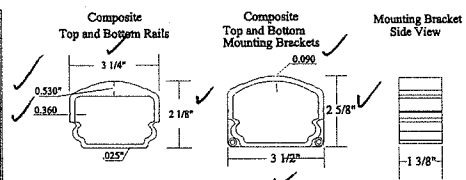


Turned & Square Balusters



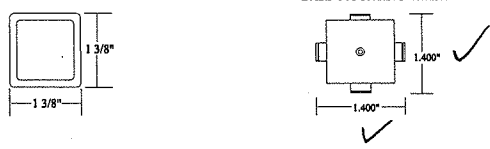
36" High Railing "A" = 33 3/4"
"B" = 29 5/8"

42" High Railing "A" = 39 3/4"
"B" = 35 5/8"



36" High Railing "A" = 32 1/2"
42" High Railing "A" = 38 1/2"

BASE MOUNTING PLATE



APPENDIX B

Photographs



Photo No. 1
Infill Loading at Center of Balusters

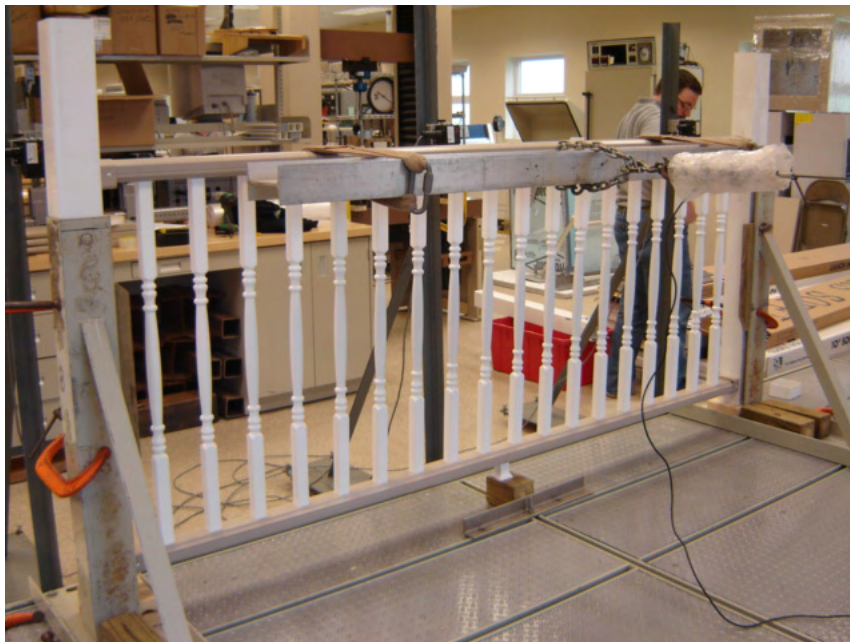


Photo No. 2
Horizontal Uniform Load Test on Top Rail



Photo No. 3
Concentrated Load at End of Rail (Bracket)



Photo No. 4
Post / Bracket / Rail Connection