



TEST REPORT

Rendered to:

TUSCAN MANUFACTURING, LP

For:

PRODUCT: Compliant Rail
TYPE: 1-1/2" Diameter PVC Secondary Handrail

Report No: 75945.01-119-19
Report Date: 10/19/07

TEST REPORT

75945.01-119-19
October 19, 2007

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TEST REPORT

Rendered to:

TUSCAN MANUFACTURING, LP
P.O. Box 185
Landisville, Pennsylvania 17538

Report No: 75945.01-119-19
Test Date: 08/14/07
Report Date: 10/19/07

1.0 General Information

1.1 Product

Compliant Rail

1.2 Type

1-1/2" Diameter PVC Secondary Handrail

1.3 Project Description

Architectural Testing, Inc. (ATI) was contracted by Tuscan Manufacturing, LP to perform testing on their 1-1/2" diameter PVC secondary handrail system in a 60" length (center post to center post). The purpose of the testing is code compliance evaluation in accordance with the following criteria:

ICC-ES™ AC174 (March 1, 2007), *Acceptance Criteria for Deck Board Span Ratings and Guardrail Systems (Guards and Handrails)*.

Testing for ICC-ES™ AC174 was limited to satisfying the structural load testing requirements of Section 5.1, *Guardrail System (Guard and Handrail) Performance Requirements*. Testing was limited to the minimum test loads required under AC174, which are equal to 2.5 times the design load of the referenced building code. Justification for the adequacy of the 2.5 load factor is not within the scope of this report.

1.4 Product Description

The handrails are produced by a mono-extrusion process while the brackets used for attachment are manufactured using an extrusion process. One product color (white) was evaluated for the secondary handrail.

1.5 Limitations

All tests performed were to evaluate structural performance of the handrail assembly to carry and transfer imposed loads to the supports (posts). The test specimen evaluated included the handrail, handrail 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.

1.6 Product Sampling

Testing was conducted for preliminary evaluations only and all samples used for the testing reported herein were provided by Tuscan Manufacturing, LP.

1.7 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 Reference Standards

ASTM D 7032-04, *Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails)*.

3.0 Structural Performance Testing of Assembled Handrail System

Re: AC174 - Section 5.0

3.1 General

Handrail assemblies were tested in a self-contained structural frame designed to accommodate anchorage of the handrail 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.

3.2 Handrail Assembly Description

The handrail system consisted of a 1-1/2" diameter PVC tube (0.290" wall thickness) reinforced with a 6063 aluminum alloy tube (0.075" wall thickness) with exterior splines extending 0.125" from the outside diameter. Two powder coated extruded aluminum brackets mounted to pressure treated Southern Yellow Pine (SYP) 4x4 posts with plastic/wood composite sleeves (0.250" wall thickness) using one 3/8" by 2" long lag bolt. In Test Series No. 2 the bracket attachment was modified by the addition of two 1/4" by 2" long lag bolts into the post through the top of each bracket. The 60" by 1-1/2" diameter PVC secondary handrail was attached to the powder coated extruded aluminum bracket using two #12 by 1" long self-tapping, stainless steel hex-head screws. The post supports and handrail were predrilled prior to bracket attachment.

See drawings in Appendix A and photographs in Appendix B for additional detail.

3.3 Test Setup

Each handrail assembly was installed and tested as a single handrail section by directly securing the support posts into a rigid test frame. The 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 handrail system (ends and mid-point) to determine net component deflections. See photographs in Appendix B for test setups.

3.4 Test Procedure

Testing and evaluation was performed in accordance with Section 5.1 of AC174. 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. Each design load test was performed using the following procedure:

1. Zeroed transducers and load cell at zero load
2. Increased load to specified test load in no less than ten seconds

3.5 Test Results

Unless otherwise noted, all loads and displacement measurements were normal to the handrail (horizontal). The test results apply to the handrail assembly and anchorage to the supports. There was no test load adjustment factors applied to the required test loads.

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.

Test Series No. 1

Design Load: 200 lb Concentrated Load at Midspan of Handrail			
Load Level	Test Load (lb)	E.T. (min:sec)	Achieved load equal to or greater than 500 lb
500 lb (2.5x D.L.)	502	00:37	

Design Load: 250 lb Concentrated Horizontal Load at End of Handrail (Bracket)			
Load Level	Test Load (lb)	E.T. (min:sec)	Achieved load equal to or greater than 625 lb
625 lb (2.5x D.L.)	633	00:33	

Test Series No. 2

Modification - Two Lag Screws Located at Top of Bracket

Design Load: 250 lb Concentrated Vertical Load at End of Handrail (Bracket)			
Load Level	Test Load (lb)	E.T. (min:sec)	Achieved load equal to or greater than 625 lb
625 lb (2.5x D.L.)	625	00:20	

3.6 Summary and Conclusions

The 1-1/2" diameter PVC secondary handrail assembly reported herein met the structural performance requirements of Section 5.1 of AC174 for handrail lengths up to and including 60" for attachment to the support posts as reported herein.

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, Inc. 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, Inc. 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, Inc.

For ARCHITECTURAL TESTING, INC.:

Matthew C. Holloway
Technician

MCH:mch/alb

Travis A. Hoover
Project Engineer

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	10/19/07	N/A	Original report issue

APPENDIX A

Drawings



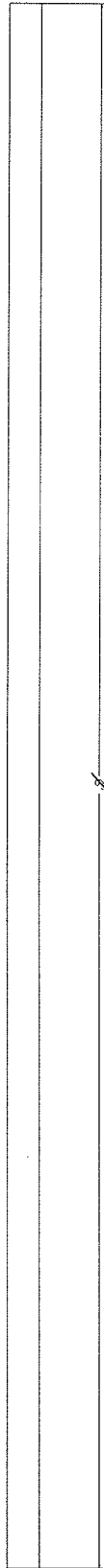
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 75945.01

Date 10/18/07

Tech TJB



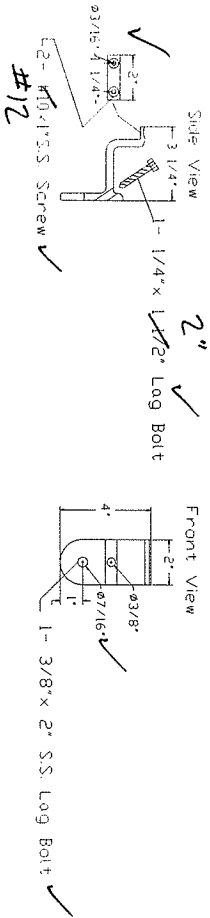
60" ✓

Vinyl Handrail
Ø1.470" ✓
1.8773" ✓

(6063) Aluminum Insert ✓

0.470" ✓
0.866" ✓

Handrail Bracket



Manf.UL	Tuscan Manful . L.C
DWG. Description	Compliant Rail
Scale	N.T.S.
Date	08/07/07
DWG. #	DWG. By: John Morrison

✓ Note: A second hole was added to the top of the handrail bracket for Test Series No. 2. Therefore two (2) 1/4" x 2" lag bolts were used on the top and a 3/8" x 2" lag bolt was used on the bottom of the bracket for attachment to the support post.

APPENDIX B

Photographs

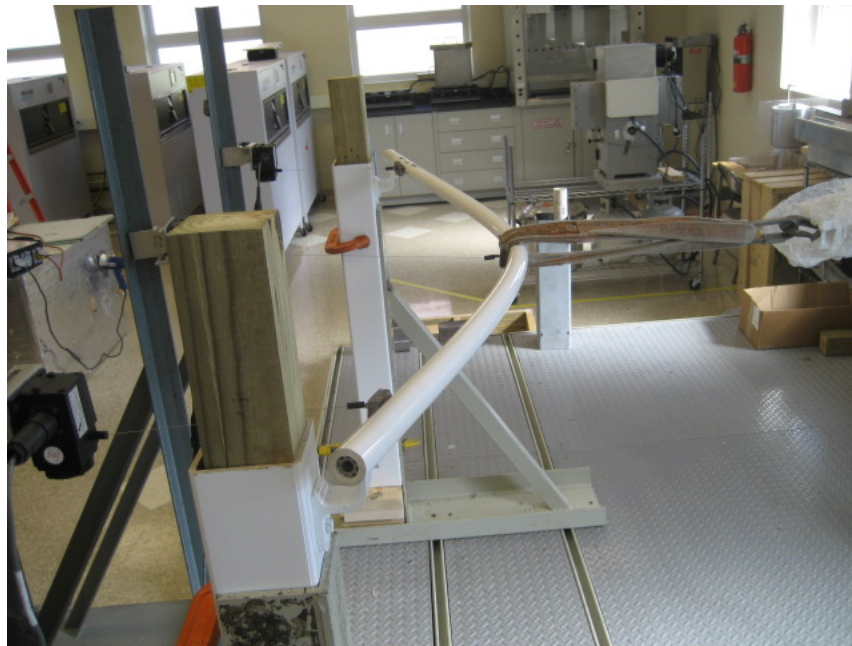


Photo No. 1
Concentrated Load Test at Midspan of Handrail



Photo No. 2
Concentrated Horizontal Load Test at Ends of Handrail (Bracket)



Photo No. 3
Concentrated Vertical Load Test at Ends of Handrail (Bracket)



Photo No. 4
Modification to Bracket in Test Series No. 2