

TEST REPORT

Rendered to:

HOMELAND VINYL PRODUCTS, INC.

For:

PVC Guardrail System Utilizing New Nylon/PVC Rail Mounting Bracket

Report No: C0624.01-119-19
Report Date: 10/31/12



Architectural Testing

TEST REPORT

C0624.01-119-19

October 31, 2012

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Architectural Testing

TEST REPORT

Rendered to:

HOMELAND VINYL PRODUCTS, INC.
3300 Pinson Valley Parkway
Birmingham, Alabama 35217

Report No: C0624.01-119-19
Test Date: 08/29/12
Report Date: 10/31/12

1.0 General Information

1.1 Product

PVC Guardrail System Utilizing New Nylon/PVC Rail Mounting Bracket

1.2 Project Description

Architectural Testing was contracted by Homeland Vinyl Products, Inc. to perform structural testing on a new Nylon/PVC rail mounting bracket manufactured by LMT-Mercer Group for use with their 8 ft by 42 in PVC guardrail system. This report is in conjunction with Architectural Testing Report No. 53597.01-119-19, which includes material test results and flame spread test results for the railing material. The purpose of the testing is code compliance evaluation in accordance with the following criteria:

ICC-ES™ AC174 (approved January, 2012), *Acceptance Criteria for Deck Board Span Ratings and Guardrail Systems (Guards and Handrails)*.

ICC-ES™ AC174-12 was developed by the ICC Evaluation Service, Inc. (ICC-ES™) as acceptance criteria to evaluate compliance with the following building codes:

2012 *International Building Code*®, International Code Council

2012 *International Residential Code*®, International Code Council

1.3 Limitations

All tests performed were to evaluate structural performance of the railing 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 supports. 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.

1.4 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

Homeland Vinyl Products, Inc.'s railing systems are comprised of PVC rails, balusters, and posts produced by an extrusion process. Extruded products are co-extruded (capped). Test specimens consisted of four different colored products identified by the manufacturer as follows: White, Tan, Adobe, and Mocha Walnut. 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

All railing materials were marked with a sample number and initialed with a permanent marker as an indication that they were selected by RADCO (independent inspection agency). All test specimens were supplied by Homeland Vinyl Products, Inc. and were marked as indicated. See photograph in Appendix B for typical sampling mark.

1.7 Witnessing

A representative of LMT-Mercer Group and Homeland Vinyl Products, Inc. was present on 08/29/12 to witness the following tests and/or test setups and assist in assembly of the test specimens:

- Assembly fastener tests; and
- Structural performance testing of assembled railing 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 $68 \pm 4^{\circ}\text{F}$ and humidity in the range of $50 \pm 5\%$ RH. All test specimen materials were stored in the laboratory environment for no less than 40 hours prior to testing.

2.0 Reference Standards

ASTM D 1761-06, *Standard Test Methods for Mechanical Fasteners in Wood*

ASTM D 7032-08, *Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails)*

3.0 Assembly Fastener Testing

Re: ICC-ES™ AC174 - Section 5.2

3.1 General

The purpose of this testing was to simulate a 90° bracket loading condition for the in-line application, which addresses a situation when the guardrail system is to be installed with the top rails in a corner condition.

3.2 Test Specimens

Short sections of the top rail were attached in accordance with Homeland Vinyl Products installation instructions to short sections of posts. Specimens were assembled by a representative of LMT-Mercer Group and Homeland Vinyl Products Inc. The rail brackets were attached to PVC-sleeved treated 4x4 wood posts (Southern Pine). Brackets were secured to the post and to the rail as described in Section 5.4 Fastening Schedule.

3.3 Test Setup

The testing machine was fitted with the post sections at the top and bottom to accommodate anchorage of the rail and brackets. The top post section was attached to the test machine's crosshead with a swivel mechanism, and the bottom post section was attached rigidly to the base of the test machine.

Reference photographs in Appendix B for test setups.

3.4 Test Procedure

Testing was performed in accordance with ASTM D 1761 and by using a computer-monitored and -controlled SATEC Unidrive, Model MII 50 UD Universal Testing Machine. Tests were run at a crosshead speed of 0.05 in/min, and each specimen was tested in tension to its ultimate load capacity.

3.5 Test Results

2 in by 3-1/2 in PVC Guardrail with "P"-Shaped Aluminum Insert
Test Date: 08/29/12

Specimen No.	Ultimate Load (lb)	Deviation From Average	Mode of Failure
1	825	0.7%	Bracket deformed and screws started pulling through the aluminum insert
2	768	6.2%	
3	866	5.7%	
Average	819		
Allowable Capacity¹	273	≥ 200 lb ∴ OK²	

¹ Average ultimate load divided by a factor of safety of three (3.0)

² Acceptance criteria determined from the uniform load test: $50 \text{ plf} \times 96 \text{ in} \div 12 \text{ in} \div 2 \text{ brackets} = 200 \text{ lb}$

3.6 Summary and Conclusions

The maximum design load rating required for guardrail systems for rail lengths up to and including 8 ft for use in IBC – All Use Groups is 200 lb. Therefore, fasteners / connectors reported herein meet the performance requirements of ICC-ES™ AC174 for use in corner conditions.

Testing of the 2 in by 3-1/2 in PVC guardrail with "P"-shaped aluminum insert reported herein qualifies the "T"-shaped PVC rail since the same "P"-shaped reinforcing is used in each rail and the attachments to the reinforcing in both conditions is the same.

4.0 Guardrail End-Use Adjustments

Re: ICC-ES™ AC174 – Sections 3.6 – 3.8

4.1 General

Data from material testing reported in Architectural Testing Report No. 53597.01-119-19 was used for determination of applicable adjustment factors.

4.2 End-Use Adjustment Factors

PVC Material

End-Use Factors	Comparison (% Change) with Standard (Control) Conditions		ASTM D 7032 Criteria (as referenced by AC174)	Adjustment Factors	
	Strength ¹	Stiffness ²		Strength	Stiffness
UV	+5%	-3%	Loss within 10%	1.00	1.00
Freeze-Thaw	+3%	+10%	Loss within 10%	1.00	1.00
Greatest of:					
+125°F	-22%	-19%	Loss within 25%	1.00	1.00
-20°F	+33%	+16%			
Moisture ³	N/A	N/A			
Overall End-Use Adjustment Factor:				1.00	1.00

¹ Moment or MOR (Modulus of Rupture)

² EI (the product of MOE and the Moment of Inertia) or MOE (Modulus of Elasticity)

³ Product does not absorb moisture.

Pursuant to compliance with ICC-ES™ AC174, the test loads were increased by the amount in excess of 10% for UV exposure and freeze-thaw cycling, as well as 25% for temperature and moisture effect. This sets the overall end-use adjustment factor at 1.00. Therefore, tests are performed to a maximum test load equal to 2.50 times design load ($2.5 \div 1.00 = 2.50$). In addition, the deflection observed at design load is adjusted for the cumulative effect on stiffness properties in excess of the same tolerances specified for strength (1.00).

5.0 Structural Performance Testing of Assembled Railing Systems

Re: ICC-ES™ AC174 - Section 5.1

5.1 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 in using electronic linear displacement transducers.

5.2 Railing Assembly Description

The "T"-shaped rail and 2 in by 3-1/2 in guardrail systems consisted of extruded PVC top and bottom rails with spaced balusters between the rail members. The guardrail systems had an overall top rail length (inside of post to inside of post) of 96 in with an overall rail height (deck surface to top of top rail) of 42 in. Top and bottom rails attached to PVC-sleeved treated 4x4 wood (Southern Yellow Pine) posts via LMT-Mercer Group's new nylon/PVC rail mounting brackets. See Section 5.4 Fastening Schedule for connection details. See drawings in Appendix A and photographs in Appendix B for additional details.

5.3 Component Descriptions

The scope of testing performed and reported herein was intended to evaluate the new nylon/PVC rail mounting bracket manufactured by LMT-Mercer group for use with Homeland Vinyl Products Inc.'s "T" Rail and 2 in by 3-1/2 in PVC guardrail systems consisting of the following components (see Appendix A for drawings):

Top Rails – "T" Rail – 3-1/2 in by 3-1/2 in by 0.076 in wall, "T" profile, PVC co-extrusion (aluminum reinforced)

– 2 in by 3-1/2 in rail – 2 in by 3-1/2 in by 0.076 in wall, rectangular profile, PVC co-extrusion (aluminum reinforced)

Bottom Rail – 2 in by 3-1/2 in by 0.076 in wall, rectangular profile, PVC co-extrusion

Top Rail Insert – "P" profile – 1.73 wide in by 1.58 high in square portion; 3.14 in overall height stem; 0.065 in wall; 6063-T6 aluminum extrusion used in both top rail profiles

Baluster – 1-1/2 in square by 0.063 in wall, PVC co-extrusion

Bracket – 3-3/16 in wide by 3-5/8 in high injection molded nylon/PVC

Post Sleeve – 4 in square by 0.098 in wall, PVC co-extrusion

Support Post: Preservative-treated wood (Southern Pine) 4x4

5.4 Fastening Schedule

Connection	Fastener
Top and Bottom Rail Bracket to Post	Four #10 x 1-1/2" (0.116 in minor diameter) stainless steel, phillips drive, pan head, self-drilling screws
Top and Bottom Rail Bracket to Rail	Four #10 x 1" (0.137 in minor diameter) stainless steel, phillips drive, pan head, self-drilling screws

5.5 Test Setup

The railing assembly was installed and tested as a single railing section by directly securing the 4 in square PVC-sleeved 4x4 treated wood posts (Southern Pine) to a rigid test frame, which rigidly restrained the rail system. The 4 in square PVC-sleeved 4x4 treated 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.

5.6 Test Procedure

Testing and evaluation was performed in accordance with Section 5.1 of ICC-ES™ 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; and
2. Increased load to specified test load in no less than ten seconds.

5.7 Test Results

Unless otherwise noted, all loads and displacement measurements were normal to the rail (horizontal). The test results apply only to the railing assembly between supports and anchorage to the support. The test load adjustment factor was 2.5 x design load for the rail load tests. This was determined from test results as summarized in Section 4.0 Guardrail End-Use Adjustments.

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.

5.7 Test Results (Continued)

Test Series No. 1
96 in by 42 in PVC Level Guardrail System with "T" Shaped Top Rail
Using New Nylon/PVC Rail Mounting Bracket
IBC – All Use Groups / ICC-ES AC174
Specimen No. 1 of 3

Test No. 1 – Test Date: 08/29/12			
Design Load: 50 lb / 1 Square ft of Infill at Center of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	127	00:30	Withstood load equal to or greater than 125 lb without failure

Test No. 2 – Test Date: 08/29/12			
Design Load: 50 lb / 1 Square ft of Infill at Bottom of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	128	00:36	Withstood load equal to or greater than 125 lb without failure

Test No. 3 – Test Date: 08/29/12			
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Horizontal Uniform Load on Top Rail			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.)	1000	01:27	Withstood load equal to or greater than 1000 lb without failure

Test No. 4 – Test Date: 08/29/12			
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Vertical Uniform Load on Top Rail			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.)	1002	01:12	Withstood load equal to or greater than 1000 lb without failure

5.7 Test Results (Continued)

Test Series No. 1 (Continued) Specimen No. 1 of 3 (Continued)

Test No. 5 – Test Date: 08/29/12						
Design Load: 200 lb Concentrated Load at Midspan of Top Rail						
Load Level	Test Load (lb)	E.T. (min:sec)	Displacement (inches)			
			End	Mid	End	Net ¹
200 lb (D.L.)	203	00:27	0.05	1.38	0.07	1.32
500 lb (2.50 x D.L.)	502	00:54	Result: Withstood load equal to or greater than 500 lb without failure			
Deflection Evaluation: Maximum rail deflection at 203 lb = 1.32 in on a 96 in rail Adjusted deflection for end use factors = 1.32 in ÷ 1.00 = 1.32 in Limits per AC174: $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{42}{24} + \frac{96}{96}\right) = 2.75" > 1.32" \therefore ok$						

¹ Each end displacement was measured at the center of the support. Net displacement was the rail displacement relative to the supports.

Test No. 6 – Test Date: 08/29/12			
Design Load: 200 lb Concentrated Load at Both Ends of Top Rail (Brackets)			
Load Level ¹	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.5 x D.L.) x 2	1001	01:27	Each end withstood load equal to or greater than 500 lb without failure

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

Specimen No. 2 of 3

Test No. 1 – Test Date: 08/29/12			
Design Load: 50 lb / 1 Square ft of Infill at Center of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	125	00:22	Withstood load equal to or greater than 125 lb without failure

5.7 Test Results (Continued)

Test Series No. 1 (Continued)
Specimen No. 2 of 3 (Continued)

Test No. 2 – Test Date: 08/29/12			
Design Load: 50 lb / 1 Square ft of Infill at Bottom of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	128	00:21	Withstood load equal to or greater than 125 lb without failure

Test No. 3 – Test Date: 08/29/12			
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Horizontal Uniform Load on Top Rail			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.)	1002	01:16	Withstood load equal to or greater than 1000 lb without failure

Test No. 4 – Test Date: 08/29/12			
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Vertical Uniform Load on Top Rail			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.)	1002	01:13	Withstood load equal to or greater than 1000 lb without failure

Test No. 5 – Test Date: 08/29/12						
Design Load: 200 lb Concentrated Load at Midspan of Top Rail						
Load Level	Test Load (lb)	E.T. (min:sec)	Displacement (inches)			
			End	Mid	End	Net¹
200 lb (D.L.)	205	00:29	0.04	1.43	0.05	1.38
500 lb (2.50 x D.L.)	500	00:53	Result: Withstood load equal to or greater than 500 lb without failure			

Deflection Evaluation:

Maximum rail deflection at 205 lb = 1.38 in on a 96 in rail

Adjusted deflection for end use factors = 1.38 in ÷ 1.00 = 1.38 in

Limits per AC174: $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{42}{24} + \frac{96}{96}\right) = 2.75" > 1.38" \therefore ok$

¹ Each end displacement was measured at the center of the support. Net displacement was the rail displacement relative to the supports.

5.7 Test Results (Continued)

Test Series No. 1 (Continued)
Specimen No. 2 of 3 (Continued)

Test No. 6 – Test Date: 08/29/12			
Design Load: 200 lb Concentrated Load at Both Ends of Top Rail (Brackets)			
Load Level ¹	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.) x 2	1005	01:03	Each end withstood load equal to or greater than 500 lb without failure

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

Specimen No. 3 of 3

Test No. 1 – Test Date: 08/29/12			
Design Load: 50 lb / 1 Square ft of Infill at Center of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	125	00:22	Withstood load equal to or greater than 125 lb without failure

Test No. 2 – Test Date: 08/29/12			
Design Load: 50 lb / 1 Square ft of Infill at Bottom of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	127	00:22	Withstood load equal to or greater than 125 lb without failure

Test No. 3 – Test Date: 08/29/12			
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Horizontal Uniform Load on Top Rail			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.)	1001	01:20	Withstood load equal to or greater than 1000 lb without failure

5.7 Test Results (Continued)

Test Series No. 1 (Continued)
Specimen No. 3 of 3 (Continued)

Test No. 4 – Test Date: 08/29/12			
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Vertical Uniform Load on Top Rail			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.)	1005	01:41	Withstood load equal to or greater than 1000 lb without failure

Test No. 5 – Test Date: 08/29/12						
Design Load: 200 lb Concentrated Load at Midspan of Top Rail						
Load Level	Test Load (lb)	E.T. (min:sec)	Displacement (inches)			
			End	Mid	End	Net ¹
200 lb (D.L.)	200	00:21	0.09	1.40	0.12	1.30
500 lb (2.50 x D.L.)	502	00:48	Result: Withstood load equal to or greater than 500 lb without failure			

Deflection Evaluation:

Maximum rail deflection at 200 lb = 1.30 in on a 96 in rail

Adjusted deflection for end use factors = 1.30 in ÷ 1.00 = 1.30 in

Limits per AC174: $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{42}{24} + \frac{96}{96}\right) = 2.75" > 1.30" \therefore ok$

¹ Each end displacement was measured at the center of the support. Net displacement was the rail displacement relative to the supports.

Test No. 6 – Test Date: 08/29/12			
Design Load: 200 lb Concentrated Load at Both Ends of Top Rail (Brackets)			
Load Level ¹	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.) x 2	1002	01:11	Each end withstood load equal to or greater than 500 lb without failure

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

5.7 Test Results (Continued)

**Test Series No. 2
96 in by 42 in PVC 2 in by 3-1/2 in Level Guardrail System
Using New Nylon/PVC Rail Mounting Bracket
IBC – All Use Groups / ICC-ES AC174
Specimen No. 1 of 3**

Test No. 1 – Test Date: 08/29/12			
Design Load: 50 lb / 1 Square ft of Infill at Center of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	126	00:32	Withstood load equal to or greater than 125 lb without failure

Test No. 2 – Test Date: 08/29/12			
Design Load: 50 lb / 1 Square ft of Infill at Bottom of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	126	00:32	Withstood load equal to or greater than 125 lb without failure

Test No. 3 – Test Date: 08/29/12			
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Horizontal Uniform Load on Top Rail			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.)	1000	01:59	Withstood load equal to or greater than 1000 lb without failure

Test No. 4 – Test Date: 08/29/12			
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Vertical Uniform Load on Top Rail			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.)	1000	00:56	Withstood load equal to or greater than 1000 lb without failure

5.7 Test Results (Continued)

Test Series No. 2 (Continued)
Specimen No. 1 of 3 (Continued)

Test No. 5 – Test Date: 08/29/12						
Design Load: 200 lb Concentrated Load at Midspan of Top Rail						
Load Level	Test Load (lb)	E.T. (min:sec)	Displacement (inches)			
			End	Mid	End	Net ¹
200 lb (D.L.)	202	00:31	0.06	1.47	0.07	1.41
500 lb (2.50 x D.L.)	500	00:58	Result: Withstood load equal to or greater than 500 lb without failure			
Deflection Evaluation:						
Maximum rail deflection at 202 lb = 1.41 in on a 96 in rail						
Adjusted deflection for end use factors = 1.41 in ÷ 1.00 = 1.41 in						
Limits per AC174: $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{42}{24} + \frac{96}{96}\right) = 2.75" > 1.41" \therefore ok$						

¹ Each end displacement was measured at the center of the support. Net displacement was the rail displacement relative to the supports.

Test No. 6 – Test Date: 08/29/12			
Design Load: 200 lb Concentrated Load at Both Ends of Top Rail (Brackets)			
Load Level ¹	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.) x 2	1001	00:55	Each end withstood load equal to or greater than 500 lb without failure

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

Specimen No. 2 of 3

Test No. 1 – Test Date: 08/29/12			
Design Load: 50 lb / 1 Square ft of Infill at Center of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	126	00:36	Withstood load equal to or greater than 125 lb without failure

5.7 Test Results (Continued)

Test Series No. 2 (Continued)
Specimen No. 2 of 3 (Continued)

Test No. 2 – Test Date: 08/29/12			
Design Load: 50 lb / 1 Square ft of Infill at Bottom of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	128	00:36	Withstood load equal to or greater than 125 lb without failure

Test No. 3 – Test Date: 08/29/12			
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Horizontal Uniform Load on Top Rail			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.)	1004	02:01	Withstood load equal to or greater than 1000 lb without failure

Test No. 4 – Test Date: 08/29/12			
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Vertical Uniform Load on Top Rail			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.)	1006	01:30	Withstood load equal to or greater than 1000 lb without failure

Test No. 5 – Test Date: 08/29/12						
Design Load: 200 lb Concentrated Load at Midspan of Top Rail						
Load Level	Test Load (lb)	E.T. (min:sec)	Displacement (inches)			
			End	Mid	End	Net¹
200 lb (D.L.)	200	00:51	0.05	1.45	0.07	1.39
500 lb (2.50 x D.L.)	503	01:36	Result: Withstood load equal to or greater than 500 lb without failure			

Deflection Evaluation:

Maximum rail deflection at 200 lb = 1.39 in on a 96 in rail

Adjusted deflection for end use factors = 1.39 in ÷ 1.00 = 1.39 in

Limits per AC174: $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{42}{24} + \frac{96}{96}\right) = 2.75" > 1.39" \therefore ok$

¹ Each end displacement was measured at the center of the support. Net displacement was the rail displacement relative to the supports.

5.7 Test Results (Continued)

Test Series No. 2 (Continued)
Specimen No. 2 of 3 (Continued)

Test No. 6 – Test Date: 08/29/12			
Design Load: 200 lb Concentrated Load at Both Ends of Top Rail (Brackets)			
Load Level ¹	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.) x 2	1006	01:10	Each end withstood load equal to or greater than 500 lb without failure

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

Specimen No. 3 of 3

Test No. 1 – Test Date: 08/29/12			
Design Load: 50 lb / 1 Square ft of Infill at Center of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	126	00:25	Withstood load equal to or greater than 125 lb without failure

Test No. 2 – Test Date: 08/29/12			
Design Load: 50 lb / 1 Square ft of Infill at Bottom of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	126	00:36	Withstood load equal to or greater than 125 lb without failure

Test No. 3 – Test Date: 08/29/12			
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Horizontal Uniform Load on Top Rail			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.)	1004	01:21	Withstood load equal to or greater than 1000 lb without failure

5.7 Test Results (Continued)

Test Series No. 2 (Continued)
Specimen No. 3 of 3 (Continued)

Test No. 4 – Test Date: 08/29/12			
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Vertical Uniform Load on Top Rail			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.)	1001	00:55	Withstood load equal to or greater than 1000 lb without failure

Test No. 5 – Test Date: 08/29/12						
Design Load: 200 lb Concentrated Load at Midspan of Top Rail						
Load Level	Test Load (lb)	E.T. (min:sec)	Displacement (inches)			
			End	Mid	End	Net ¹
200 lb (D.L.)	202	00:35	0.05	1.56	0.07	1.50
500 lb (2.50 x D.L.)	502	01:05	Result: Withstood load equal to or greater than 500 lb without failure			

Deflection Evaluation:

Maximum rail deflection at 202 lb = 1.50 in on a 96 in rail

Adjusted deflection for end use factors = 1.50 in ÷ 1.00 = 1.50 in

Limits per AC174: $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{42}{24} + \frac{96}{96}\right) = 2.75" > 1.50" \therefore ok$

¹ Each end displacement was measured at the center of the support. Net displacement was the rail displacement relative to the supports.

Test No. 6 – Test Date: 08/29/12			
Design Load: 200 lb Concentrated Load at Both Ends of Top Rail (Brackets)			
Load Level ¹	Test Load (lb)	E.T. (min:sec)	Result
1000 lb (2.50 x D.L.) x 2	1009	00:51	Each end withstood load equal to or greater than 500 lb without failure

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

5.8 Summary and Conclusions

The nylon/PVC brackets manufactured by LMT-Mercer Group reported herein meet the structural performance requirements of Section 5.1 of ICC-ES™ AC174 as installed between adequate supports with guardrail details and Occupancy Classification as shown in the following table:

"T" Shaped and 2 in by 3-1/2 in Rails	Guardrail Type	Baluster	Code Occupancy Classification
96 in by 42 in	Level / In-Line Application	1-1/2 in Square PVC Picket	IBC – All Use Groups

The railing supports were not included within the scope of this testing, and these conclusions would apply only for a railing that is provided with adequate supports that provide equal or better substrate material (Southern Pine wood) for the fasteners used to anchor the rail brackets.

6.0 Closing Statement

Architectural Testing will service this report for the entire test record retention period. The report retention will be four years from the report date. Test records that are retained such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation will be retained by Architectural Testing, Inc. for the entire test record retention period. 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:

Kyle J. Evans
Technician II
Structural Systems Testing

Virgal T. Mickley, Jr., P.E.
Senior Project Engineer
Structural Systems Testing

KJE:vtm/drm

Attachments (pages): This report is complete only when all attachments listed are included.

Appendix A - Drawings (8)

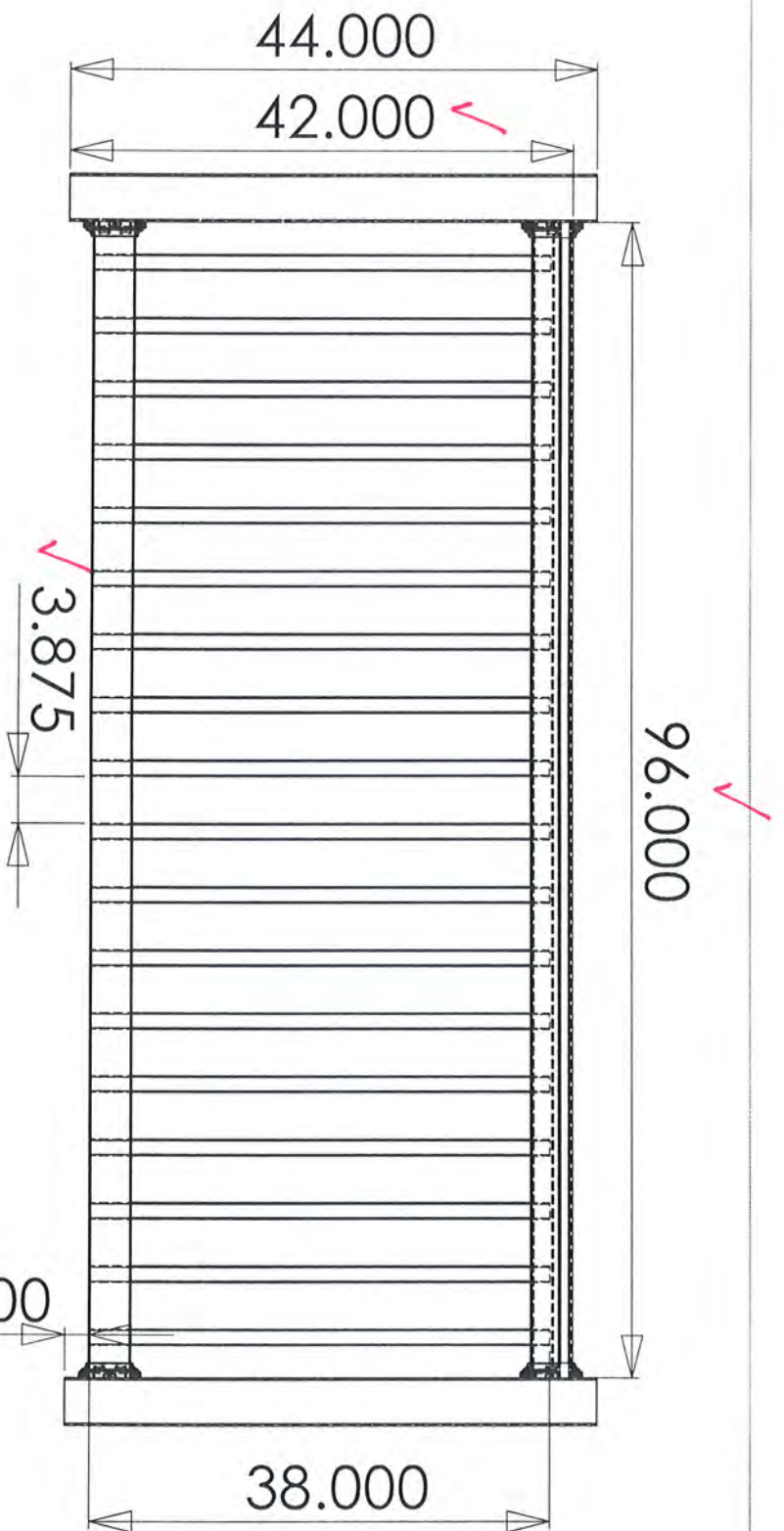
Appendix B - Photographs (7)

Revision Log

<u>Rev. #</u>	<u>Date</u>	<u>Page(s)</u>	<u>Revision(s)</u>
0	10/31/12	N/A	Original report issue

APPENDIX A

Drawings



ITEM NO.	PART NUMBER	DESCRIPTION	42" - 8' T-rail system/QTY.
1	4" x4" x 44"	4x4 .135 wall 18"	2
2	2x3.5	Routed 8' 2x3.5	1
3	3.5 T Rail	Routed 8' T-rail	1
4	2x3.5 P insert	8' p insert	1
5	1.375x1.375x38	1.375x1.375 13.75" picket	18
6	2x3.5 Bracket	1.5 x 1.5	2
7	T Rail Bracket		2

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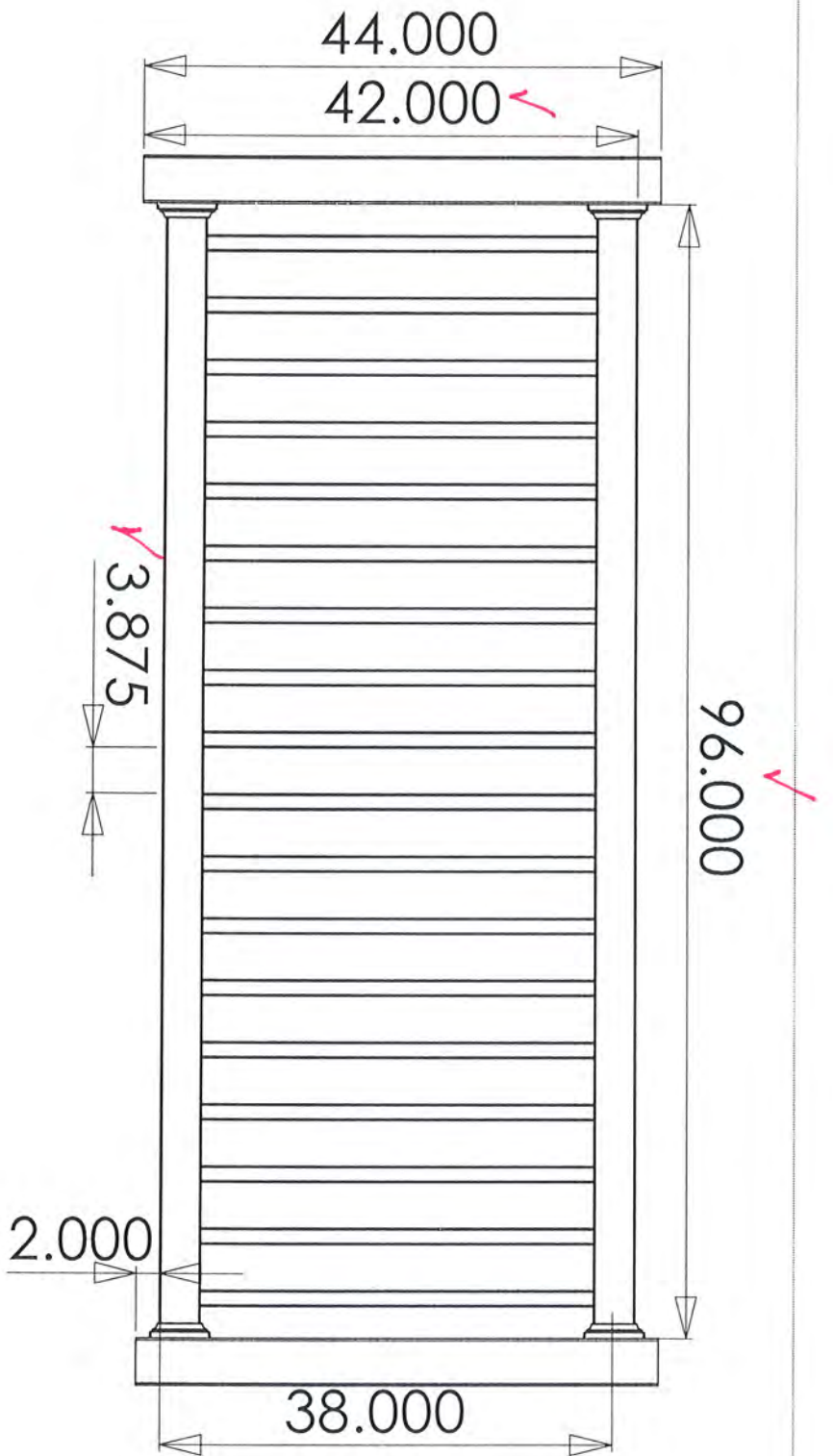
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42" - 8' T-rail system



Test sample complies with these details.
 Deviations are noted.
 Report # **C0624.01-119-19**
 Date **10/29/12** Tech **KJE**

42x96 T-Rail
 C:\Users\vhale\Desktop\Homeland\Birmingham



ITEM NO.	PART NUMBER	DESCRIPTION	42" - 8' 2x3.5 system/QTY.
1	4" x4" x 44"	4x4 .135 wall 18"	2
2	2x3.5	Routed 8' 2x3.5	2
3	2x3.5 P insert	8' p insert	1
4	1.375x1.375x38	1.375x1.375 13.75" picket	18
5	2x3.5 Bracket	1.5 x 1.5	4

Architectural Testing
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 Deviations are noted.
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42" - 8' 2x3.5 system

42696 2X3.5

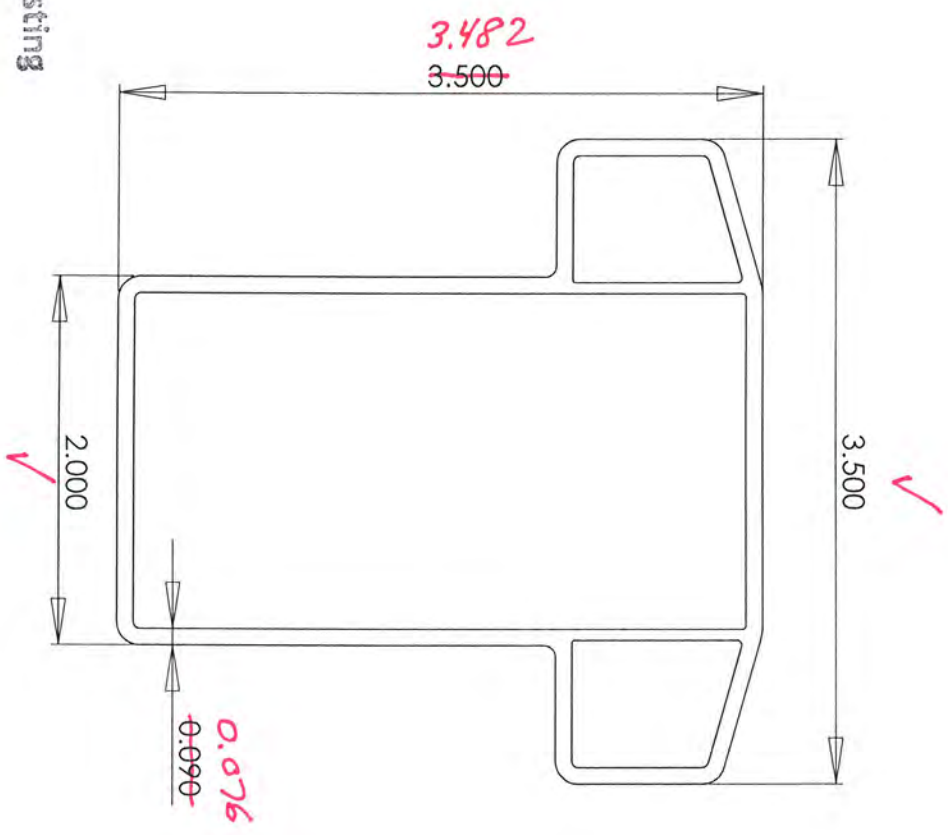


Architectural Testing

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Report # CO624.01-119-19

Date 10/29/12 Tech KJE



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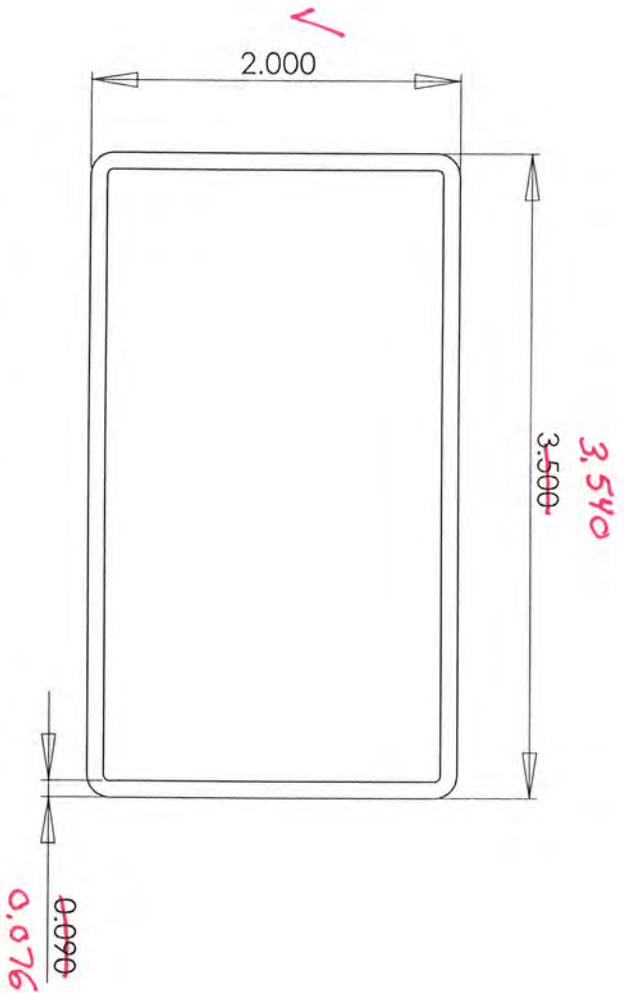


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3.5 T rail

T-rail profile 3.5x3.5

DATE	3/5/13
BY	3.5 T Rail A
APP	
REV	
DATE	
BY	
APP	
REV	



Architectural Testing

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DATE 08/20/2013 BY 60322 UCBAW/STP

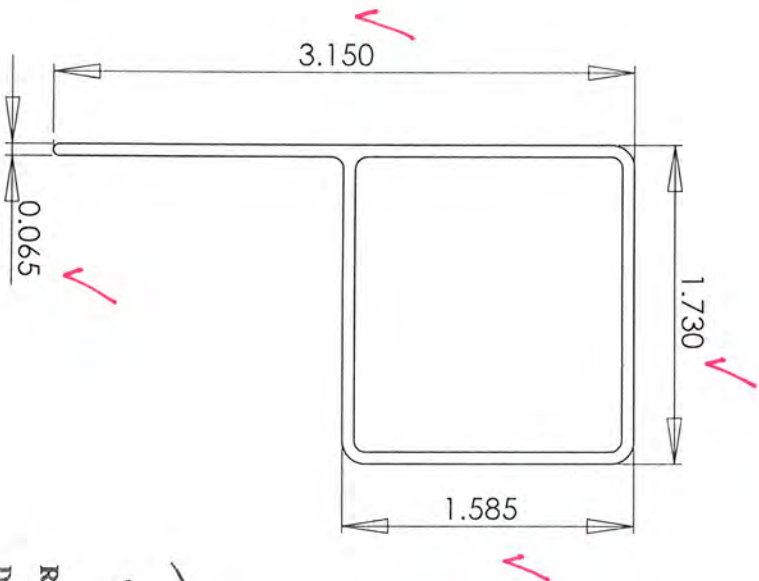


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DATE	2X3.5 12"	DESCRIPTION	2X3.5 .090 wall profile
DATE	2/23/09	DESCRIPTION	snathorn
DATE		DESCRIPTION	
DATE		DESCRIPTION	
DATE		DESCRIPTION	

2X3.5 0
C:\Users\pdyke\Documents\HomelandVinyl\2013\201308\20130812\20130812.dwg



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DATE: 10/29/12

PROJECT: 2012-0001
 DRAWING: 2012-0001-01
 TITLE: 12" P INSERT



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 fax: 205-854-3677
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ART NUMBER: 12" P Insert

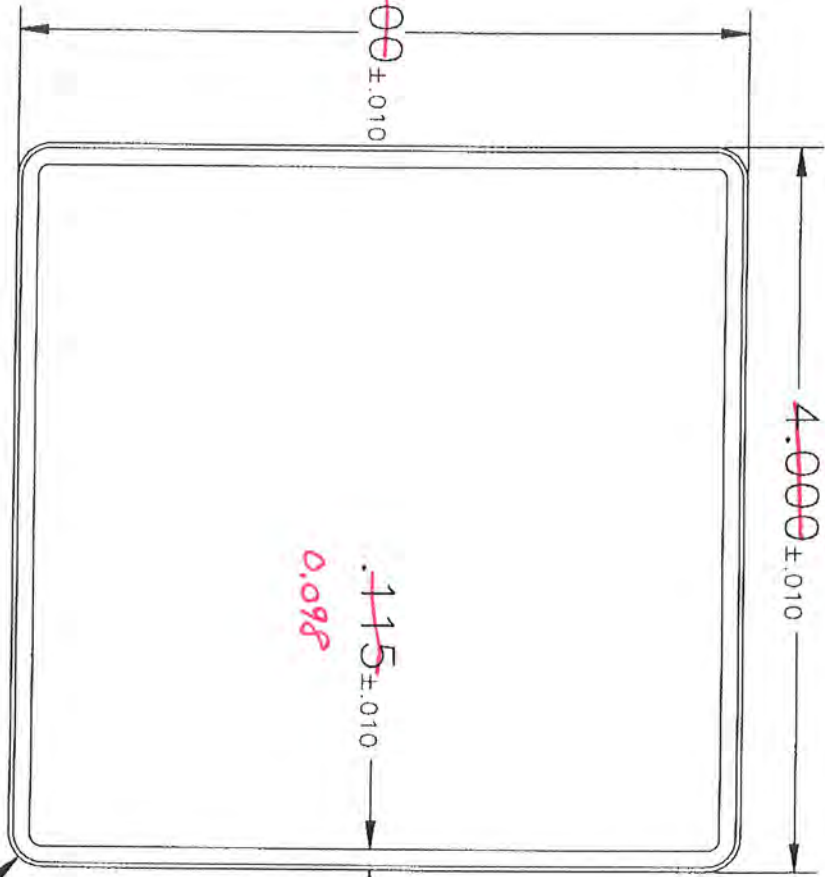
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0		6063-16
1	10/29/12	0.597

DIRECTION

2012-0001-01
 12" P Insert

FI2E 4" X 4" Co-Ex Utility

REV	DESCRIPTION	DATE	APPROVED
A	ORIGINAL	06/12/01	ROH
B	Updated to Co-Ex cap thickness	08/02/06	



PALLET CONFIGURATION
 STANDARD: 121 PIECES: 11 WIDE by 11 HIGH
 16', 24'; 55 PIECES: 11 WIDE by 5 HIGH



Architectural Testing

Test sample complies with these details. Deviations are noted.

Report # **CO62X.0J-119-19**
 Date **10/29/12** Tech **KJS**

LBS / FT: 1.097
 AREA: 1.7603

TOLERANCES
 LENGTH: ± 1/8" Short Lengths
 +1/4" to +1/2" Long Lengths
SQUARE: 1/16"
 MAX BOW PER SIDE: 1/16" per 4'

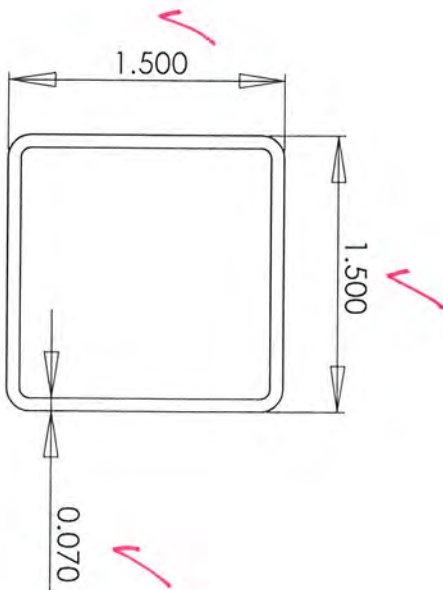
ITEM #	LENGTH	PIECES (WxH)	LBS / PIECE	PALLET WEIGHT	WOOD WRAPS	SIDES	TOP & BOTTOM	Plastic BAND
FI2EW072121	6'	121 (11x11)	6.582	1150	2	43 7/8"	4 7/8"	16' 0"
FI2EW084121	7'	121 (11x11)	7.679	1335	2	43 7/8"	4 7/8"	16' 0"
FI2EW192055	16'	55 (11x5)	17.552	1395	5	19 7/8"	4 6"	12' 6"
FI2EW289055	24'	55 (11x5)	26.328	2070	5	19 7/8"	4 6"	12' 6"

R0.1875

HOMELAND Vinyl Products, Inc.

FI2E

SCALE 1" = 1'
 All dimensions are subject to change without notice.
 DWG NO. SHEET 1 of 1



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Report # C062X.01-119-19

Date 10/29/12 Tech KTB

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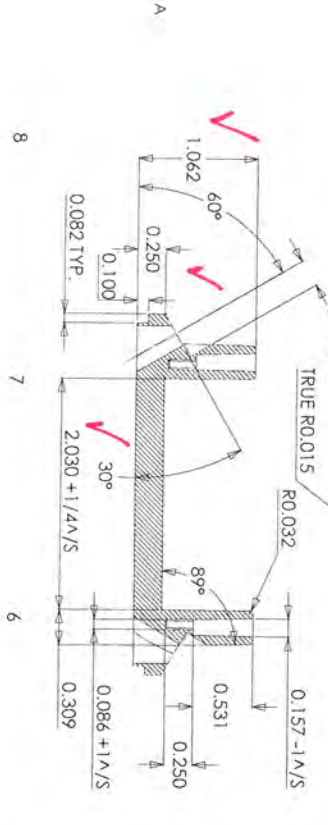
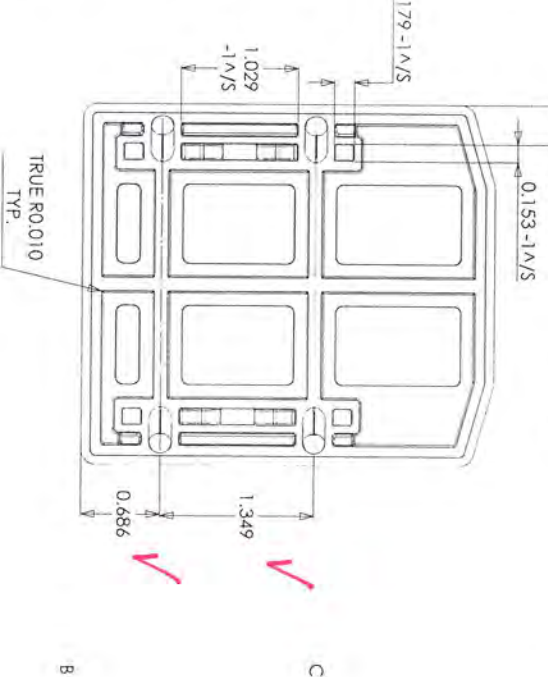
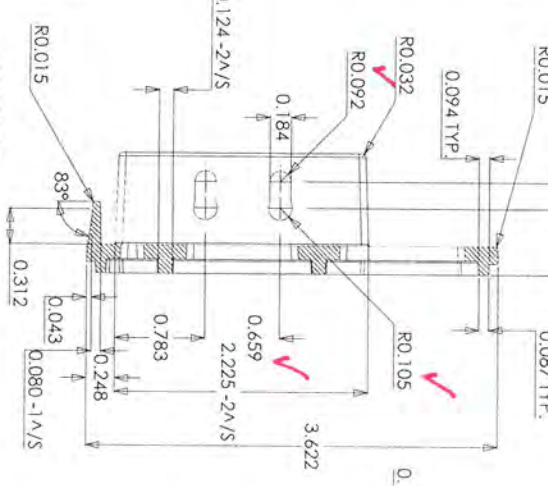
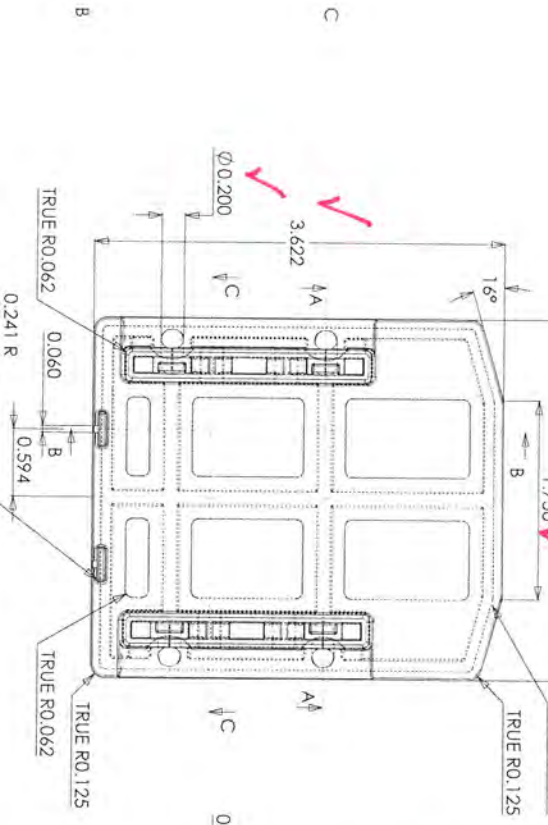
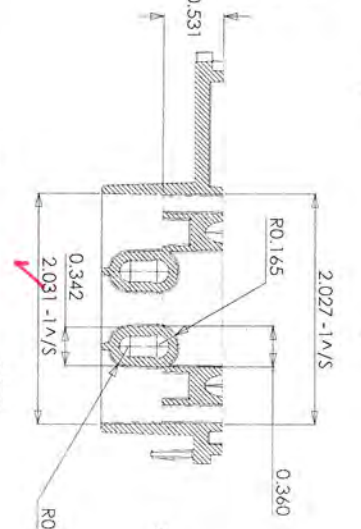
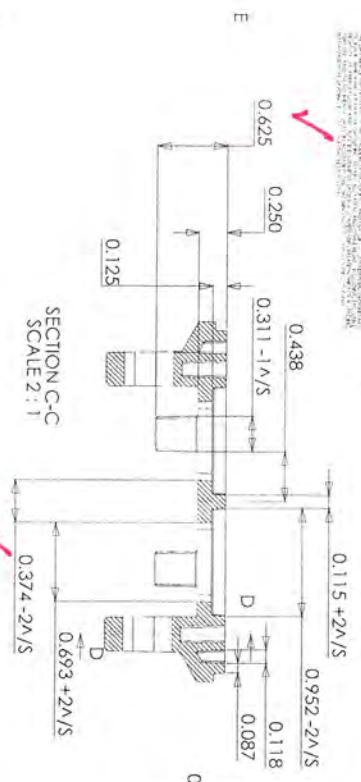
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DATE	DESCRIPTION
1.5X1.5X12	
PVC Rigid	
0.220	
1.5 SQ	

8 7 6 5 4 3 2 1



Architectural Testing

Test sample complies with these details.
 Deviations are noted.

Report # **C0624.01-119-19**
 Date **10/29/12** Tech **KJE**

DESIGNED BY: [Name]	DATE: [Date]
DRAWN BY: [Name]	DATE: [Date]
CHECKED BY: [Name]	DATE: [Date]
APPROVED BY: [Name]	DATE: [Date]

LMT-MERCER GROUP
 ARCHITECTURAL TESTING
 1000 [Address]
 [City, State, Zip]

APPENDIX B

Photographs



Photo No. 1
Typical Sample Markings



Photo No. 2
Infill Loading at Center of Two Balusters



Photo No. 3
Infill Loading at Bottom of Two Balusters



Photo No. 4
Horizontal Uniform Load on Top Rail



Photo No. 5
Vertical Uniform Load on Top Rail



Photo No. 6
Concentrated Load at Midspan of Top Rail



Photo No. 7
Concentrated Load at Both Ends of Top Rail (Brackets)



Photo No. 8
2 in by 3-1/2 in Top Rail-Bracket-Post Attachment



Photo No. 9
"T" Shaped Top Rail-Bracket-Post Attachment



Photo No. 10
Bottom Rail-Bracket-Post Attachment

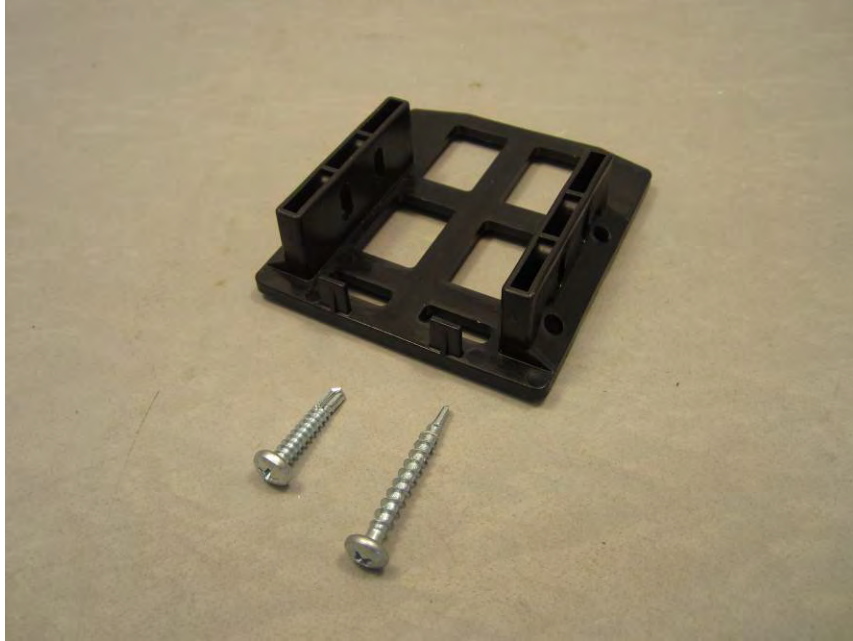


Photo No. 11
Nylon/PVC Rail Mounting Bracket with Screws

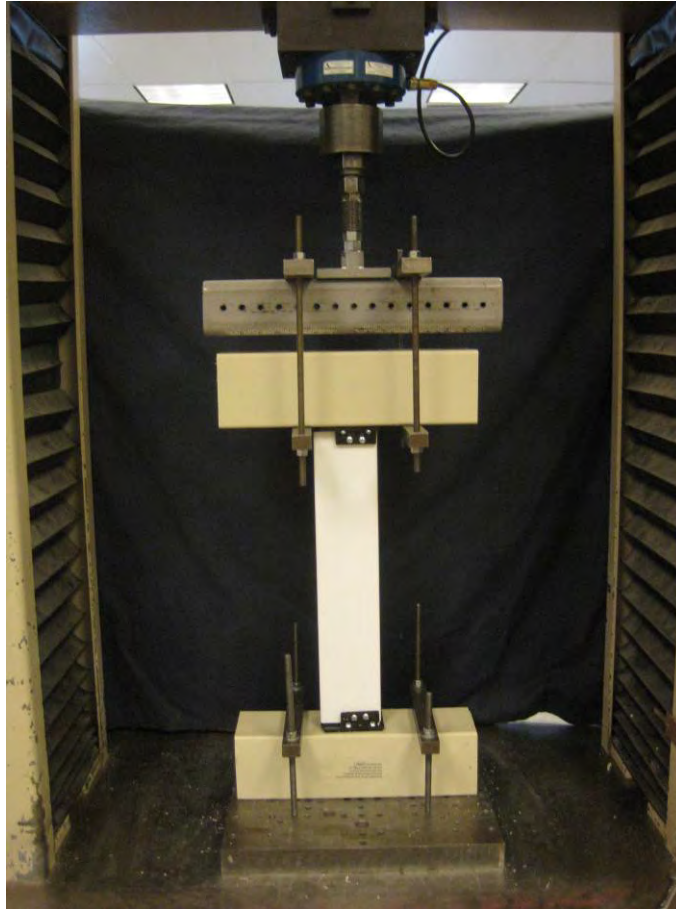


Photo No. 12
Assembly Fastener Test Setup