Progressive Engineering Inc.

USA Vinyl LLC

ASTM D7032 Guardrail
Post Mount Tests

3/22/2018

This test report contains eleven (11) pages, including the cover sheet. Any additions to, alterations of, or unauthorized use of excerpts from this report are expressly forbidden.

2017-6122
(B)

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Phone: 574-533-0337 - Fax: 574-533-9736
www.p-e-i.com

1. TITLE

ASTM D7032 Guardrail Post Mount Tests

2. OBJECTIVE

To apply a load to the top of a guardrail post, as described in ASTM D7032, Section 6.2.4 Concentrated Load Test, to test the post and the post anchorage system when installed on a rigid platform.

This test report pertains only to the specimens tested. It remains the sole responsibility of the manufacturer to provide a product consistent to that which was tested.

3. TESTED FOR

USA Vinyl, LLC
5795 Green Pointe Drive S
Groveport, OH 43125

4. TESTING ORGANIZATION

Progressive Engineering Inc.
58640 State Road 15
Goshen, IN 46528
www.p-e-i.com

See IAS Evaluation Report TL-178 for ISO 17025 Accreditation

5. TESTING PERSONNEL

Director of Testing	- Jason R. Holdeman
Project Manager	- Jacob Bontrager
Technician	- Justin Witmer

6. REFERENCE STANDARDS

ASTM D7032 - 17 - Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite and Plastic Lumber Deck Boards, Stair Treads, Guards, and Handrails

7. TEST EQUIPMENT

A. Hydraulic Cylinders
B. Load Cell - (PEI No. 466)
C. String Potentiometer - (PEI No. 1033)
D. Data Acquisition - (PEI No. 643)

8. TEST SPECIMEN

A. Aluminum Guardrail Post - 2-1/2" x 2-1/2" x 44" long with an average measured thickness of 0.108" Part No. LCAL-POST-2.5xx_V2. See attached drawing for details.

B. Post Base - 4-11/16" x 4-11/16" x 0.436" thick aluminum plate Part No. ACAL-POSTBASE-2.5_V2, with eight (8) screw holes for attachment to Post. See attached drawing for details.

C. Fasteners - Base plate to post fasteners were ELCO Part No. EAF886 (also Hilti Part No. 452) 1/4"-20 x 2" long Washer Hex Head with an average head diameter of 0.501" and an average shank diameter of 0.247", and length of 1.998". See attached drawing for details.

9. TEST SPECIMEN CONSTRUCTION

The test samples were tested in the 'As Received" condition.

10. TEST SET-UP

The Guardrail Post Assembly was secured to a rigid steel fixture with four (4) 3/8" diameter Grade 5 bolts. No washers were used above the base. A hydraulic cylinder was attached to another steel fixture such that the load direction was horizontal. A strap was looped around the Guardrail Post at the height of 42", and held in place with quick-clamp. A chain was used to connect the strap to the hydraulic cylinder, and a load cell was positioned inline. A string potentiometer was used to measure the deflection at the load point, 42" above the deck surface.

11. TEST PROCEDURE

A horizontal concentrated load test was applied at the test location. The load was applied at an approximate rate of 2" per minute until a force of 500 lbf was reached, which was held for 60 seconds. Loading was then continued until a failure occurred. Deflection readings were not taken after 500 lbf.

12. TEST REQUIREMENTS

Allowable deflection limit at 200 lbf is 3.5".

Post height 42" / 12 = 3.5"

13. TEST RESULTS

Average deflection at 200 lbs. = 0.827"
Average Maximum Load = 851 lbf.

All samples reached 500 lbf load, and held it for a minimum of 60 seconds.

14. CONCLUSION

USA Vinyl, LLC 2-1/2" x 2-1/2" LCAL-POST-2.5xx_V2 Deck Post, when installed to the ACAL-POSTBASE-2.5_V2 Post Base with eight (8) ELCO EAF886 screws, has met the structural requirements for section 6.2.4.2 of ASTM D7032. This test report does not purport to address the post anchorage.

Progressive Engineering Inc.

ASTM D7032 Guardrail Post Test

Date: 3/22/2018
Client: USA Vinyl LLC
Specimen: 2-1/2" x 2-1/2" Aluminum Guardrail Post

Temperature: 70° F
Rel. Humidity: 35%
End-Use Adjustment Factor: N/A
Guardrail Height (in): 42
Load Hold Time: 60 Seconds

	ASTM D7032 Section 6 - Test Information					Test Results				
Test Order	Sample No.	Loading Location	[1]Design Load	[2]Required Ultimate Load	[3]Allowable Deflection @ Design Load	Deflection @ Design Load	Maximum Load Applied	Deflection @ Max. Load	Comments or Observations	Pass / Fail
1	Post Test-1	42" Above Deck Surface	200 lbf	500 lbf	3.50"	0.849"	847 lbf	N/A	The sample held the required load for 60 seconds. Load increased until failure occurred. The screws which secured the post to the post base failed in tension on the opposite load side.	PASS
2	Post Test-2	42" Above Deck Surface	200 lbf	500 lbf	3.50"	0.842"	873 lbf	N/A	The sample held the required load for 60 seconds. Load increased until failure occurred. The screws which secured the post to the post base failed in tension on the opposite load side.	PASS
3	Post Test-3	42" Above Deck Surface	200 lbf	500 lbf	3.50"	0.789"	834 lbf	N/A	The sample held the required load for 60 seconds. Load increased until failure occurred. The screws which secured the post to the post base failed in tension on the opposite load side.	PASS
						See attached charts for load versus deflection				

[1] Minimum code requirements prescribed in 2009 IBC Section 1607.7.1, IRC Section R301.5 and/or ASTM D7032 Section 6.2.

[2] The Concentrated Load Requirement is 500 pounds, applied at he maximum guardrail height per section 6.2.4 of ASTM D7032.

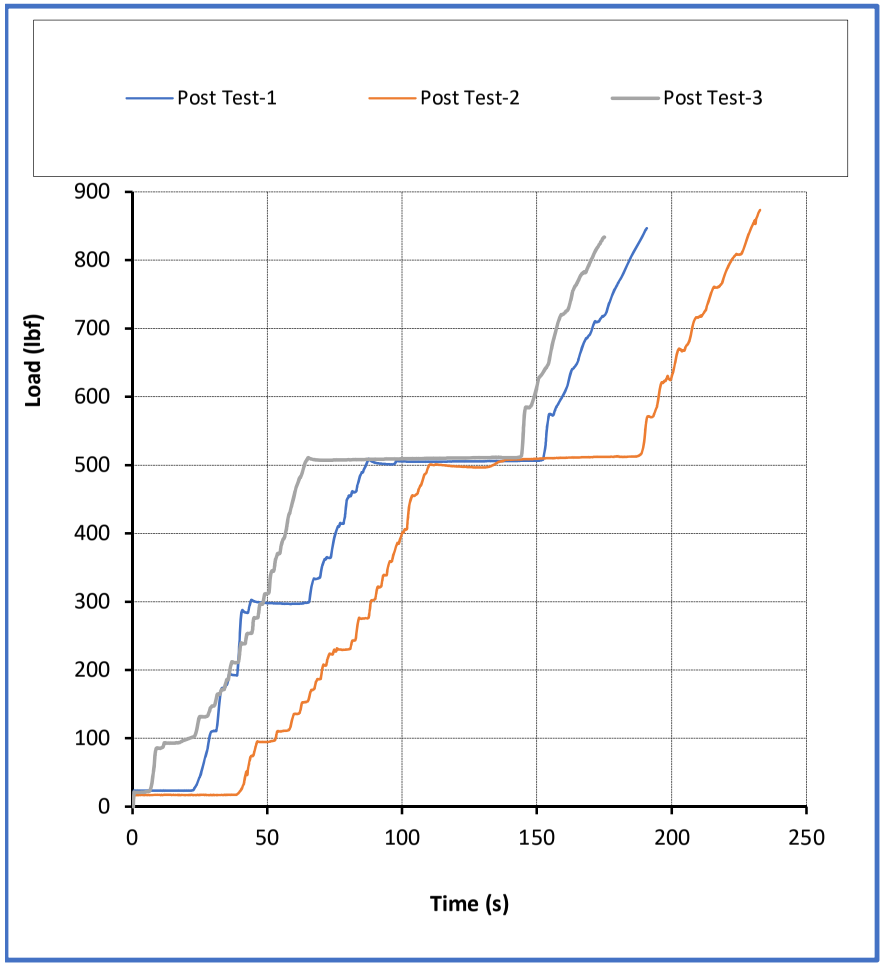
[3] The Allowable Deflection is based on the equation (L/96 + h/24) found in ASTM D7032.

Progressive Engineering Inc.

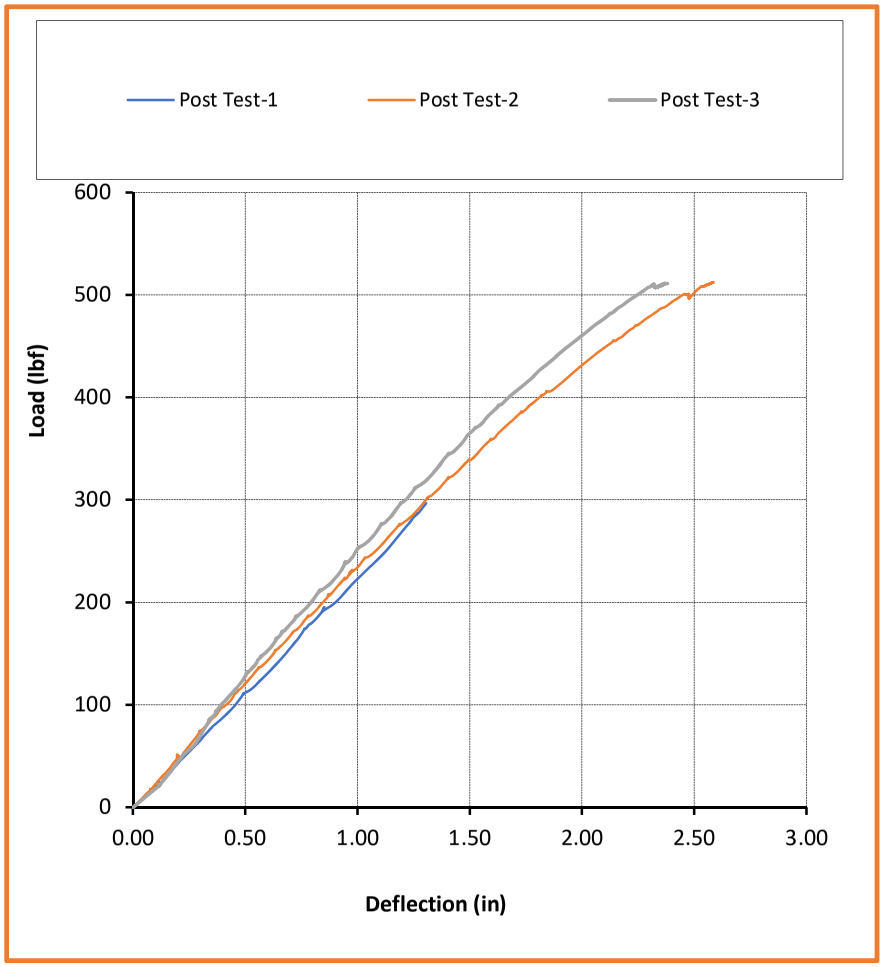
ASTM D7032 Guardrail Post Test

Date: 3/22/2018
Client: USA Vinyl LLC
Specimen: 2-1/2" x 2-1/2" Aluminum Guardrail Post

Load versus Time

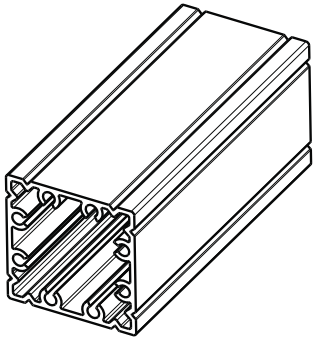


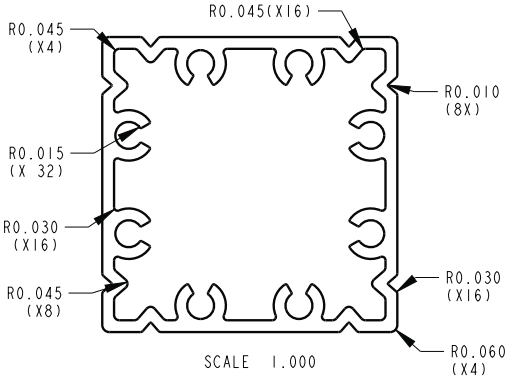
Load versus Deflection

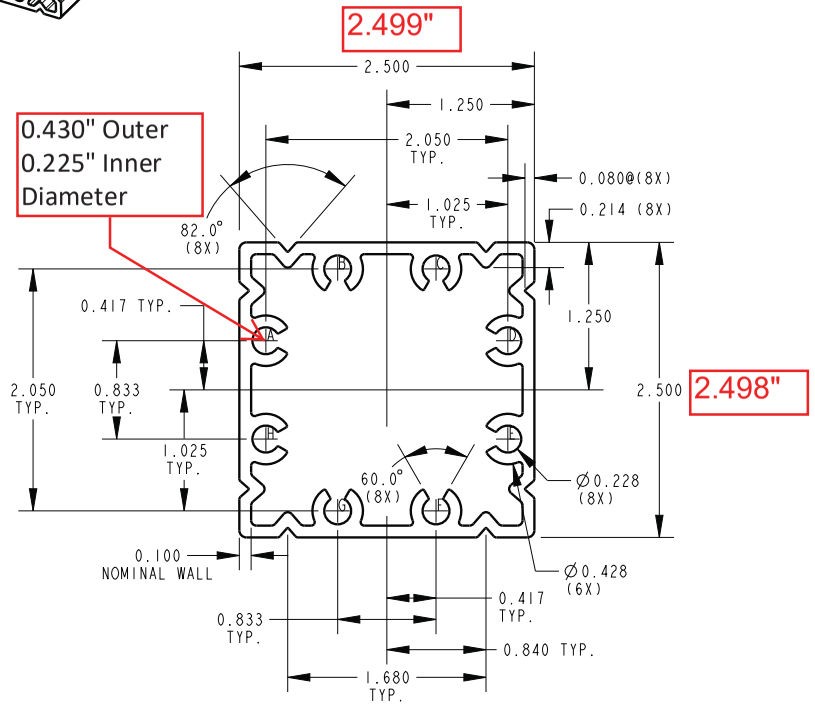


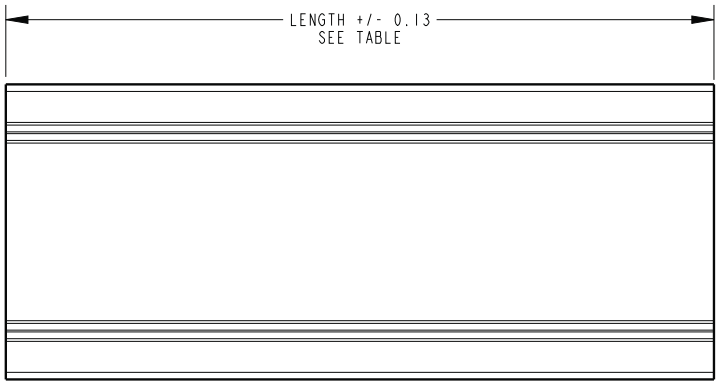
Note: All deflection values are Net Deflection and do not include post deflection.

REV.	DESCRIPTION	DATE	BY
0	INITIAL RELEASE	04/19/17	SWW
2	QTY. 8 SCREW BOSSES WERE QTY. 4	01/16/18	SWW









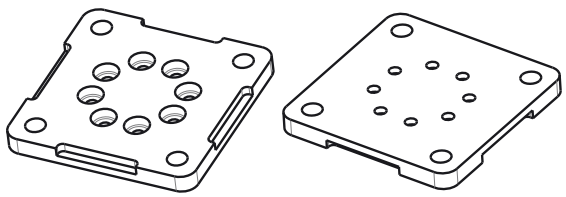
NOTES:

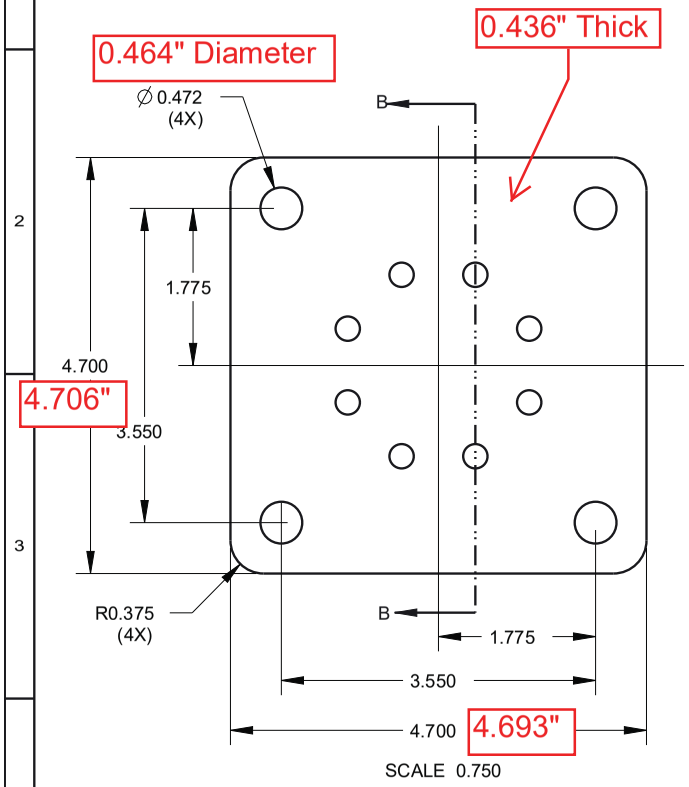
1. DRAWING IS FOR REFERENCE AND QC ONLY. ALL NON-DIMENSIONED FEATURES ARE TO BE CONTROLLED BY THE APPROVED 3D CAD DATA.
2. STRAIGHTNESS TOLERANCE:
3. TWIST TOLERANCE:
4. MATERIAL: 6005-T5 ALUMINUM
5. FINISH: POWDERCOAT
6. COLOR: SEE TABLE
7. POWDERCOAT MUST MEET AAMA 2604 SPECIFICATIONS.
8. CROSS SECTION AREA: 1.556 SQ.IN.
9. WEIGHT: 1.81 LBS/ FOOT
10. PARTS MUST BE FREE OF BLEMISHES AND COSMETIC DEFECTS.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		
DIMENSION	INCH	METRIC
2 PLACES	±0.02	±0.50
3 PLACES	±0.010	±0.250
ANGULAR	±0.50°	±0.50°

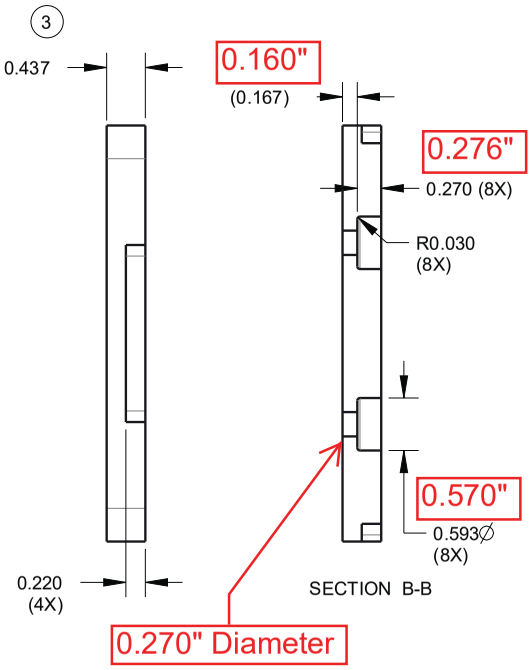
DRAWN BY: SWW	DRAWN DATE: 02/20/17	PART NAME: POST	USA VINYL, LLC 5795 GREEN POINT DRIVE GROVEPORT, OH 43215
APPRVD BY: -	APPRVD DATE: -		
MATERIAL: AS NOTED	COLOR: AS NOTED	PART NO.: LCAL-POST-2.5xx_V2	
FINISH: AS NOTED	TEXTURE: AS NOTED	SCALE: N/A / SHEET: 1 OF 1 / REV.: 01	

REV.	DESCRIPTION	DATE	BY
0	RELEASE FOR QUOTATION	04/25/17	SWW
1	ADDED (QTY. 4) 2.00" X .20" X .220" SLOTS -	07/11/17	SWW
2	QTY. 8 COUNTERBORED HOLES WAS QTY.3	01/16/18	SWW
3	.437" THICKNESS WAS .375"	01/16/18	SWW
4	.472"Ø (x4) was .400"Ø (x4)	02/20/18	SWW

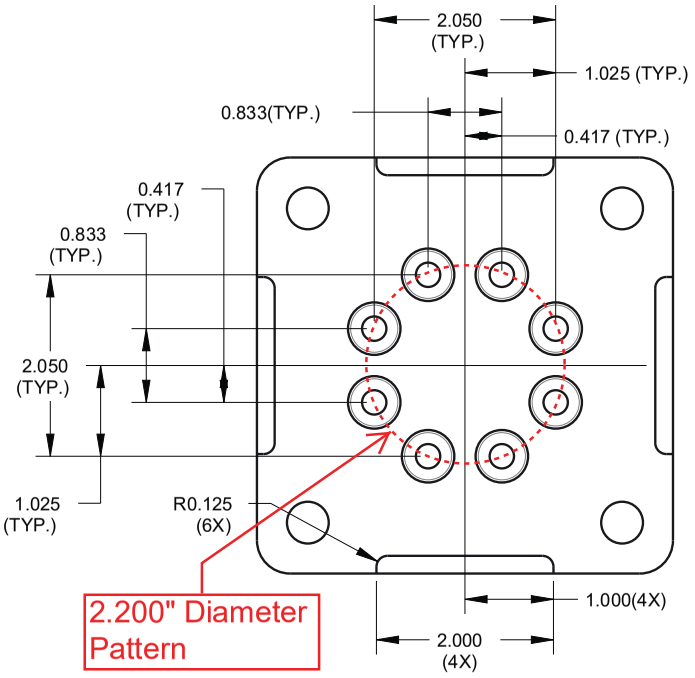




SCALE 0.750



SECTION B-B



NOTES:

1. DRAWING IS FOR REFERENCE AND QC ONLY. ALL NON-DIMENSIONED FEATURES ARE TO BE CONTROLLED BY THE APPROVED 3D CAD DATA.
2. DIMENSIONS ARE TO THEORETICAL INTERSECTIONS.
3. ALL DIMENSIONS ARE FINISHED PART DIMENSIONS.
4. MATERIAL: 6061 T6 ALUMINUM
5. FINISH: MILL FINISH
6. COLOR: SEE TABLE
7. IF POWDERCOATED, MUST MEET AAMA 2604 SPECIFICATIONS.
8. PARTS MUST BE FREE OF TOOL MARKS, BLEMISHES AND COSMETIC DEFECTS.

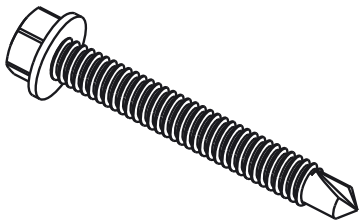
PART NO.	COLOR
ABAL-POSTBASE-2.5	TEXTURE BLACK
AWAL-POSTBASE-2.5	WHITE
AZAL-POSTBASE-2.5	BRONZE

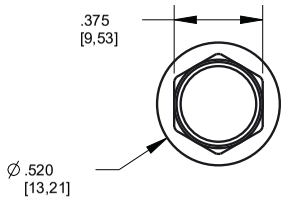
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

DIMENSION	INCH	METRIC
2 PLACES	±0.01	±0.25
3 PLACES	±0.005	±0.125
ANGULAR	±0.50°	±0.50°

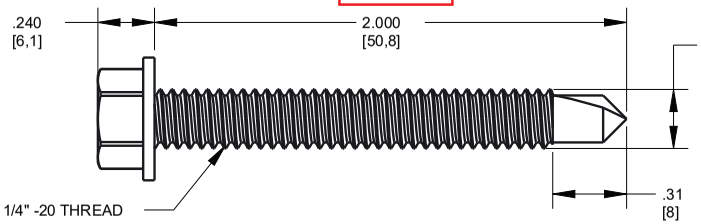
DRAWN BY: SWW	DRAWN DATE: 04/23/17	PART NAME: BASE, POST	USA VINYL, LLC 5795 GREEN POINT DRIVE GROVEPORT, OH 43215
APPRVD BY: -	APPRVD DATE: -		
MATERIAL: AS NOTED	COLOR: AS NOTED	PART NO.: ACAL-POSTBASE-2.5_V2	
FINISH: AS NOTED	TEXTURE: AS NOTED	SCALE: N/A / SHEET: 1 OF 1 / REV.: 0	

REV.	DESCRIPTION	DATE	BY
0	INITIAL RELEASE	11/08/17	SWW
-	-	-	-





0.501"



SCALE 2.000

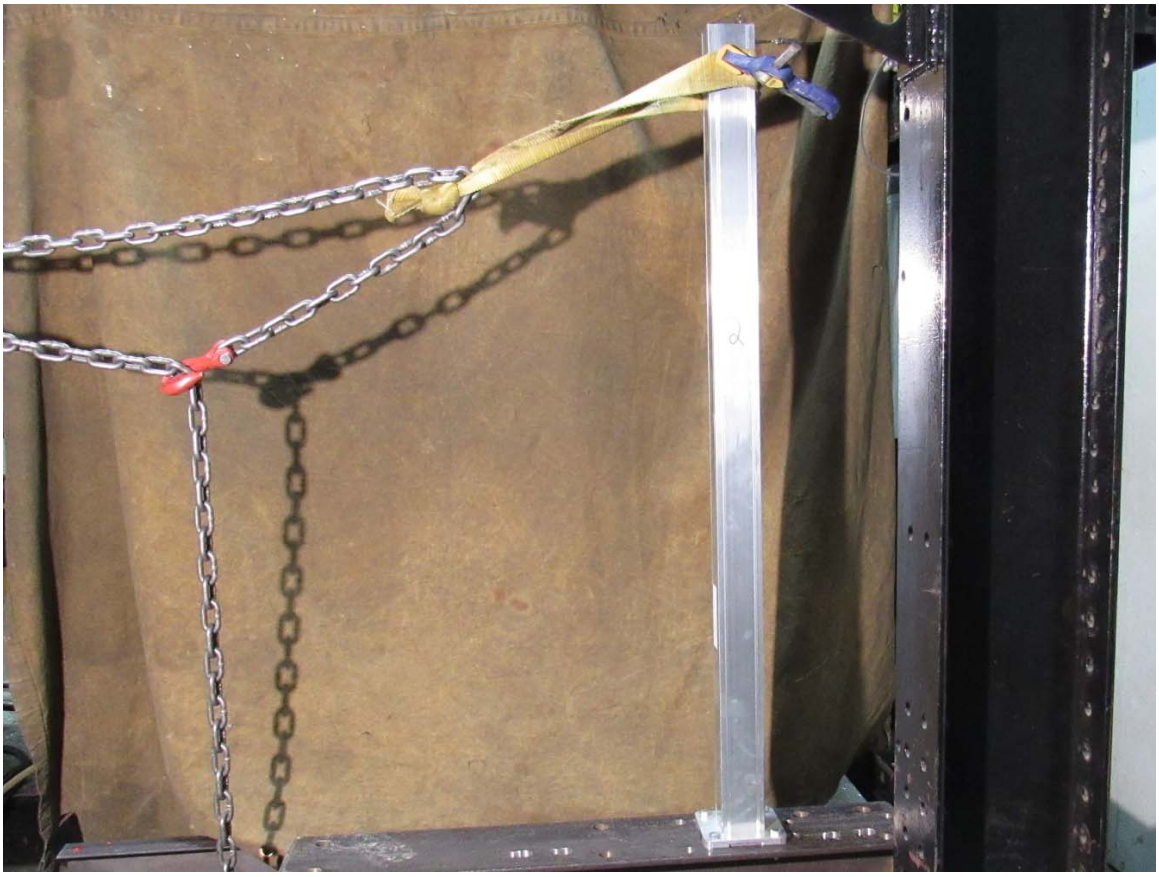
NOTES:

1. .25"-20 X 2.0" LG. HEX WASHER HEAD, SELF DRILLING SCREW
2. MATERIAL: ALLOY STEEL
3. FINISH: ULTRA CORROSION RESISTANT COATING
4. ELCO EAF886 OR HILTI KWIK FLEX SCREW 452
5. MCMASTER CARR PART # 90122A341

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

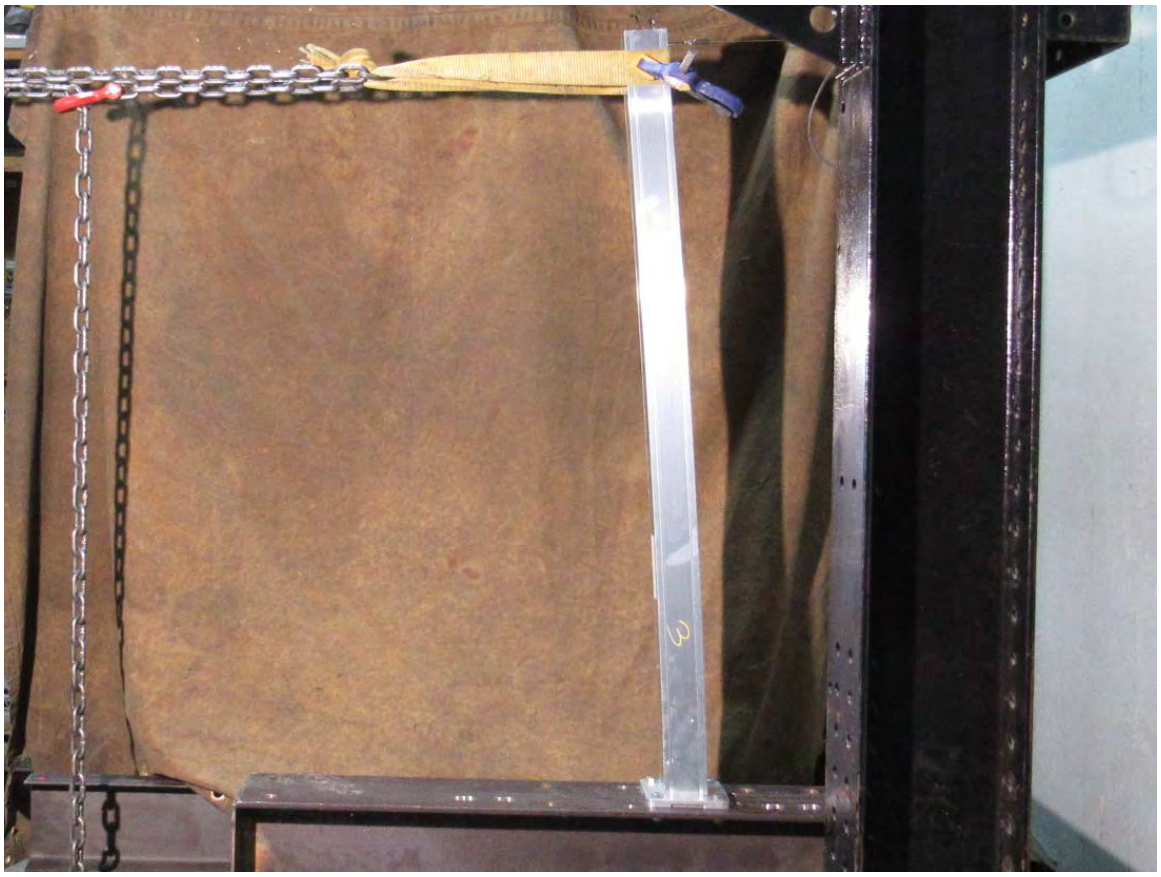
DIMENSION	INCH	METRIC
2 PLACES	±0.02	±0.50
3 PLACES	±0.010	±0.250
ANGULAR	±0.50°	±0.50°

DRAWN BY: SWW	DRAWN DATE: 171108	PART NAME: POST BASE SCREW	USA VINYL, LLC 5795 GREEN POINT DRIVE GROVEPORT, OH 43215
APPRVD BY: -	APPRVD DATE:		
MATERIAL: AS NOTED	COLOR: AS NOTED	PART NO.: AMFA-DRILFX_25-20X2	
FINISH: AS NOTED	TEXTURE: AS NOTED	SCALE: N/A / SHEET: 1 OF 1 / REV.	

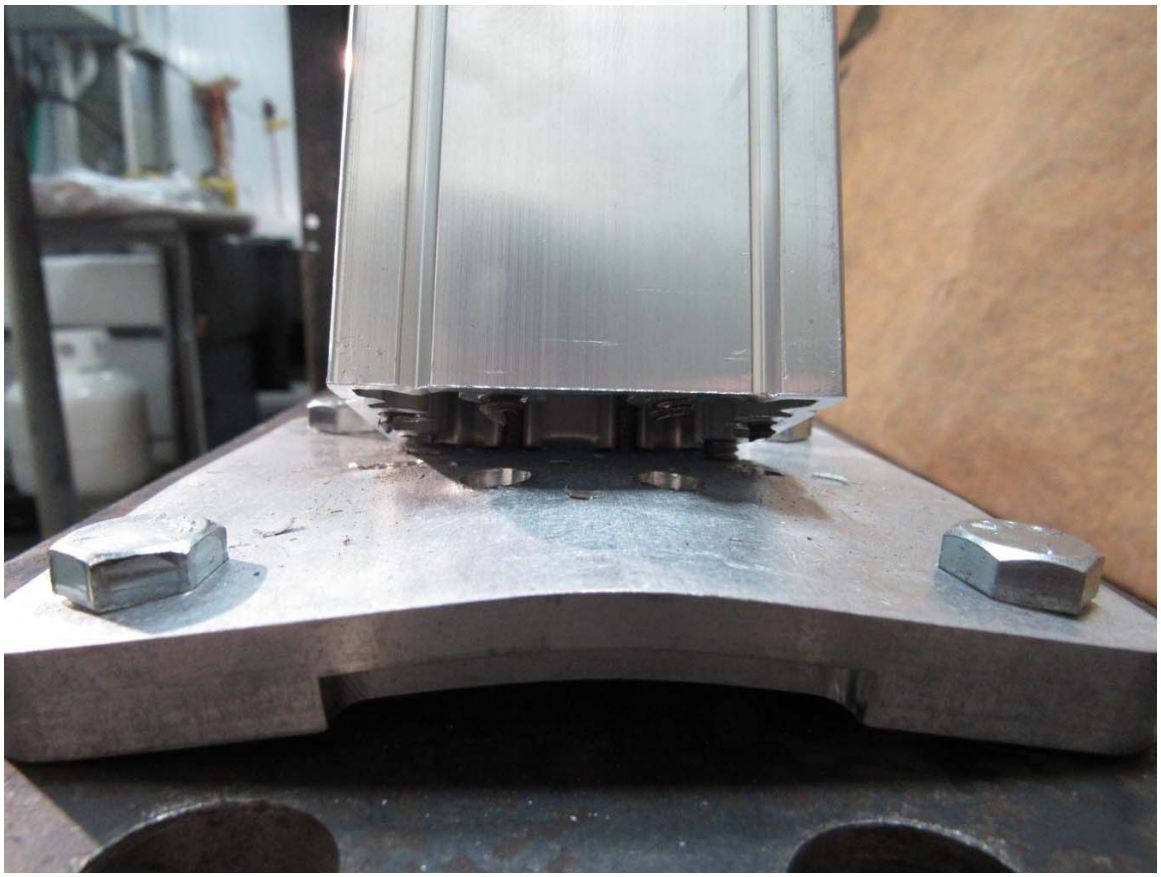


Guardrail Post Test Setup

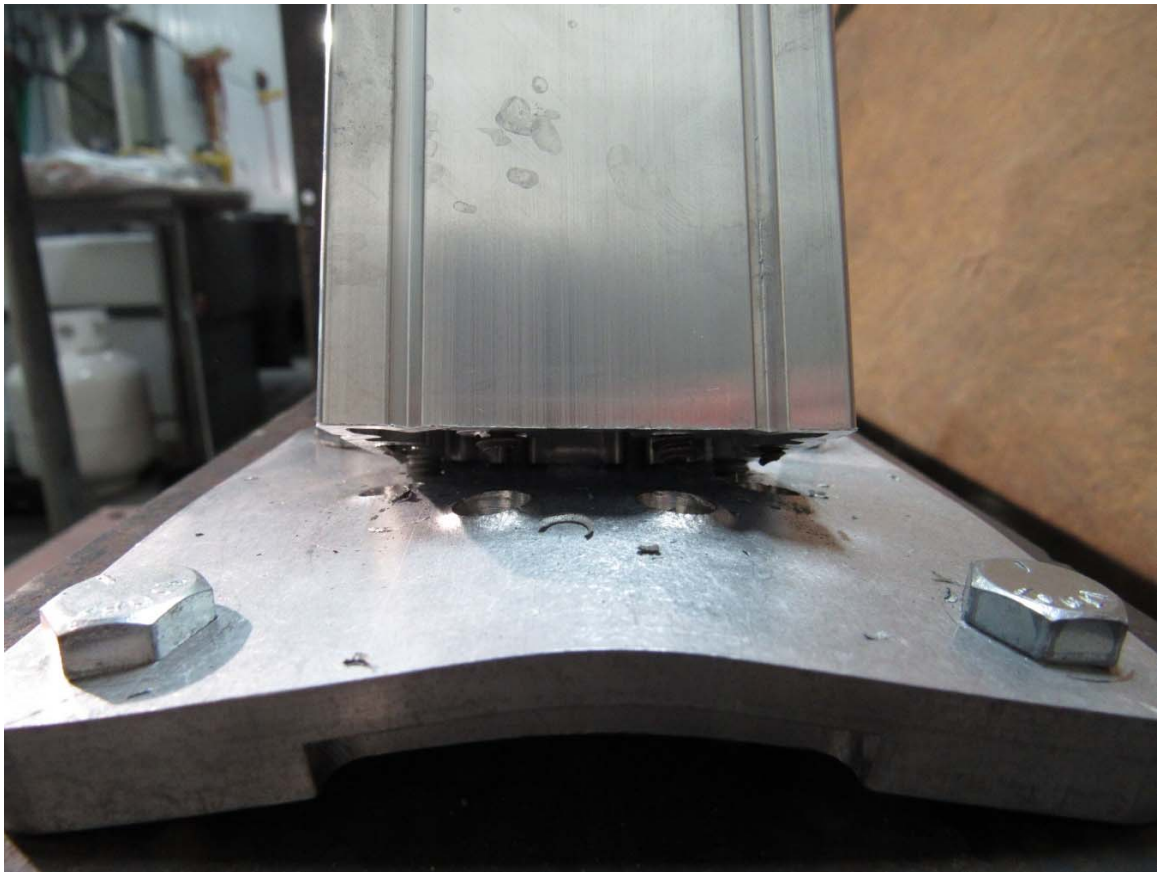
Attachment to Rigid Fixture



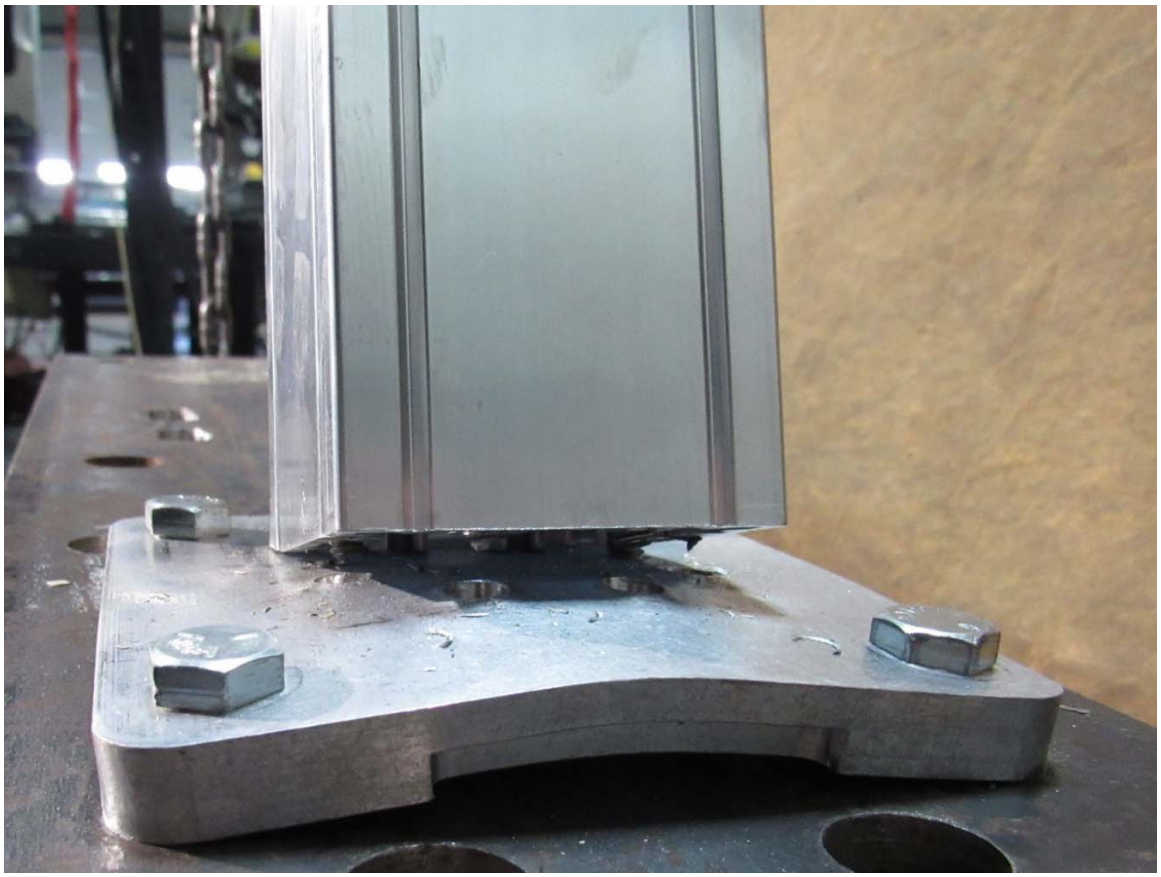
Typical Sample During Loading



Post Test-1 Failure Picture



Post Test-2 Failure Picture



Post Test-3 Failure Picture