



I-STAIR SYSTEMS, INC.

i18gs, i20gs and trg45 I-Stair Bracket
Concentrated Load Testing

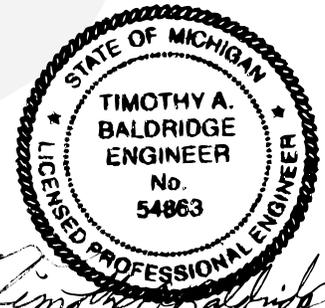
3/11/2011

Revised on
5/6/2011

3/12/2013 - Added Michigan Residential Code reference to Section 2

6/2/2016 - Revised page 2 section 2 - code revision dates.

Revised page 2 section 3 - address change.



Date Signed: Jun 09, 2016

This test report contains Seventeen (17) pages, including the cover sheet. Any additions to, alterations of, or unauthorized use of excerpts from this report are expressly forbidden.

2011-404

1. TITLE

i18gs, i20gs and trg45 I-Stair Bracket Concentrated Load Testing

2. OBJECTIVE

To verify the step brackets and the tread riser gusset can withstand the force required by the codes listed below. Secondly, to verify the use of tread and riser materials.

1. 2012 IBC, Table 1607.1, Note F
2. 2015 Michigan Residential Code, Table R301.5 (Stairs), Note c
3. ICC-ES AC174 §4.1

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

I-Stair Systems, Inc.
6548 Center Industrial Dr.
Jenison, MI 49428

4. TESTING ORGANIZATION

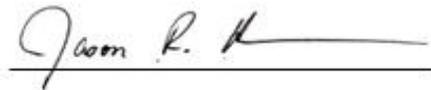
Progressive Engineering Inc.

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

See IAS Evaluation Report No. TL-178 for ISO 17025 Accreditation.

5. TESTING PERSONNEL

Laboratory Manager - Jason R. Holdeman
Project Manager - Jacob Bontrager



All of the tests were witnessed by Mike Prins of I-Stair Systems, Inc.

6. TESTING EQUIPMENT

- Load Cell (*PEI* No. 465)
- Linear Transducers (*PEI* No. 648, 653, 731)
- Data Acquisition System (*PEI* No. 566)

7. TEST SPECIMEN

*The test specimen was built by I-Stair Systems Inc., and was verified by **PEI** personnel to the attached drawings.*

The i18gs I-Stair Brackets consisted of triangular shaped galvanized steel with a triangular shaped cut-out in the center. The average measured thickness was .046". Two (2) 1" wide tabs, one (1) located on each side of the triangle, were folded at a 90° angle and fastened to the stair tread and the other to the stair riser. See attached drawing B2 for details.

The i20gs I-Stair Brackets consisted of triangular shaped galvanized steel with a triangular shaped cut-out in the center. The average measured thickness was .036". Two (2) 1" wide tabs, one (1) located on each side of the triangle, were folded at a 90° angle and fastened to the stair tread and the other to the stair riser. See attached drawing B3 for details.

The trg45 consisted of a gang nail plate 30 inches long, with 3/4" slots at the bend point. The average measured thickness is .033". The gusset is intended for use with stair systems 45" wide.

The brackets were attached to a 2x4 stringer, which were attached to the base and back piece which was comprised of 3/4" OSB. The brackets were fastened to the stringer with 1-1/2" long Galvanized Joist Hanger Nails. The treads and the riser were fastened with 3/4" long Drywall Screws.

The steps were comprised of 3/4" OSB material for the tread as well as the riser support underneath the tread. Each tread to riser connection was supported with the trg45. The tread and riser material measured 45 inches wide.

8. TEST SET-UP

A hydraulic cylinder was positioned above the test specimen, in the desired location, with a load cell, and a 2.000" x 2.000" loading block inline. A linear transducer was set to measure the deflection of the hydraulic cylinder at the load point, and two other were used to subtract out the system deflection. The system deflection was defined as movement not directly related to the loaded parts, such as the test specimen support at the base and the stringer deflection. The Data Acquisition System was set to record the Load and Deflection throughout the tests. See attached fixture Drawing No. F1765 for details.

9. TEST PROCEDURE

The load was applied to 850 lbf, which is more than 2.5 times the 300 lbf requirement. Load was applied at a uniform rate through the 2" by 2" loading block until the desired load was reached. The load was increased until a failure was attained at the final test location, at the direction of the client.

10. TEST RESULTS

See the attached data pages for details.

Progressive Engineering Inc.

Stair Tread Concentrated Load Test

Date: 3/11/2011

Project No.: 2011-404

Client: I-Stair Systems, Inc.

Temp.: 62.7° F

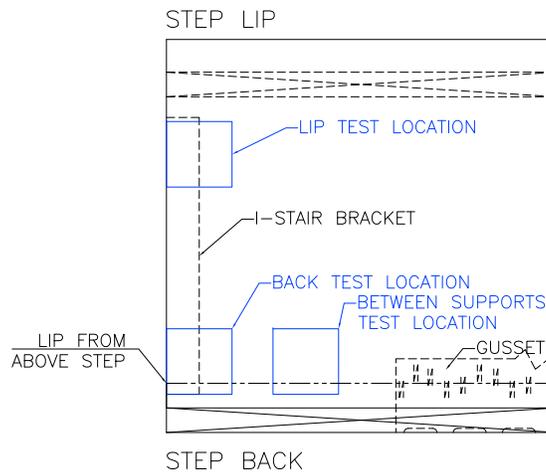
Specimen: i18gs I-Stair Bracket, trg45

Humidity: 39.4% R.H.

Test: 2" x 2" Concentrated Load **Deflection Limit @ 300 lbf*:** .125"

Test Location / Deflection ¹ (in)			
Load (lbf)	Step Lip	Step Back	Between supports
200	.086	.078	.071
300	.103	.100	.107
400	.117	.119	.144
500	.133	.136	.185
600	.149	.155	.232
700	.166	.177	.303
800	.184	.200	.401

Note: Each location was loaded separately.



* Based on ICC-ES AC174 §4.1

¹ The deflection is measured at the loading nose. The system deflection was removed.

Progressive Engineering Inc.

Stair Tread Concentrated Load Test

Date: 3/11/2011

Project No.: 2011-404

Client: I-Stair Systems, Inc.

Temp.: 62.7° F

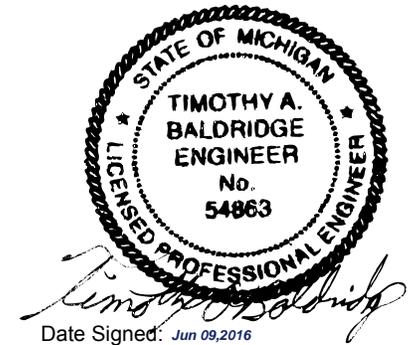
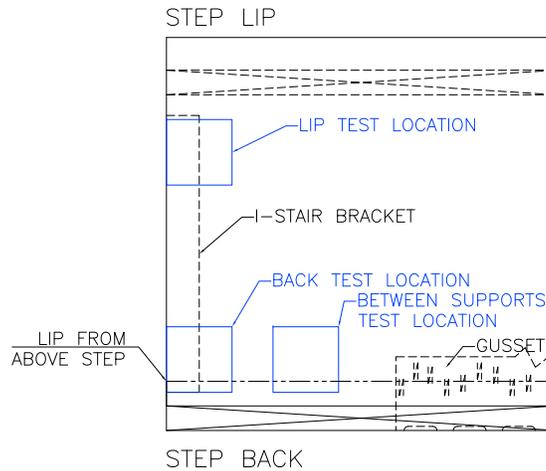
Specimen: i20gs I-Stair Bracket, trg45

Humidity: 39.4% R.H.

Test: 2" x 2" Concentrated Load **Deflection Limit @ 300 lbf*:** .125"

Test Location / Deflection ¹ (in)			
Load (lbf)	Step Lip	Step Back	Between supports
200	.040	.048	.069
300	.055	.068	.099
400	.068	.089	.130
500	.084	.108	.163
600	.100	.129	.198
700	.120	.149	.235
800	.141	.171	.280

Note: Each location was loaded separately.



* Based on ICC-ES AC174 §4.1

¹ The deflection is measured at the loading nose. The system deflection was removed.

Progressive Engineering Inc.

Stair Tread Concentrated Load Test

Date: 3/11/2011

Client: I-Stair Systems, Inc.

Specimen: **i20gs I-Stair Bracket, trg45**

Test: 2" x 2" Concentrated Load

Project No.: 2011-404

Temp.: 62.7° F

Humidity: 39.4% R.H.

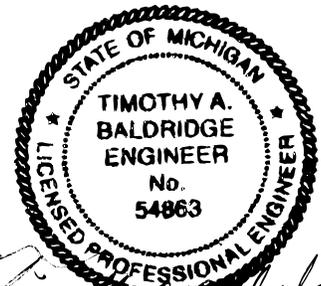
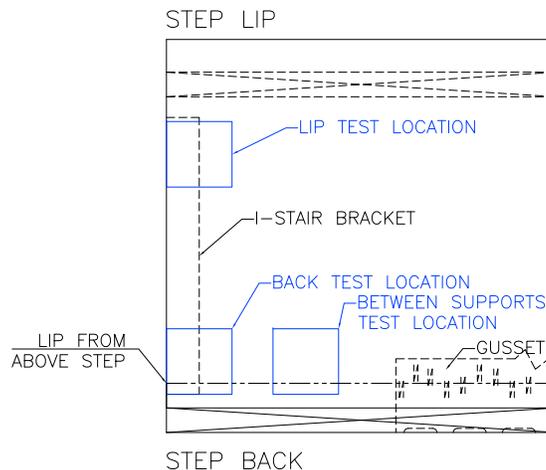
Deflection Limit @ 300 lbf*: .125"

Load (lbf)	Deflection ¹ (in) Step Lip to Failure
200	.067
300	.085
400	.103
500	.119
600	.135
700	.151
800	.167
900	.186
1000	.205
1100	.245
1200	.304
1300	.436
1400	.762

Failure Mode:

During loading, the bracket directly under the loading nose started to deform at the lower portion of the bracket. Load was applied until a loss of load, and no subsequent load gains were noted. See failure pictures for further details.

Maximum Load: **1,424 lbf**



Date Signed: Jun 09, 2016

* Based on ICC-ES AC174 §4.1

¹ The deflection is measured at the loading nose. The system deflection was removed.

Progressive Engineering Inc.

Stair Tread Concentrated Load Test

Date: 3/11/2011

Client: I-Stair Systems, Inc.

Specimen: **trg45**¹

Test: 2" x 2" Concentrated Load

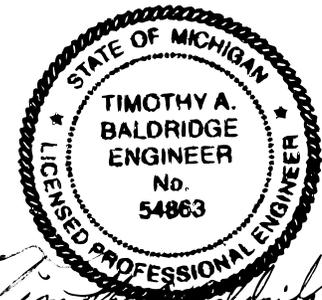
Project No.: 2011-404

Temp.: 62.7° F

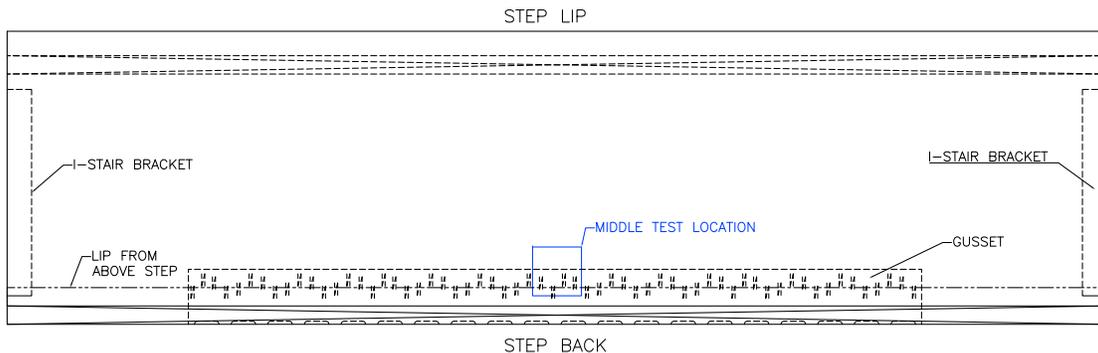
Humidity: 39.4% R.H.

Deflection Limit @ 300 lbf*: .125"

Deflection ² (in)	
Load (lbf)	Midspan - trg45
200	.041
300	.059
400	.077
500	.094
600	.111
700	.130
800	.150



Timothy A. Baldrige
Date Signed: Jun 09, 2016

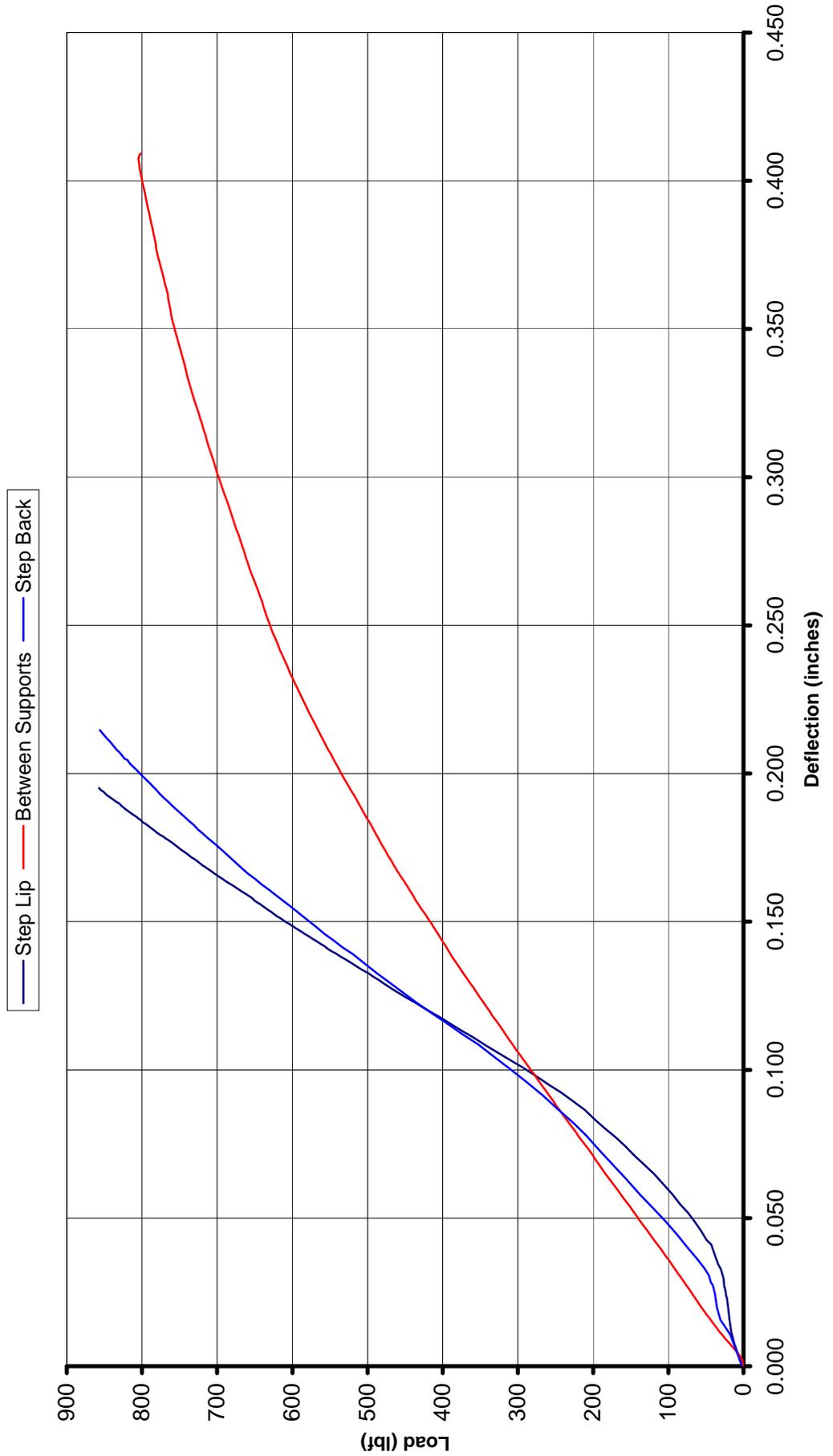


* Based on ICC-ES AC174 §4.1

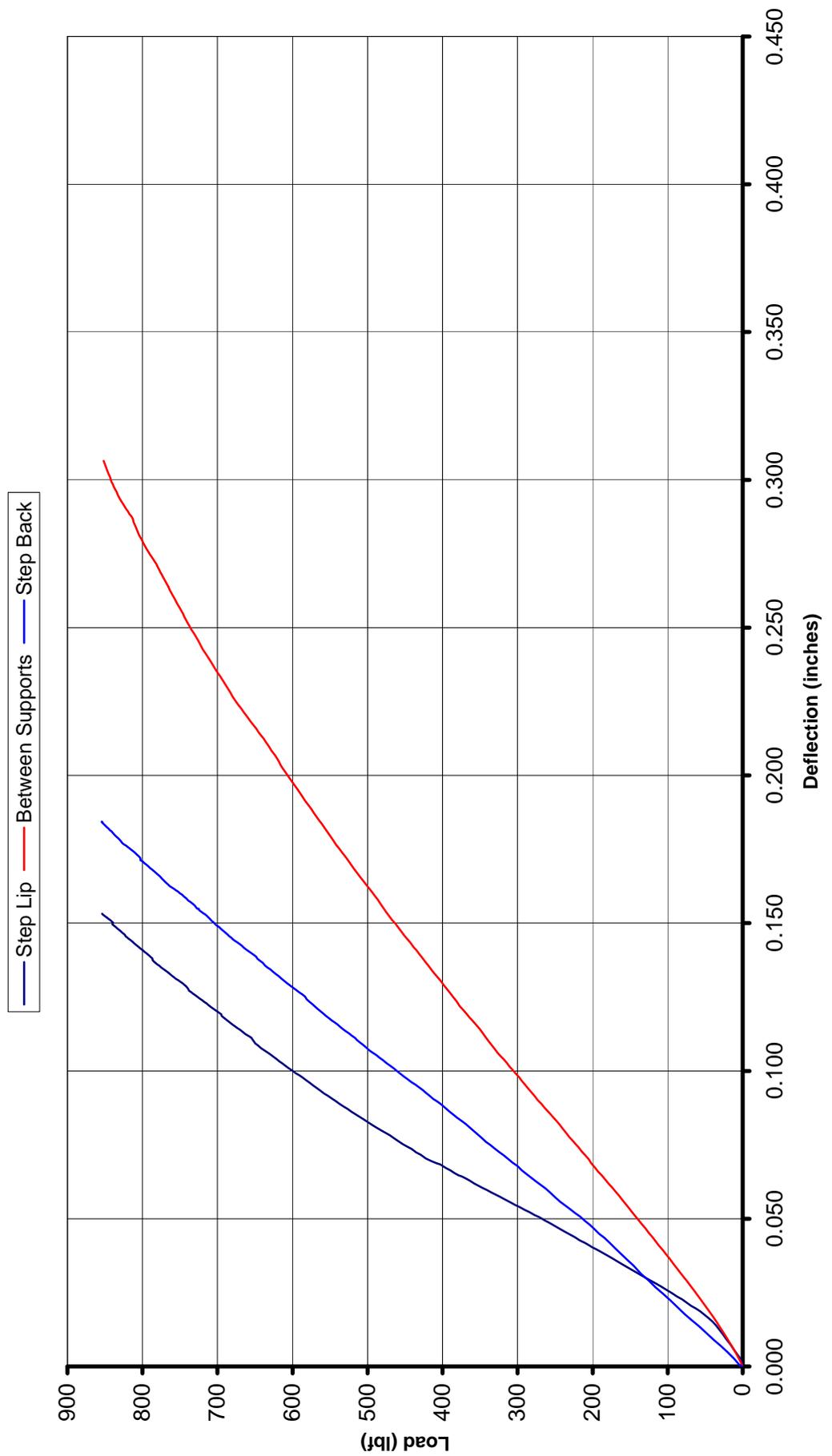
¹ tread-riser-gusset, 45"

² The deflection is measured at the loading nose. The system deflection was removed.

**I-Stair Systems
2x2" Concentrated Load
Load versus Deflection
i18GS I-Stair Bracket and trg45**

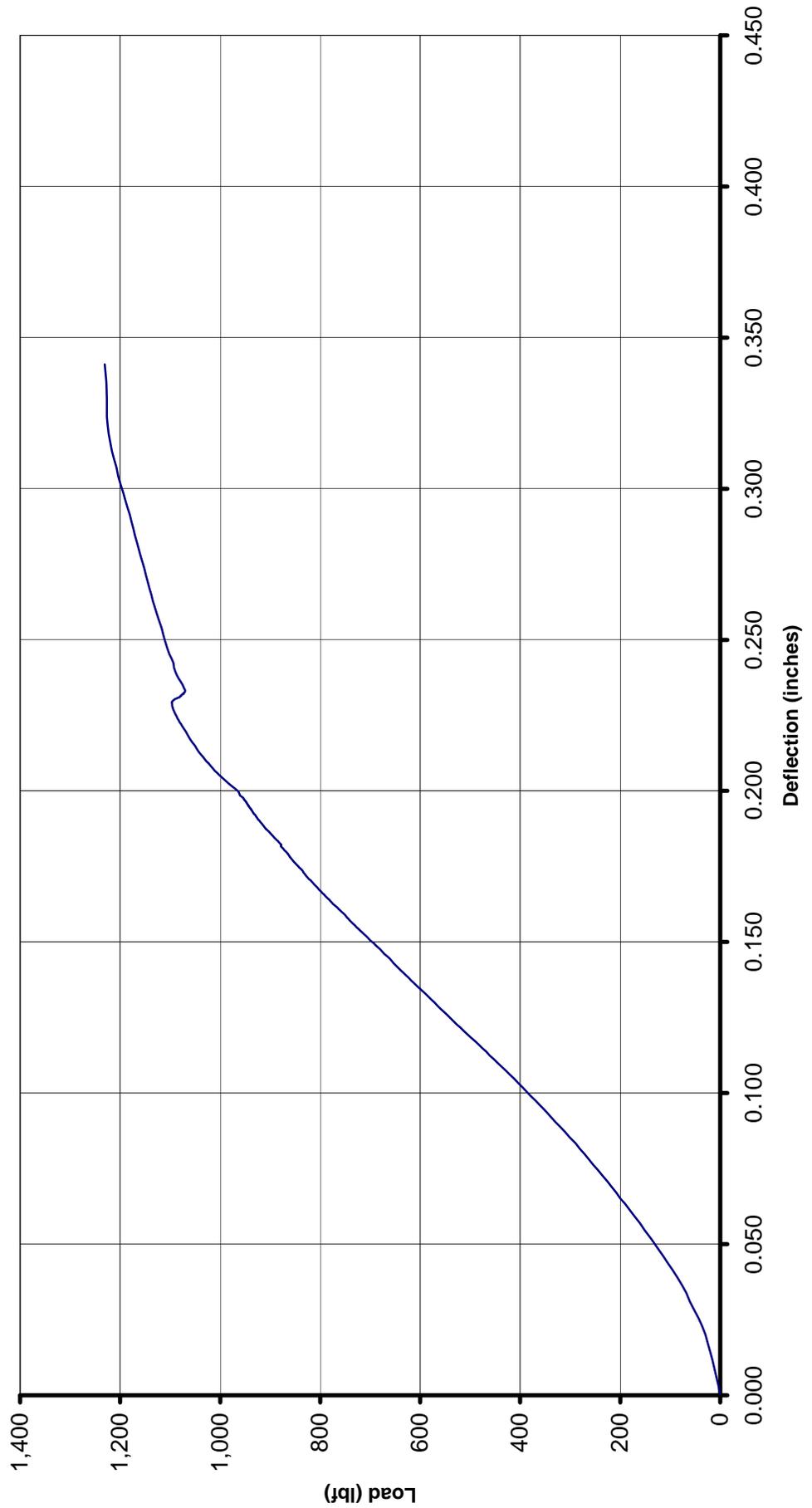


**I-Stair Systems
2x2" Concentrated Load
Load versus Deflection
i20GS I-Stair Bracket and trg45**

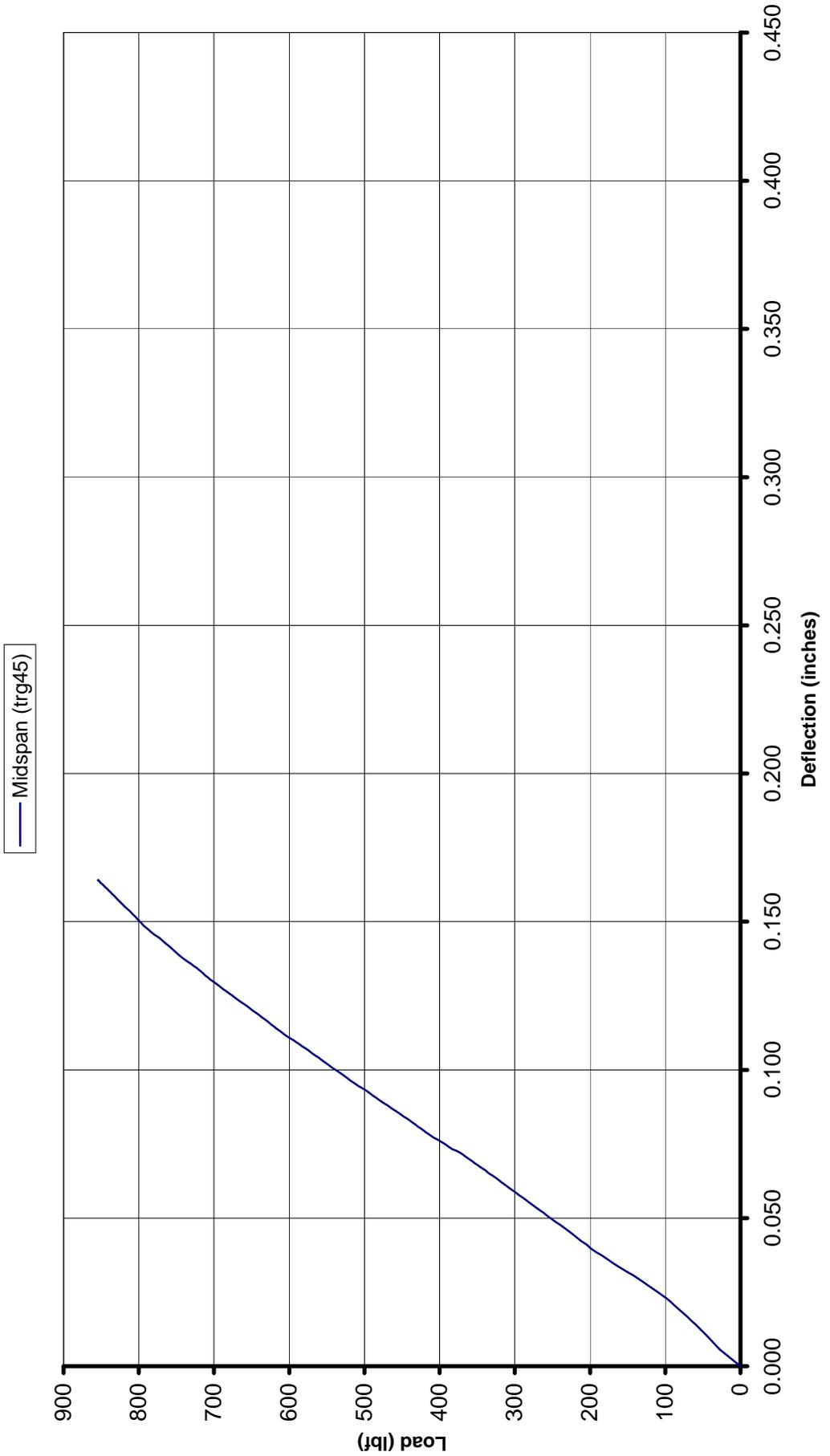


**I-Stair Systems
2x2" Concentrated Load
Load versus Deflection
i20GS I-Stair Bracket and trg45**

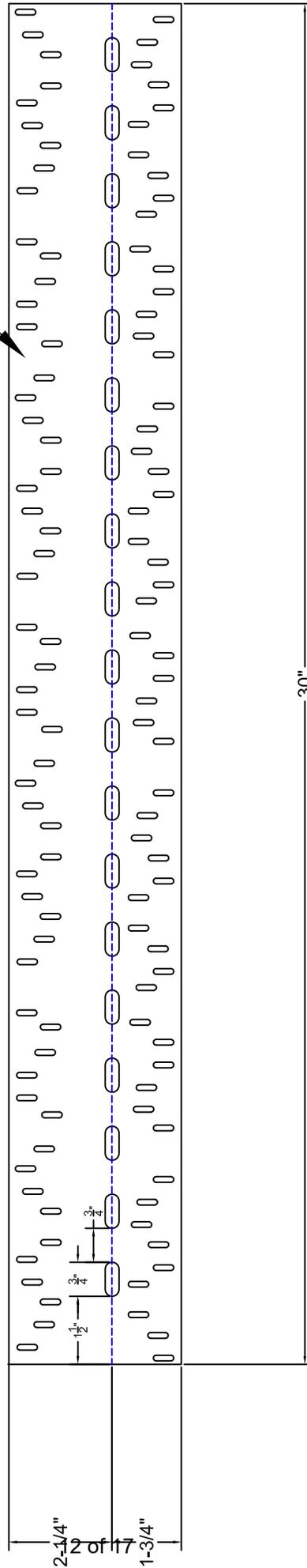
— Step Lip to Failure



**I-Stair Systems
2x2" Concentrated Load
Load versus Deflection
trg45" I-Stair Bracket**



3/4" SLOT @ BENT POINT



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Progressive Engineering Inc.



58640 State Road 15
Goshen, IN 46528
Phone (574) 533-0337
Fax (574) 533-9736
www.p-e-i.com

DRAWN BY: J. BONTRAGER	CLIENT:
DATE: 04/01/11	I-STAIR SYSTEMS
SCALE:	TITLE:
JOB NO. 2011-404	trg45 - TREAD RISER GUSSET
DWG. NO. B1	
REVISED ON:	

THICKNESS: .036"

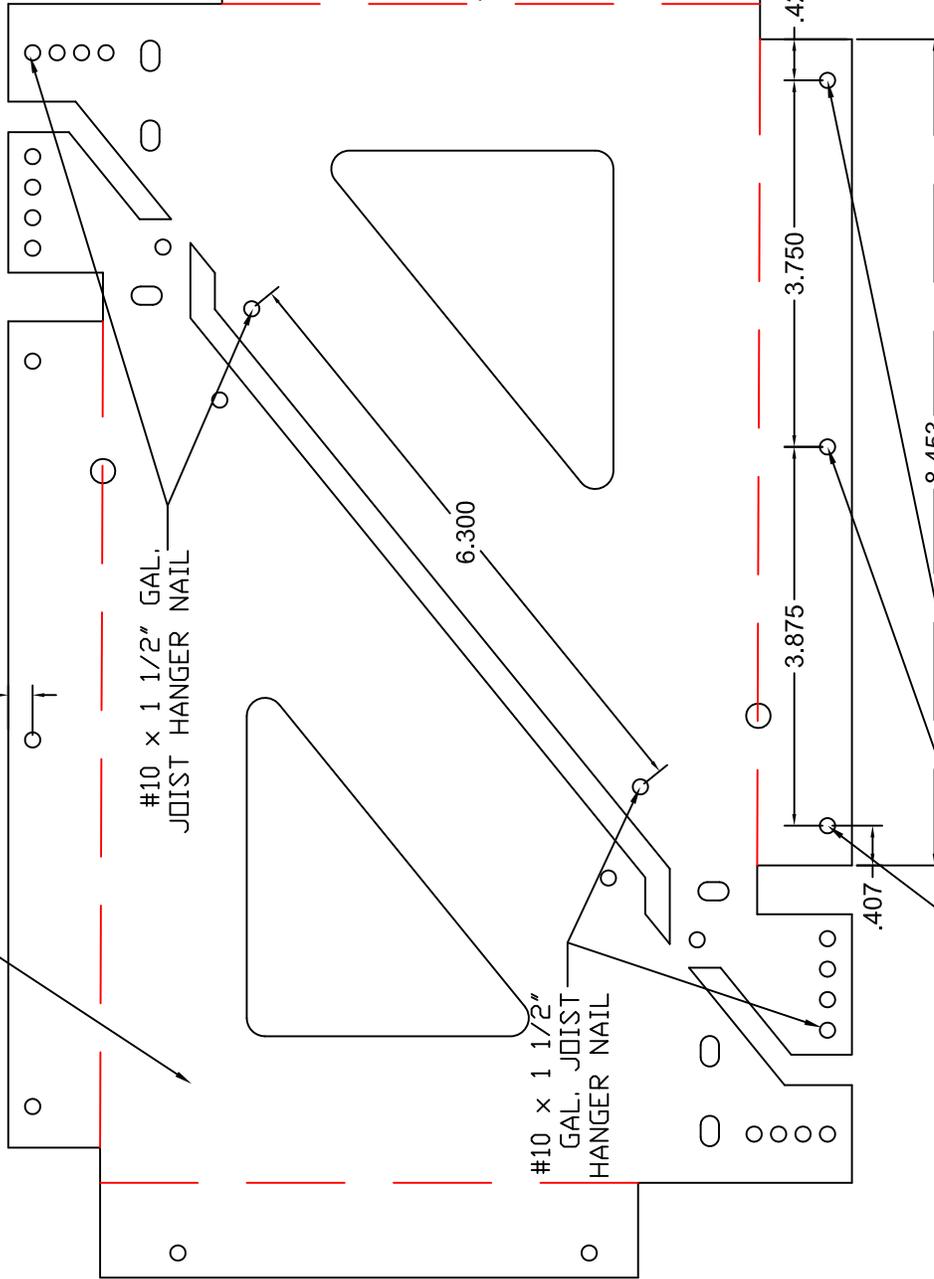
f.250

#10 x 1 1/2" GAL. JOIST HANGER NAIL

6.300

#10 x 1 1/2" GAL. JOIST HANGER NAIL

#8 x 3/4" FLAT BUGLE HEAD DRYWALL SCREW



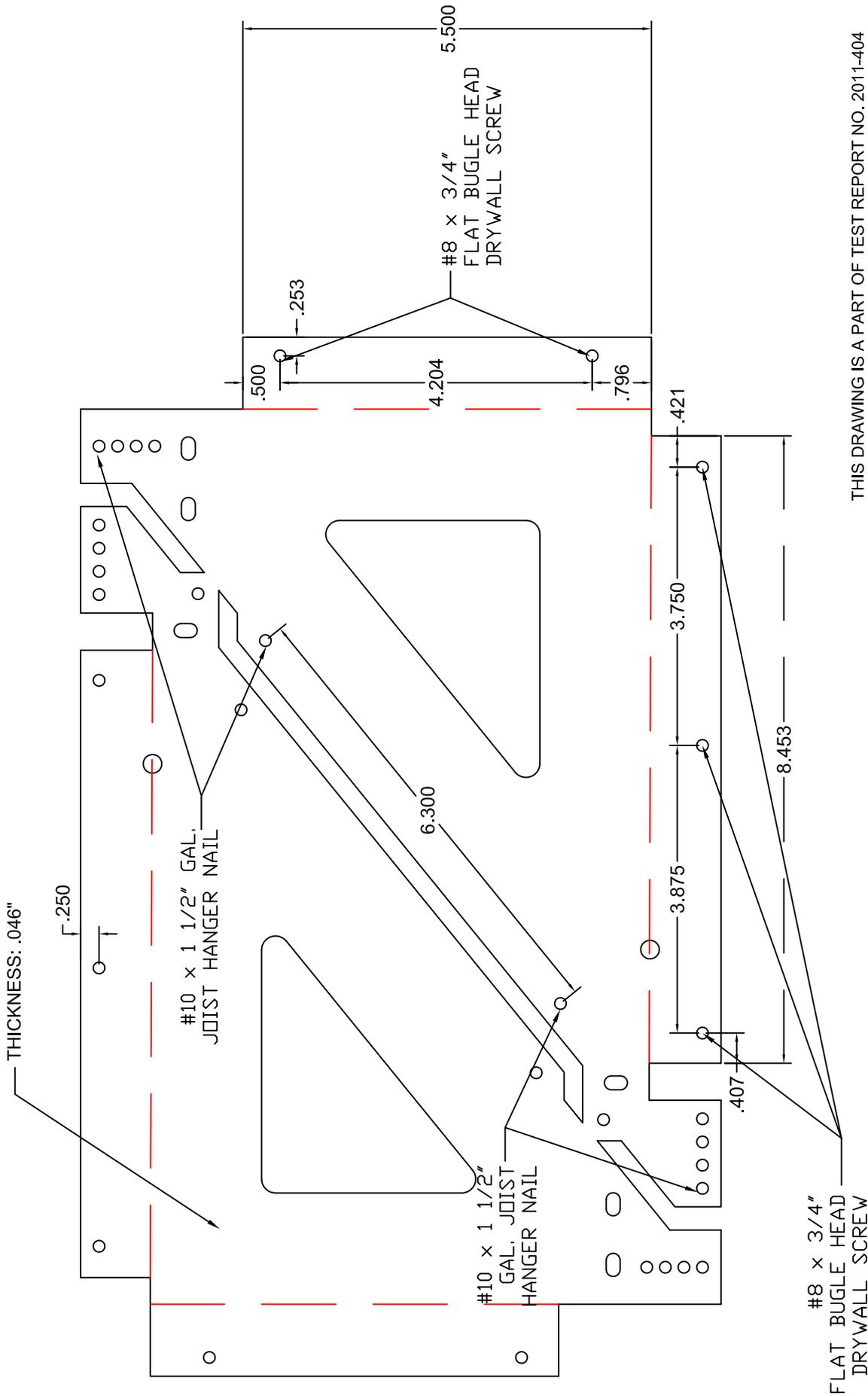
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DRAWN BY:	REVISED ON:	CLIENT:
J. WITMER		I-STAIR SYSTEM
DATE: 3-29-11		TITLE:
SCALE:		118gs I-STAIR BRACKET
JOB NO. 2011-404		
DWG. NO. B2		



Progressive Engineering Inc.
 58640 State Road 15
 Goshen, IN 46528
 Phone (574) 533-0337
 Fax (574) 533-9736
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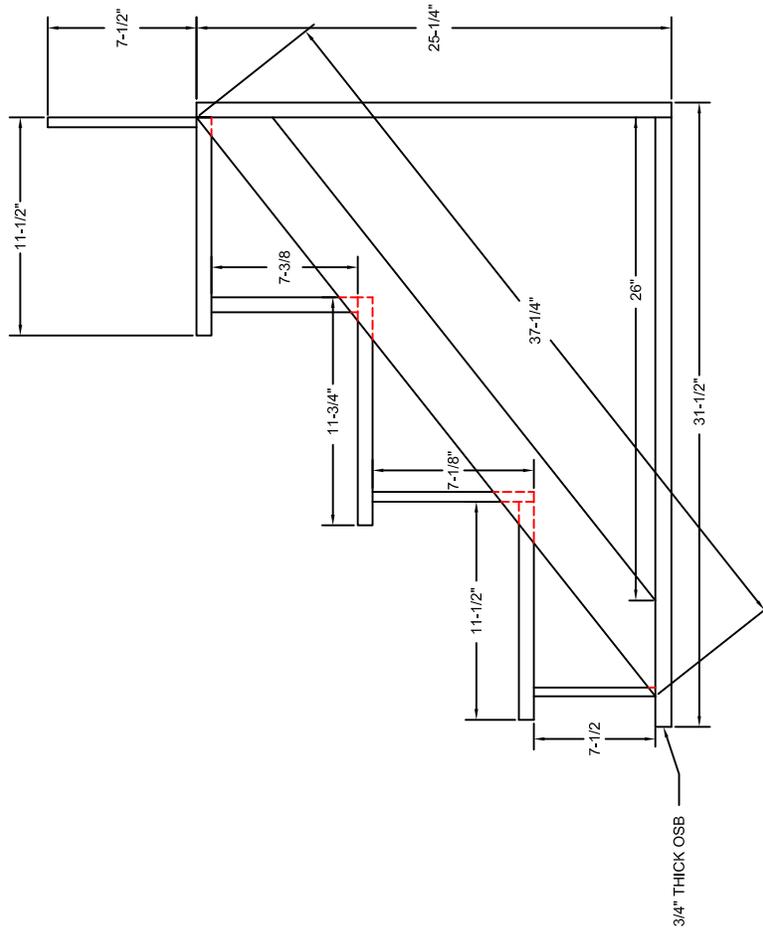
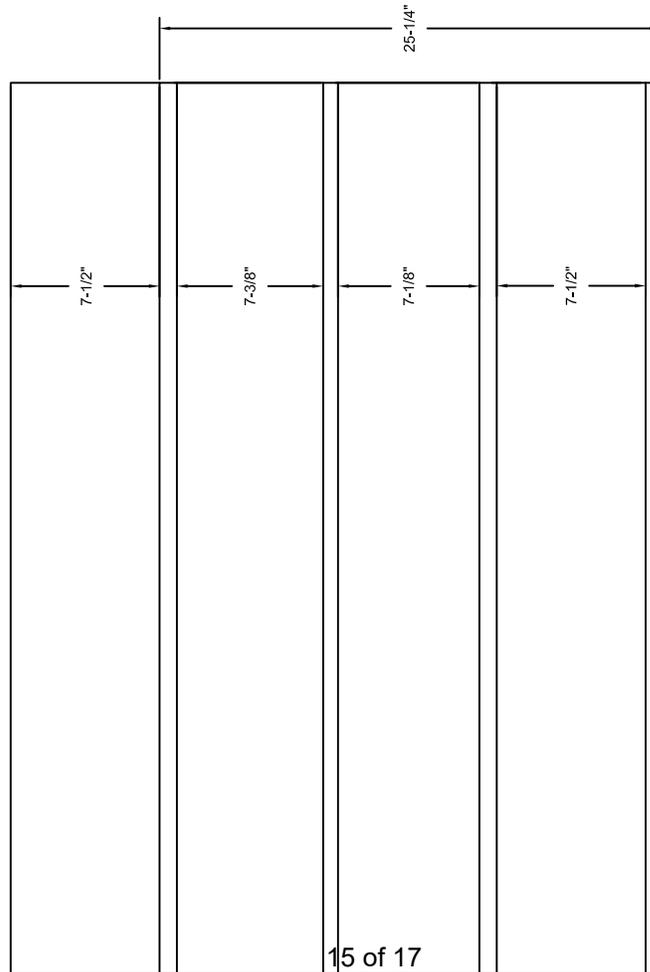
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DRAWN BY:	J.WITMER	CLIENT:	I-STAIR SYSTEM
DATE:	3-29-11	REVISED ON:	
SCALE:		TITLE:	120gs I-STAIR BRACKET
JOB NO.:	2011-404		
DWG. NO.:	B3		



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 Phone (574) 533-0337
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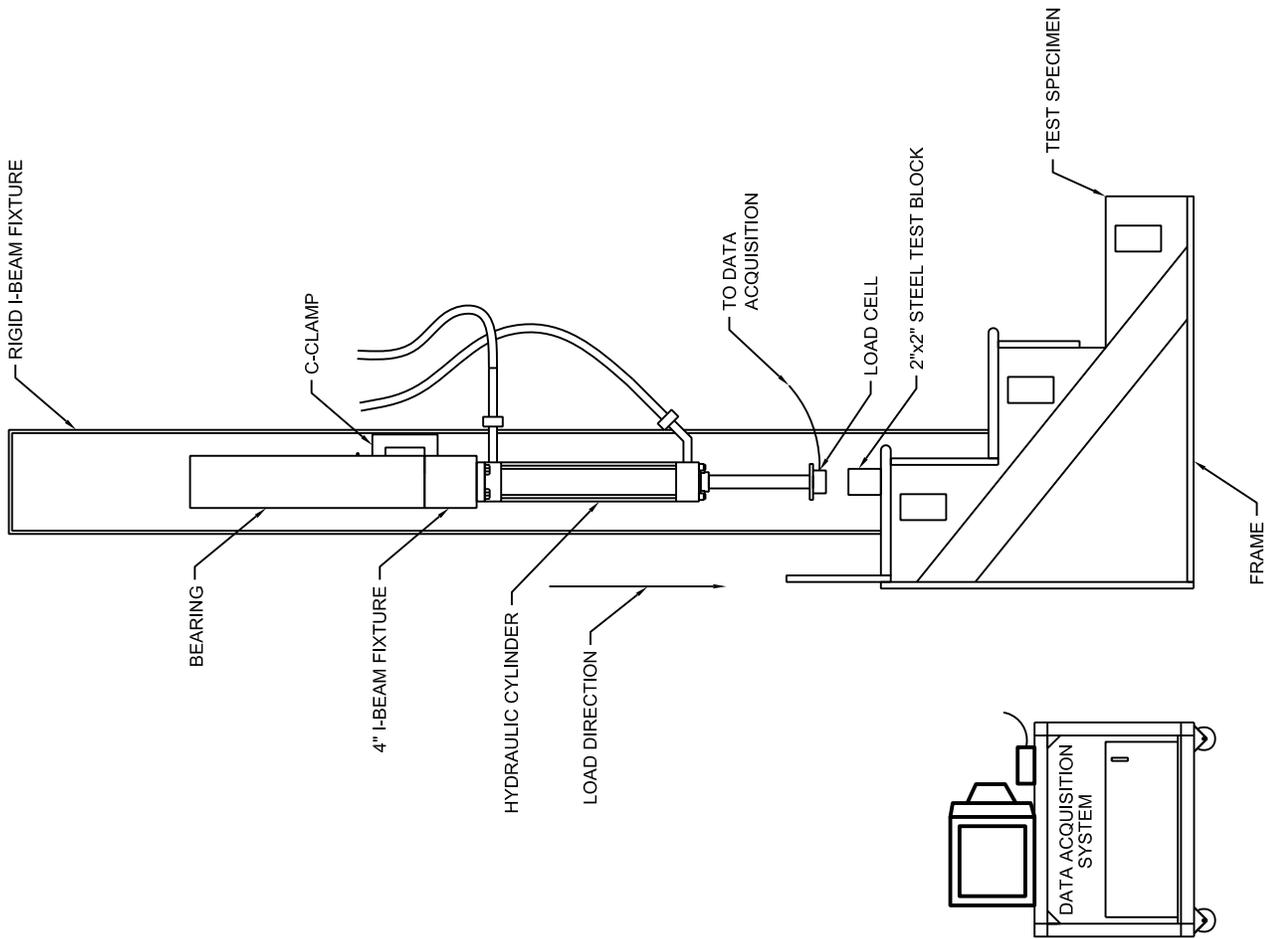
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DRAWN BY: J. BONTRAGER	CLIENT:	I-STAIR SYSTEMS
DATE: 03/24/11	REVISED ON:	
SCALE:		
JOB NO. 2011-404	TITLE:	FRONT AND SIDE ELEVATION
DWG. NO. B4		



Progressive Engineering Inc.
 58640 State Road 15
 Goshen, IN 46528
 Phone (574) 533-0337
 Fax (574) 533-9736

www.p-e-i.com



SIDE VIEW

DWN BY:	N. AMSTUTZ	This drawing and all information contained herein is the property of PROGRESSIVE ENGINEERING, INC. and is not to be reproduced without the written permission of PEI. PEI assumes no responsibility for unauthorized use of this drawing.
DATE:	03/30/10	
SCALE:		
DRAWING NUMBER	F1765	TITLE:
		TEST SET-UP

Progressive Engineering Inc.
 58640 State Road 15
 Goshen, IN 46528
 Phone (574) 533-0337
 Fax (574) 533-9736
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Progressive Engineering Inc.



Typical test setup



Typical test setup



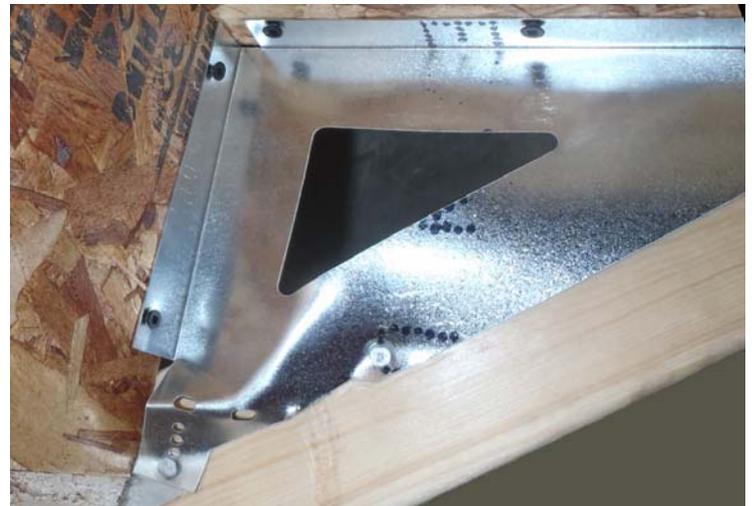
Testing back location



Testing midspan back location



Ultimate load failure mode



Ultimate load failure mode