PSE CONSULTING ENGINEERS INC.

STRUCTURAL ENGINEERING CALCULATIONS

PROJECT: Aluminum and glass infill guard rail design

PROJECT LOCATION: Ohio State

PSE PROJECT NUMBER: EGlass 223-802 OH

DATE: March 7, 2023

BY: Adel Elfayoumy, Ph.D., P.E.
BY: Nabil Taha, Ph.D., P.E.

3/10/2023
STATE OF OHIO
ADEL
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REGISTERED
PROFESSIONAL ENGINEER
EXP. 12/31/2023

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Table of Contents:

References:

1- Literature:

a. 2017 Ohio Building Code based on 2015 International Building Code

b. 2019 Residential Code of Ohio, based on 2018 International Residential Code

c. 2015 International Building Code with local amendments

d. 2018 International Residential Code with local amendments

e. AISC Design Guide 27: Structural Stainless Steel.

f. National Design Specifications for Wood Construction, 2015 Edition

g. Building Code Requirements for Structural Concrete (ACI318-14)

2- Software:

a. RISA 3D Version
RISA Technologies,
26212 Dimension Dr. Suite 200

Design Criteria:

1- Location: Ohio State

2- Live Load on Handrail & guards:

a. Uniform Distributed load 50 p/f
b. Single Concentrated load 200 lbs
c. 50 psf on infill

3- Wind:

Basic wind speed 110 mph (3 s. gust)
Exposure C

**Other criteria assumed as stated in design calculations.

PROJECT NO. Eglass SHEET ____ OF ____
PROJECT NAME ____ DESIGNED BY AF DATE ____
SUBJECT ____ CHECKED BY ____ DATE ____

Conclusion 117

- Glass w/ Top & bottom rail:

Material = Alu. 6061-T6

Post: $2\frac{3}{8}'' * 2\frac{3}{8}'' * 0.125''$ (42" height, 4' apart)

Top rail: $2\frac{3}{8} * 1\frac{1}{2} * 0.125$

Bottom rail: $1\frac{1}{4} * 1\frac{1}{4} * 0.125$

Glass: Fully Tempered $\frac{1}{4}''$ or $\frac{3}{8}''$ thick

- Glass w/ Clip

post: $2\frac{3}{8}'' * 2\frac{3}{8}'' * 0.125''$

Glass: Fully tempered, $\frac{3}{8}''$ thick

PROJECT NO. Eglass SHEET ____ OF ____

PROJECT NAME ____ DESIGNED BY AF DATE ____

SUBJECT ____ CHECKED BY ____ DATE ____

Conclusion (2/7

* For square post (square base plate)

Base plate, Alu. Alloy 384 (ADC12), $F_y = 24$ ksi

$(4\frac{1}{2} * 4\frac{1}{2} * 3/8")$

Anchors

- To Concrete

[$4-\frac{3}{8}"\phi$ Red head w/min 4" Embed,
Edge distance $3\frac{1}{2}"$, $f'c \not< 3000$ psi]

- To wood

[$4-\frac{3}{8}"\phi$ lag screw w/min 6" Embed]

or

[$4-\frac{3}{8}"\phi$ thru-bolt]

PROJECT NO. Eg1288 SHEET ______ OF ______

PROJECT NAME ______ DESIGNED BY AF DATE ______

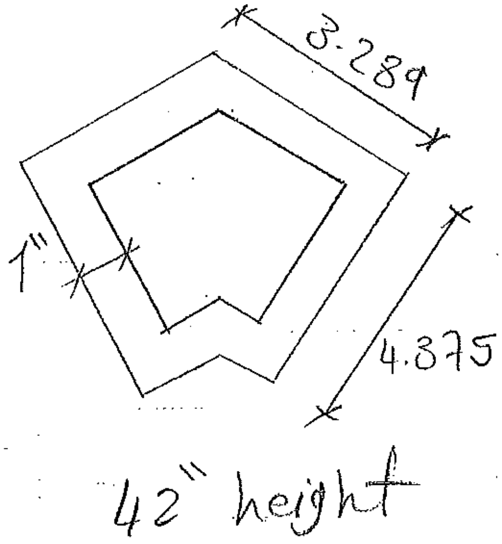
SUBJECT ______ CHECKED BY ______ DATE ______

Conclusion 3/7

135° post and base plate

- post = Alu. 6061-T6,
  t = 0.125"

- Base plate: 0.39" thick
  (As shown)



Anchors to Concrete

[5 - $\frac{3}{8}$" ø Red head ITW or LDT
w/min 4" Embed & 3" edge distance
$f'_c \nless 3000$]

Anchors to wood

[5 - $\frac{3}{8}$" ø lag screws w/6" Embed, min]

PROJECT NO. Eglass SHEET ____ OF ____
PROJECT NAME ____ DESIGNED BY AF DATE ____
SUBJECT ____ CHECKED BY ____ DATE ____

Conclusion 4/7

No bracket

To Concrete

use 2-$\frac{1}{2}$" ϕ red head, 7" apart min
w/min 4" Embed. post to extend
2.5" below bottom anchor
$f'_c \not< 3000$ psi

To wood:

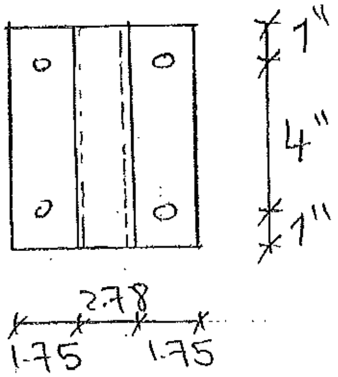
use 2-$\frac{3}{8}$" ϕ lag screw, 7" apart w/min 4" Embed
post to extend 2.5" below bottom screw

PROJECT NO. Eg1282 SHEET ____ OF ____
PROJECT NAME ____ DESIGNED BY AF DATE ____
SUBJECT ____ CHECKED BY ____ DATE ____

Conclusion 5/7

Intermediate post:

use [2-#10 tek screws to hold post in place]



Bracket: As shown
$t = \frac{3}{16}"$ thick

Anchor to Concrete

use [$4-\frac{3}{8}"\phi$ Red head or LDT
w/min 4" Embed, 3" edge distance
f'c ≮ 2500 psi]

To wood

use [$4-\frac{3}{8}"\phi$ lag screws w/4" min Embed]

PROJECT NO. Eglass SHEET ____ OF ____

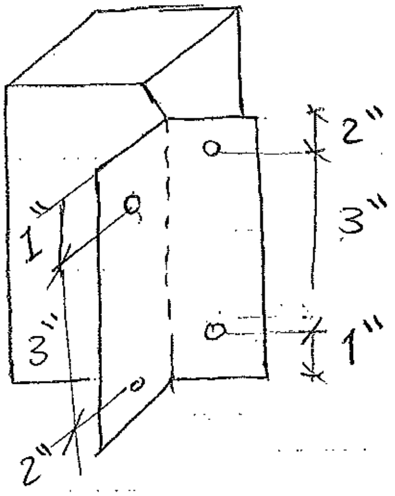
PROJECT NAME ____ DESIGNED BY AF DATE ____

SUBJECT ____ CHECKED BY ____ DATE ____

Conclusion 6/7

outside Corner bracket

Bracket: $\frac{3}{16}$" thick, as shown



Anchor to Concrete

use [4 - $\frac{1}{2}$" ϕ Red head or LDT
w/min 3" Embed, 1.5" edge
distance, $f'c$ < 2,500 psi]

Anchor to wood

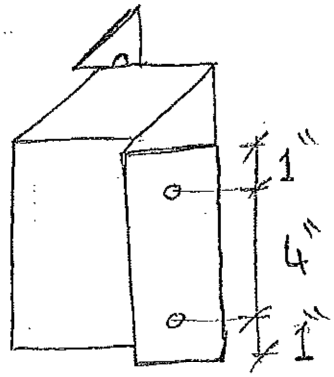
use [4 - $\frac{1}{2}$" ϕ lag screw w/min 4" Embed]

PROJECT NO. Eglass SHEET ____ OF ____
PROJECT NAME ____ DESIGNED BY YAF DATE ____
SUBJECT ____ CHECKED BY ____ DATE ____

Conclusion 7/7

Inside Corner:

post: $t = \frac{3''}{16}$, As shown
total length = 6"

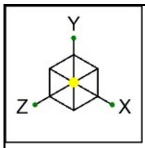


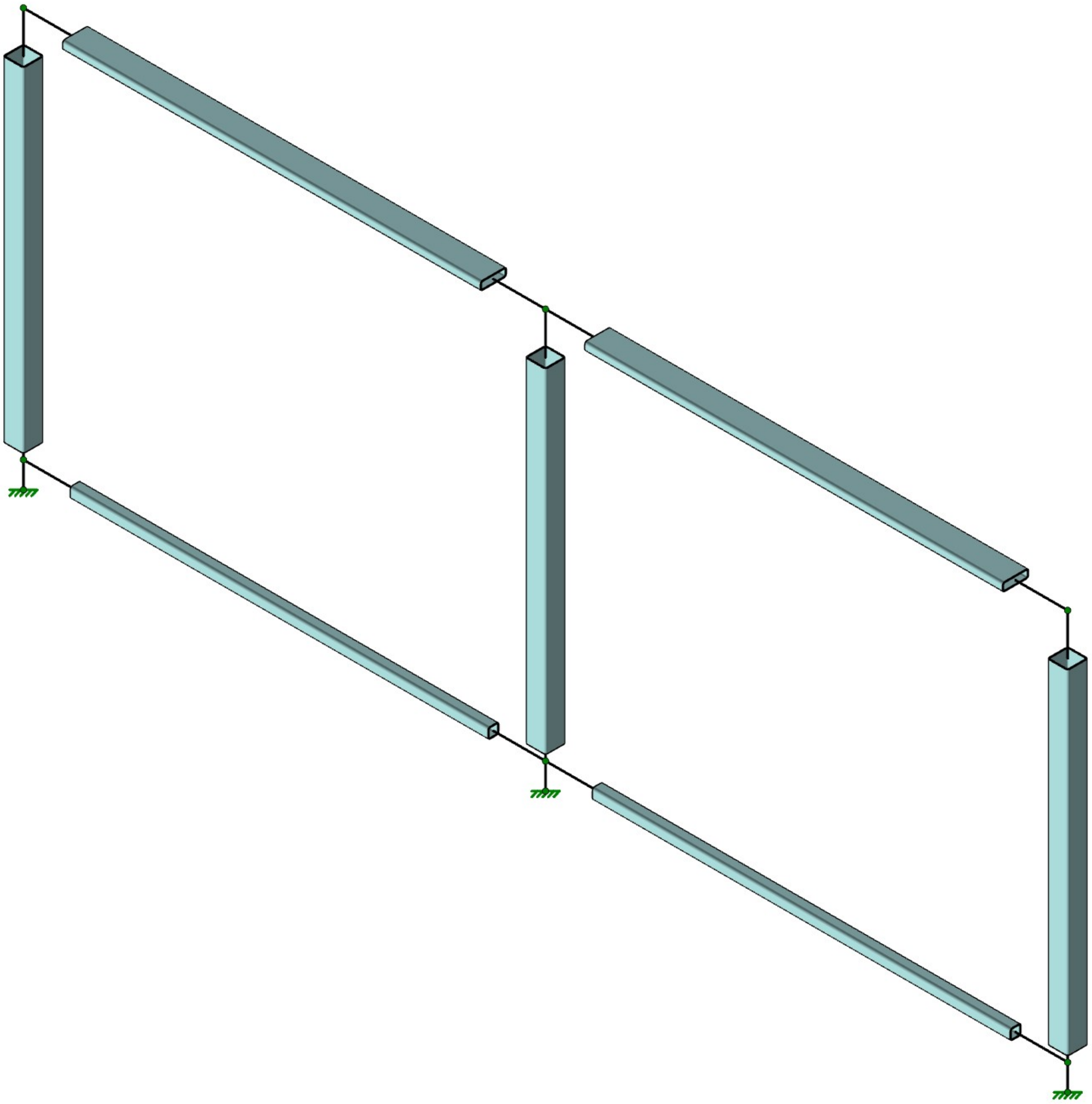
Anchor to Concrete:
similar to outside Corner

Anchor to wood
similar to outside Corner

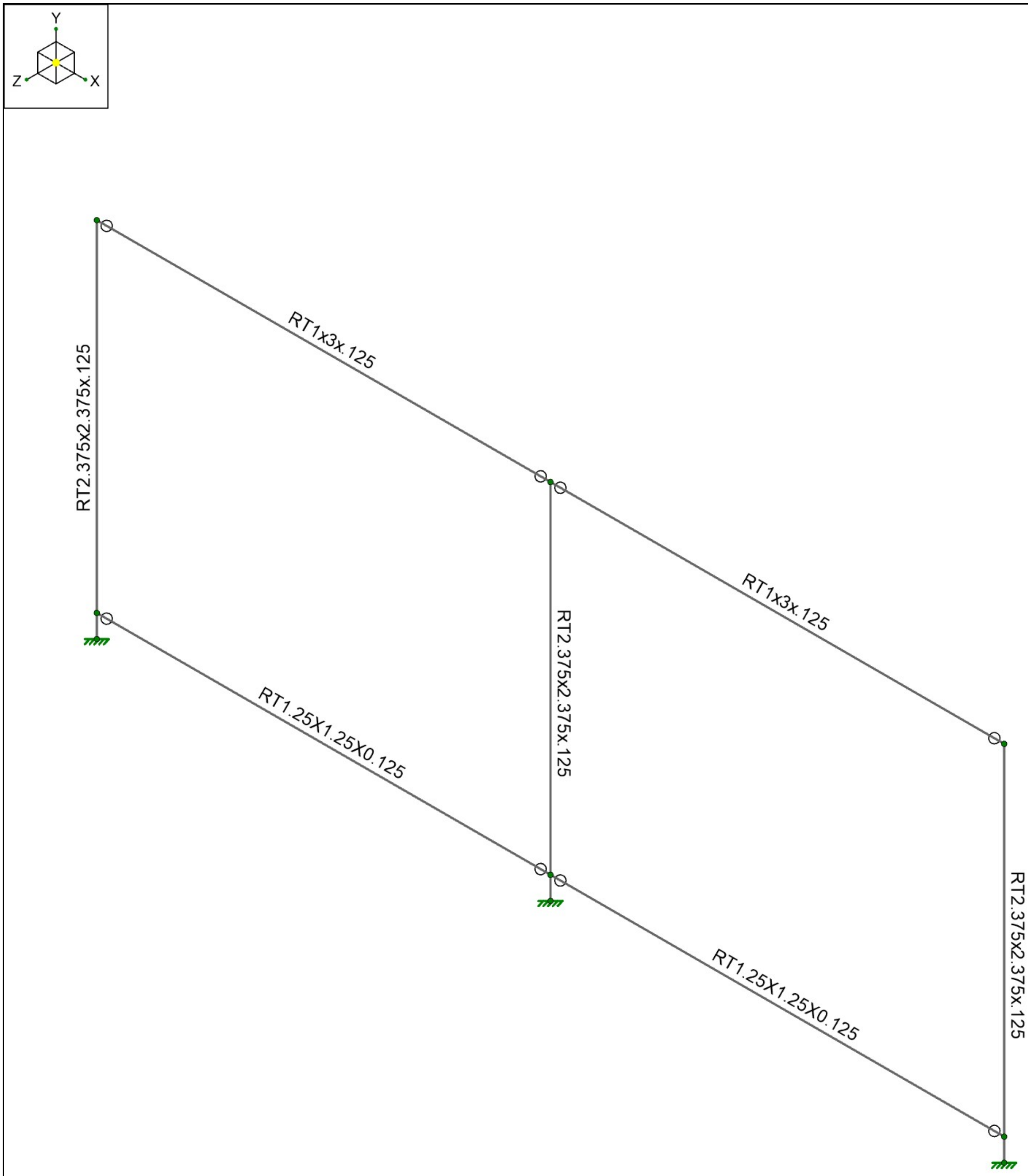
GUARD RAIL ANALYSIS & DESIGN:

Pages 1,000 - 1,999

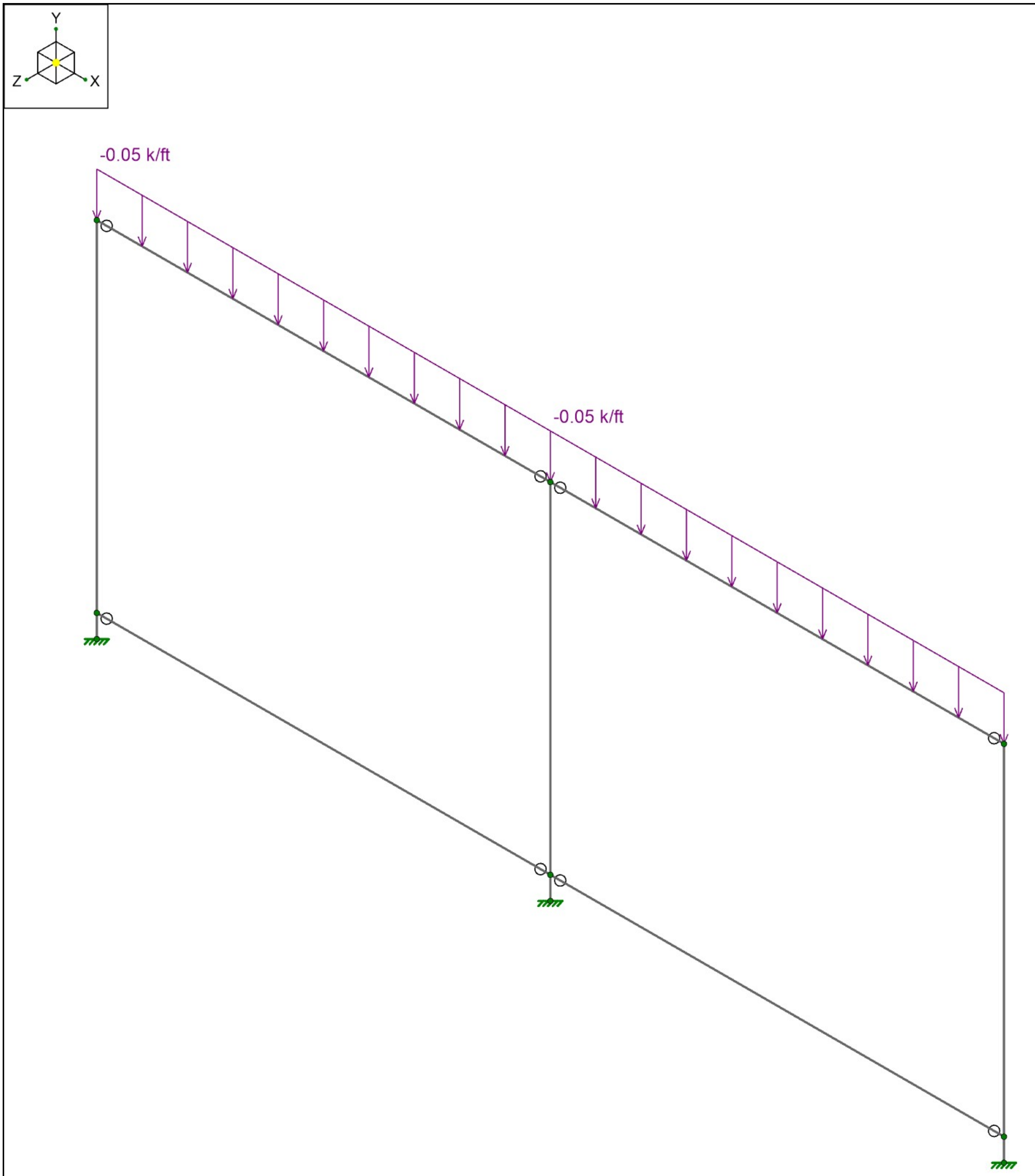




PSEI	Glass W/ Top & Bottom Rail	SK-2
AF		Mar 10, 2023
Eglass 223-802		2023-03-07 Glass w-top and botto…

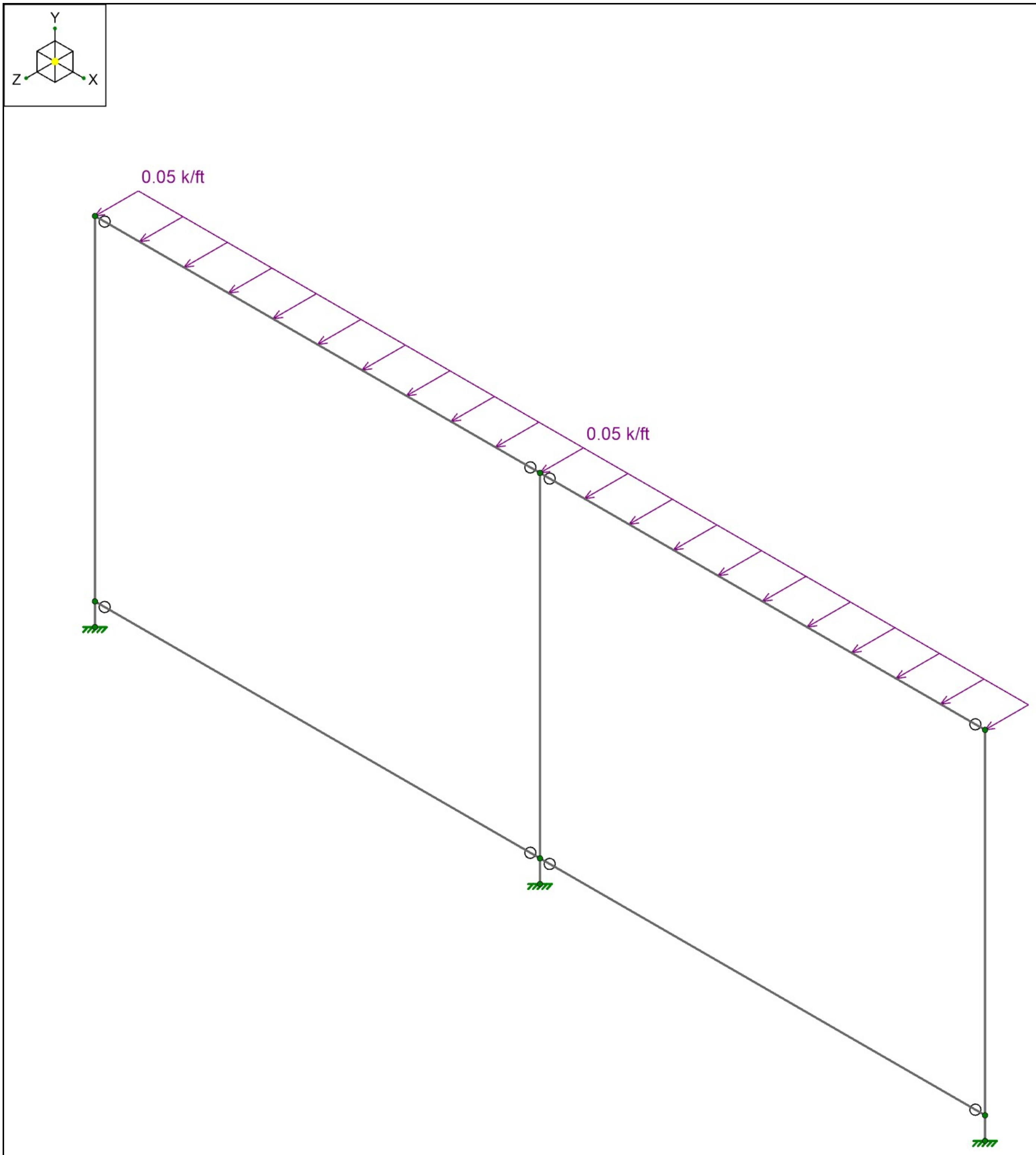


PSEI	Glass W/ Top & Bottom Rail	SK-3
AF		Mar 10, 2023
Eglass 223-802		2023-03-07 Glass w-top and botto…



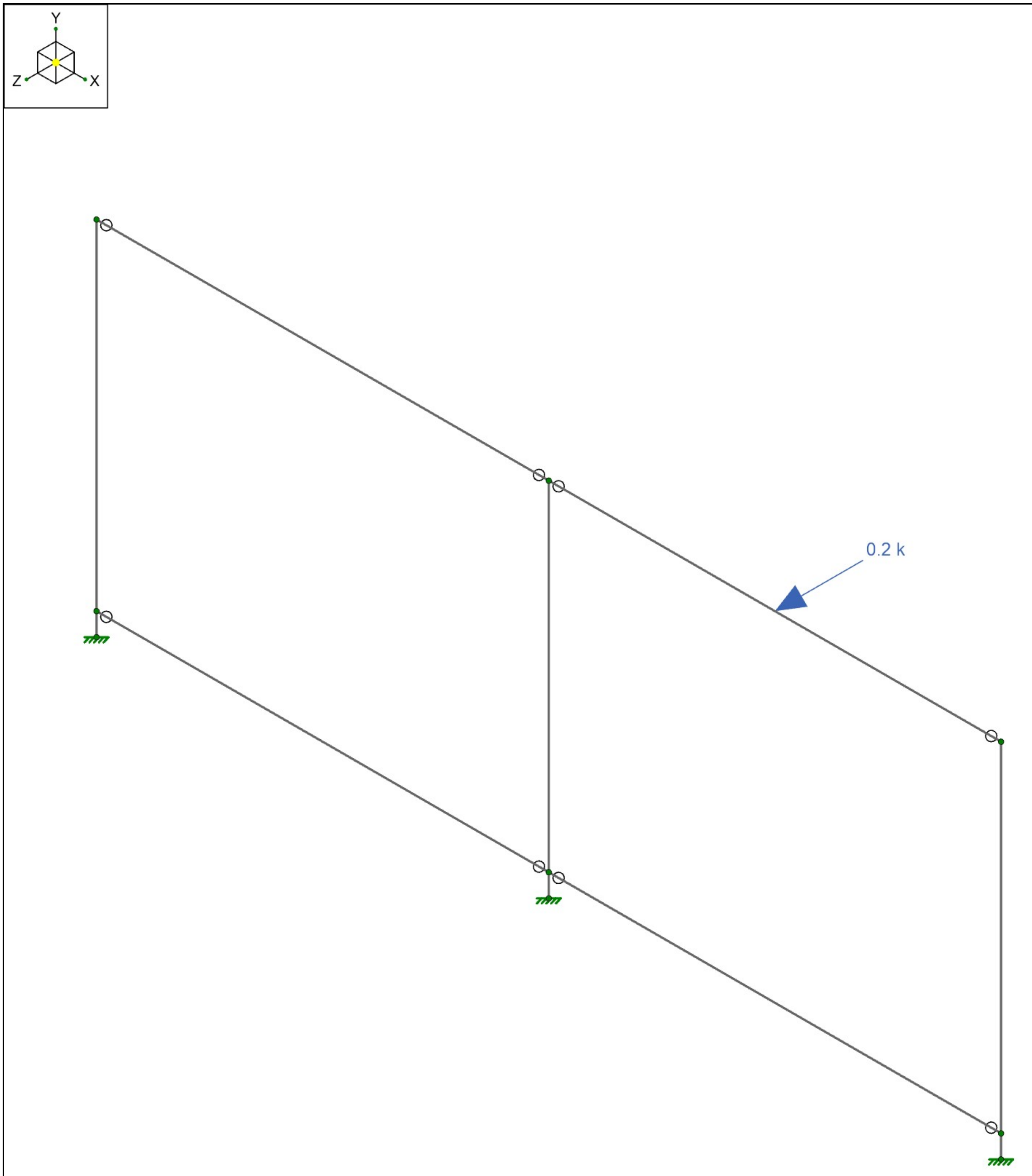
Loads: BLC 1, Distributed load-y at the top of

PSEI	Glass W/ Top & Bottom Rail	SK-4
AF		Mar 10, 2023
Eglass 223-802		2023-03-07 Glass w-top and botto…



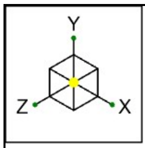
Loads: BLC 2, Distributed load-X at the side o

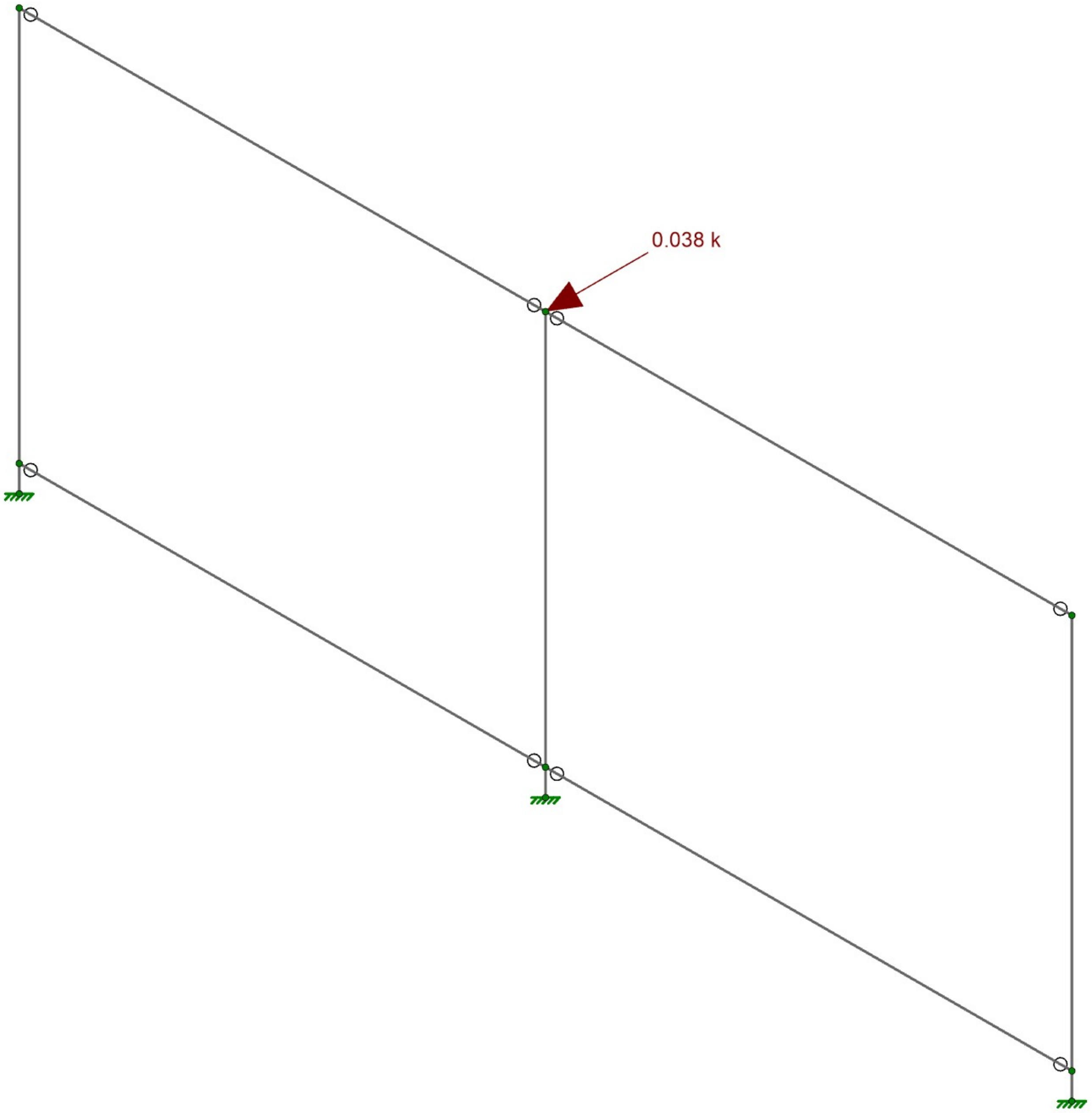
PSEI	Glass W/ Top & Bottom Rail	SK-5
AF		Mar 10, 2023
Eglass 223-802		2023-03-07 Glass w-top and botto…



Loads: BLC 4, Point load applied at the middle

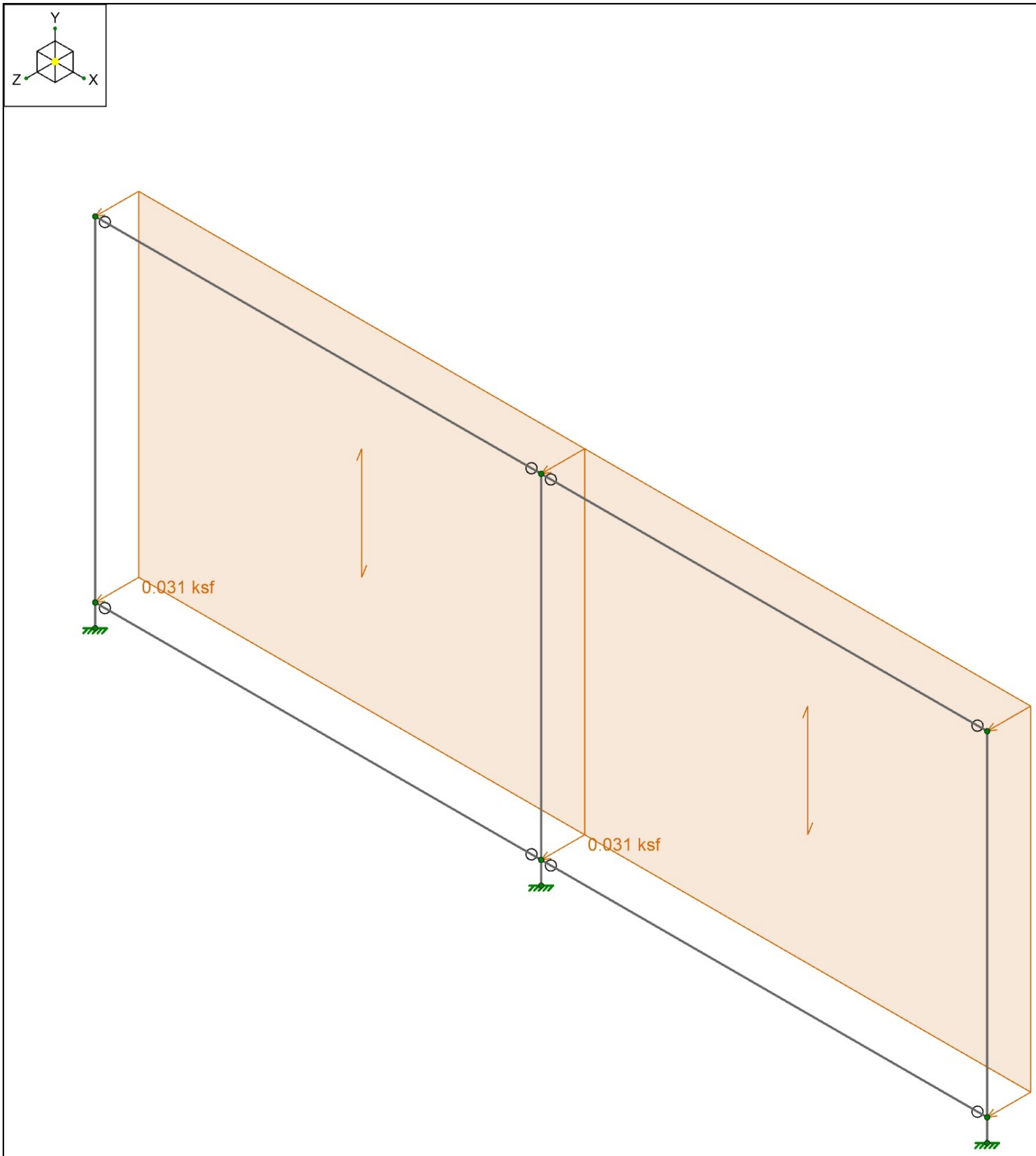
PSEI	Glass W/ Top & Bottom Rail	SK-7
AF		Mar 10, 2023
Eglass 223-802		2023-03-07 Glass w-top and botto…





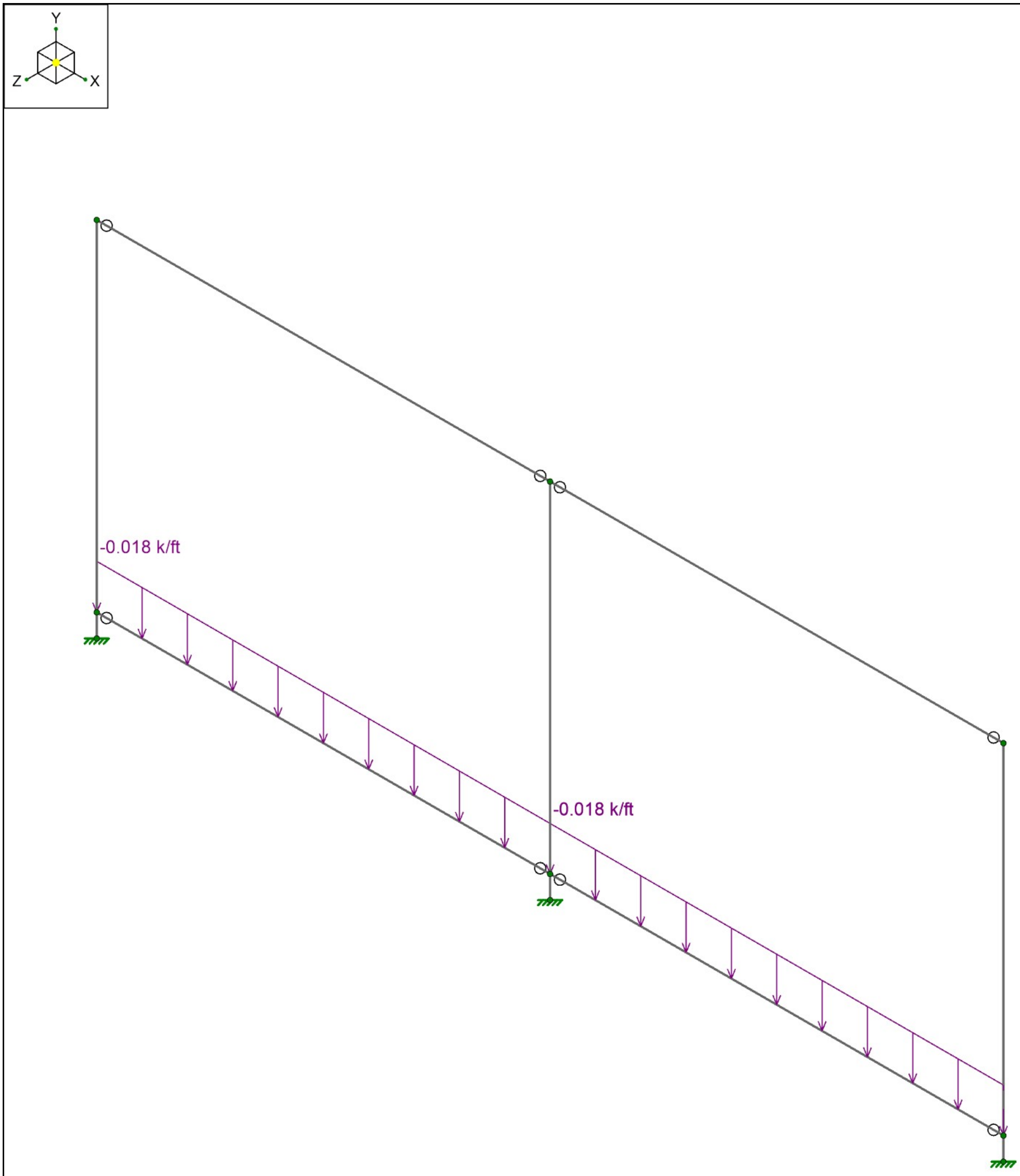
Loads: BLC 5, Infill

PSEI	Glass W/ Top & Bottom Rail	SK-8
AF		Mar 10, 2023
Eglass 223-802		2023-03-07 Glass w-top and botto…



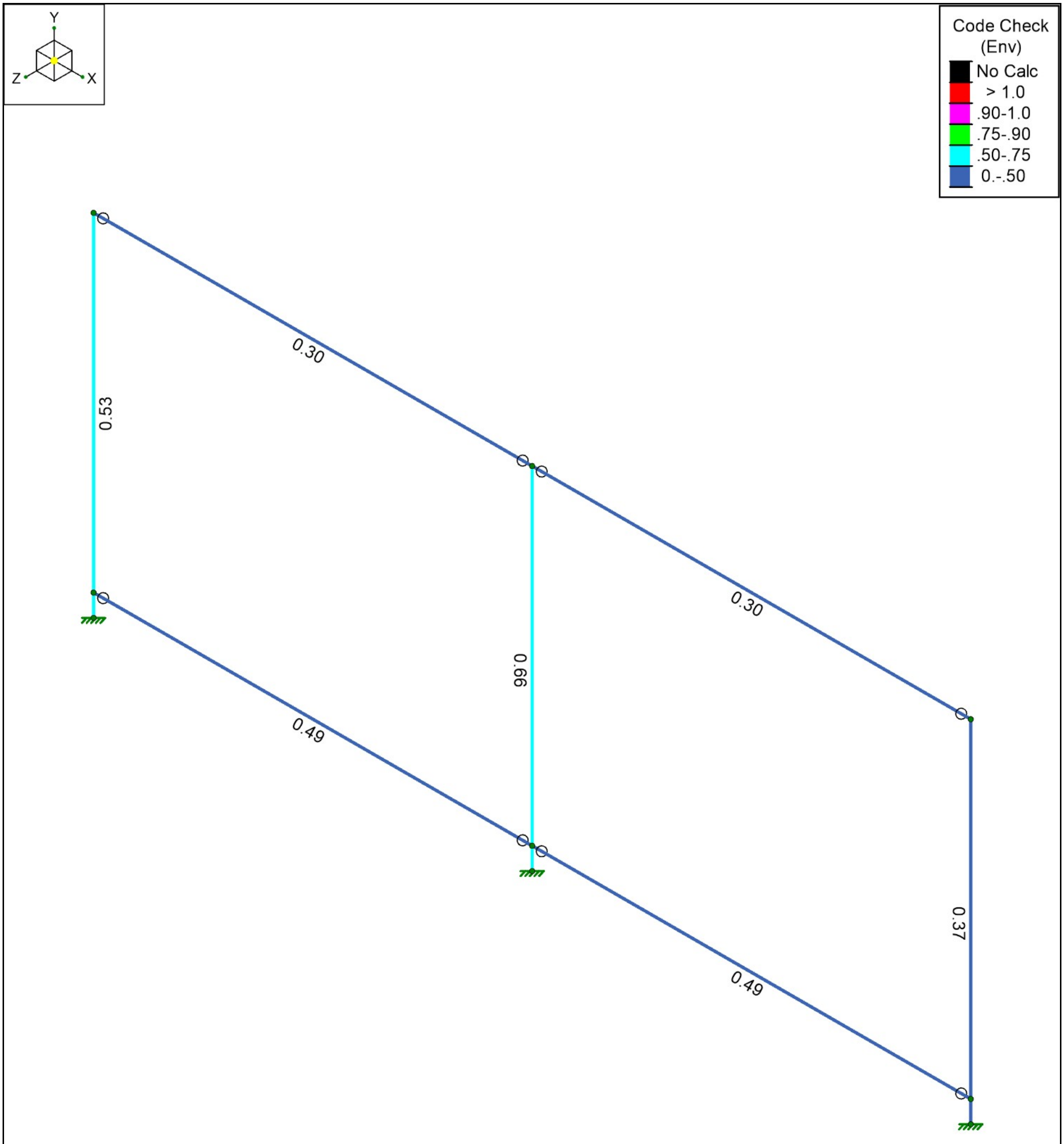
Loads: BLC 6, Wind

PSEI	Glass W/ Top & Bottom Rail	SK-9
AF		Mar 10, 2023
Eglass 223-802		2023-03-07 Glass w-top and botto…



Loads: BLC 7, Glass Weigh

PSEI	Glass W/ Top & Bottom Rail	SK-10
AF		Mar 10, 2023
Eglass 223-802		2023-03-07 Glass w-top and botto…



Member Code Checks Displayed (Enveloped)
Envelope Only Solution

PSEI	Glass W/ Top & Bottom Rail	SK-11
AF		Mar 10, 2023
Eglass 223-802		2023-03-07 Glass w-top and botto…

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	0	0	
2	N2	0	4	0	
3	N3	5	0	0	
4	N4	5	4	0	
5	N5	10	0	0	
6	N6	10	4	0	
7	N7	0	0.25	0	
8	N8	5	0.25	0	
9	N9	10	0.25	0	

Node Boundary Conditions

	Node Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot [k-ft/rad]	Y Rot [k-ft/rad]	Z Rot [k-ft/rad]
1	N1	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction
2	N3	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction
3	N5	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction

Aluminum Properties

	Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [1e^5°F^{-1}]	Density [k/ft^3]	Table B.4	kt	Ftu [ksi]	Fty [ksi]	Fcy [ksi]	Fsu [ksi]	Ct
1	3003-H14	10100	3787.5	0.33	1.3	0.173	Table B.4-1	1	19	16	13	12	141
2	6061-T6	10100	3787.5	0.33	1.3	0.173	Table B.4-2	1	38	35	35	24	141
3	6063-T5	10100	3787.5	0.33	1.3	0.173	Table B.4-2	1	22	16	16	13	141
4	6063-T6	10100	3787.5	0.33	1.3	0.173	Table B.4-2	1	30	25	25	19	141
5	5052-H34	10200	3787.5	0.33	1.3	0.173	Table B.4-1	1	34	26	24	20	141
6	6061-T6 W	10100	3787.5	0.33	1.3	0.173	Table B.4-1	1	24	15	15	15	141
7	6005-T5	10100	3787.5	0.33	1.3	0.173	Table B.4-1	1	38	35	35	24	141

Aluminum Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in^2]	Iyy [in^4]	Izz [in^4]	J [in^4]
1	POST	RT2.375x2.375x.125	Column	Rectangular Tubes	6005-T5	Typical	1.125	0.952	0.952	1.424
2	TOP RAIL	RT1x3x.125	Beam	Rectangular Tubes	6005-T5	Typical	0.938	0.153	0.95	0.422
3	BOTTOM RAIL	RT1.25X1.25X0.125	Beam	Rectangular Tubes	6005-T5	Typical	0.563	0.12	0.12	0.178

Aluminum Design Parameters

	Label	Shape	Length [ft]	Lcomp top [ft]	Function
1	M1	POST	4	Lbyy	Lateral
2	M2	TOP RAIL	5	Lbyy	Lateral
3	M3	POST	4	Lbyy	Lateral
4	M4	TOP RAIL	5	Lbyy	Lateral
5	M5	POST	4	Lbyy	Lateral
6	M6	BOTTOM RAIL	5	Lbyy	Lateral
7	M7	BOTTOM RAIL	5	Lbyy	Lateral

Member Point Loads (BLC 4 : Point load applied at the middle)

	Member Label	Direction	Magnitude [k, k-ft]	Location [(ft, %)]
1	M4	Z	0.2	2.5

Member Distributed Loads (BLC 1 : Distributed load-y at the top of)

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M2	Y	-0.05	-0.05	0	%100
2	M4	Y	-0.05	-0.05	0	%100

Member Distributed Loads (BLC 2 : Distributed load-X at the side o)

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M2	Z	0.05	0.05	0	%100
2	M4	Z	0.05	0.05	0	%100

Member Distributed Loads (BLC 7 : Glass Weigh)

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M6	Y	-0.018	-0.018	0	%100
2	M7	Y	-0.018	-0.018	0	%100

Member Distributed Loads (BLC 8 : BLC 6 Transient Area Loads)

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M2	Z	0.058	0.058	4.441e-16	5
2	M6	Z	0.058	0.058	0	5
3	M4	Z	0.058	0.058	4.441e-16	5
4	M7	Z	0.058	0.058	0	5

Member Area Loads (BLC 6 : Wind)

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [ksf]
1	N7	N2	N4	N8	Z	A-B	0.031
2	N8	N4	N6	N9	Z	A-B	0.031

Basic Load Cases

	BLC Description	Category	Y Gravity	Nodal	Point	Distributed	Area(Member)
1	Distributed load-y at the top of	None	-1			2	
2	Distributed load-X at the side o	None	-1			2	
3	Point load applied at the corner	None	-1	1			
4	Point load applied at the middle	None	-1		1		
5	Infill	None		1			
6	Wind	None					2
7	Glass Weigh	None				2	
8	BLC 6 Transient Area Loads	None				4	

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor
1	Distributed load-y at the top of	Yes	Y	1	1	7	1
2	Distributed load-X at the side o	Yes	Y	2	1	7	1
3	Point load applied at the corner	Yes	Y	3	1	7	1
4	Point load applied at the middle	Yes	Y	4	1	7	1
5	Infill	Yes	Y	5	1	7	1
6	Wind	Yes	Y	6	0.6	7	1

Envelope Node Reactions

	Node Label		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	N1	max	0	6	0.18	1	0	1	0	1	0	6	0	6
2		min	0	1	0.045	5	-0.2	3	-0.747	3	0	1	0	1
3	N3	max	0	6	0.354	1	0	1	0	1	0	6	0	6
4		min	0	1	0.089	5	-0.349	6	-0.942	2	0	1	0	1
5	N5	max	0	6	0.179	1	0	5	0	1	0	6	0	6
6		min	0	1	0.044	5	-0.174	6	-0.53	2	0	1	0	1
7	Totals:	max	0	6	0.713	1	0	1						
8		min	0	1	0.178	5	-0.698	6						

Envelope Member Section Forces

	Member	Sec		Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torque[k-ft]	LC	y-y Moment[k-ft]	LC	z-z Moment[k-ft]	LC
1	M1	1	max	0.18	1	0	6	0	1	0	6	0.747	3	0	6
2			min	0.045	5	0	1	-0.2	3	0	1	0	1	0	1
3		2	max	0.132	1	0	6	0	5	0	6	0.55	3	0	6
4			min	0	5	0	1	-0.2	3	0	1	0	1	0	1
5		3	max	0.131	1	0	6	0	5	0	6	0.35	3	0	6
6			min	0	5	0	1	-0.2	3	0	1	0	1	0	1
7		4	max	0.129	1	0	6	0	5	0	6	0.153	2	0	6
8			min	0	5	0	1	-0.2	3	0	1	0	1	0	1
9		5	max	0.128	1	0	6	0	5	0	6	0.028	2	0	6
10			min	0	5	0	1	-0.2	3	0	1	-0.051	3	0	1
11	M2	1	max	0	6	0	5	0	6	0.051	3	0	6	0	6
12			min	0	1	-0.125	2	-0.128	1	-0.028	2	0	1	0	1
13		2	max	0	6	0	5	0	6	0.051	3	0	6	0.117	2
14			min	0	1	-0.062	2	-0.064	1	-0.028	2	-0.12	1	0	1
15		3	max	0	6	0	6	0	6	0.051	3	0	6	0.156	2
16			min	0	1	0	1	0	1	-0.028	2	-0.16	1	0	1
17		4	max	0	6	0.062	2	0.064	1	0.051	3	0	6	0.117	2
18			min	0	1	0	1	0	5	-0.028	2	-0.12	1	0	1
19		5	max	0	6	0.125	2	0.128	1	0.051	3	0	6	0	6
20			min	0	1	0	1	0	5	-0.028	2	0	1	0	1
21	M3	1	max	0.256	1	0	6	0	1	0	6	0.055	2	0	6
22			min	0	5	0	1	-0.25	2	0	1	-0.044	3	0	1
23		2	max	0.257	1	0	6	0	1	0	6	0	1	0	6
24			min	0	5	0	1	-0.25	2	0	1	-0.195	2	0	1
25		3	max	0.258	1	0	6	0	1	0	6	0	1	0	6
26			min	0	5	0	1	-0.25	2	0	1	-0.445	2	0	1
27		4	max	0.26	1	0	6	0	1	0	6	0	1	0	6
28			min	0	5	0	1	-0.25	2	0	1	-0.695	2	0	1
29		5	max	0.354	1	0	6	0	1	0	6	0	1	0	6
30			min	0.089	5	0	1	-0.349	6	0	1	-0.942	2	0	1
31	M4	1	max	0	6	0	5	0	6	0.028	2	0	6	0	6
32			min	0	1	-0.125	2	-0.128	1	-0.003	4	0	1	0	1
33		2	max	0	6	0	5	0	6	0.028	2	0	6	0.125	4
34			min	0	1	-0.1	4	-0.064	1	-0.003	4	-0.12	1	0	1
35		3	max	0	6	0.1	4	0	6	0.028	2	0	6	0.25	4
36			min	0	1	0	1	0	1	-0.003	4	-0.16	1	0	1
37		4	max	0	6	0.1	4	0.064	1	0.028	2	0	6	0.125	4
38			min	0	1	0	1	0	5	-0.003	4	-0.12	1	0	1
39		5	max	0	6	0.125	2	0.128	1	0.028	2	0	6	0	6
40			min	0	1	0	1	0	5	-0.003	4	0	1	0	1
41	M5	1	max	0.128	1	0	6	0	5	0	6	0.003	4	0	6
42			min	0	5	0	1	-0.125	2	0	1	-0.028	2	0	1
43		2	max	0.129	1	0	6	0	5	0	6	0	1	0	6

Envelope Member Section Forces (Continued)

	Member	Sec		Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torque[k-ft]	LC	y-y Moment[k-ft]	LC	z-z Moment[k-ft]	LC
44			min	0	5	0	1	-0.125	2	0	1	-0.153	2	0	1
45		3	max	0.131	1	0	6	0	5	0	6	0	1	0	6
46			min	0	5	0	1	-0.125	2	0	1	-0.278	2	0	1
47		4	max	0.132	1	0	6	0	5	0	6	0	1	0	6
48			min	0	5	0	1	-0.125	2	0	1	-0.403	2	0	1
49		5	max	0.179	1	0	6	0	1	0	6	0	1	0	6
50			min	0.044	5	0	1	-0.174	6	0	1	-0.53	2	0	1
51	M6	1	max	0	6	0.047	4	0	5	0.003	3	0	6	0	6
52			min	0	1	0.045	5	-0.087	6	-0.002	2	0	1	0	1
53		2	max	0	6	0.023	4	0	5	0.003	3	0	5	-0.042	6
54			min	0	1	0.022	5	-0.044	6	-0.002	2	-0.082	6	-0.044	1
55		3	max	0	6	0	6	0	6	0.003	3	0	5	-0.056	6
56			min	0	1	0	1	0	1	-0.002	2	-0.109	6	-0.058	1
57		4	max	0	6	-0.022	6	0.044	6	0.003	3	0	5	-0.042	6
58			min	0	1	-0.023	1	0	1	-0.002	2	-0.082	6	-0.043	1
59		5	max	0	6	-0.045	6	0.087	6	0.003	3	0	6	0	6
60			min	0	1	-0.046	1	0	1	-0.002	2	0	1	0	1
61	M7	1	max	0	6	0.046	4	0	5	0.002	2	0	6	0	6
62			min	0	1	0.044	5	-0.087	6	0	4	0	1	0	1
63		2	max	0	6	0.023	4	0	5	0.002	2	0	5	-0.042	6
64			min	0	1	0.022	5	-0.044	6	0	4	-0.082	6	-0.043	1
65		3	max	0	6	0	6	0	6	0.002	2	0	5	-0.056	6
66			min	0	1	0	1	0	1	0	4	-0.109	6	-0.058	1
67		4	max	0	6	-0.022	6	0.044	6	0.002	2	0	5	-0.042	6
68			min	0	1	-0.023	1	0	1	0	4	-0.082	6	-0.043	1
69		5	max	0	6	-0.044	6	0.087	6	0.002	2	0	6	0	6
70			min	0	1	-0.046	1	0	1	0	4	0	1	0	1

Envelope AA ADM1-15: ASD - BUILDING Member Aluminum Code Checks

	Member	Shape	Code Check	Loc[ft]	LC	Shear Check	Loc[ft]	Dir	LC	Pnc/Om[k]	Pnt/Om[k]	Mny/Om[k-ft]	Mnz/Om[k-ft]	Vny/Om[k]	Vnz/Om[k]	Cb	Eqn
1	M1	RT2.375x2.375x.125	0.527	0	3	0.033	4	z	3	15.475	21.923	1.417	1.417	6.154	6.154	1	H.1-1
2	M2	RT1x3x.125	0.296	2.5	1	0.127	5	z	3	2.187	18.269	0.54	1.12	8.077	1.923	1	H.1-1
3	M3	RT2.375x2.375x.125	0.665	4	2	0.057	4	z	6	15.475	21.923	1.417	1.417	6.154	6.154	1	H.1-1
4	M4	RT1x3x.125	0.296	2.5	1	0.07	5	z	2	2.187	18.269	0.54	1.12	8.077	1.923	1	H.1-1
5	M5	RT2.375x2.375x.125	0.374	4	2	0.028	4	z	6	15.475	21.923	1.417	1.417	6.154	6.154	1	H.1-1
6	M6	RT1.25X1.25X0.125	0.486	2.5	6	0.038	5	z	6	1.712	10.971	0.339	0.339	2.692	2.692	1.136	H.1-1
7	M7	RT1.25X1.25X0.125	0.485	2.5	6	0.038	5	z	6	1.712	10.971	0.339	0.339	2.692	2.692	1.136	H.1-1

Glass Load Resistance Report --

Friday, September 22, 2017

Glazing Information

Edge Supports: 2 Sides
Glazing Angle: 90°
Lite Dimensions:
Unsupported Length: 60.0 in.
Supported Length: 42.0 in.

Project Details

Project Name:
Location:
Comments:

Glass Construction (Rectangular)

Single Glazed Lite

Glass Type: Fully Tempered
Nominal Thickness: 5/16 in.

Short Load Duration, Resistance, and Deflection Data

Load (~ 3 sec.): 31.0 psf
Load Resistance: 43.7 psf
Approximate center of glass deflection: 1.68 in.

Long Load Duration, Resistance, and Deflection Data

Load (~ 30 days): 13.2 psf
Load Resistance: 32.8 psf
Approximate center of glass deflection: 0.72 in.

Conclusion

Based on your design information, the load resistance is greater than or equal to the specified loading.

Statement of Compliance

Procedures followed in determining the resistance of this window glass are in accordance with ASTM E1300-09/12.

Disclaimer:

This software can be used to determine the load resistance of specified glass types exposed to uniform lateral loads of short or long duration subject to the following conditions:

- The glass is free of edge and surface damage and has been properly glazed in the opening in conformance with the manufacturer's recommendations.
- Procedures exist to determine load resistance for rectangular glass assemblies that are:
  a. Continuously supported along all four edges,
  b. Continuously supported along three edges,
  c. Continuously supported along two parallel edges, and
  d. Continuously supported along one edge.
- The software user has the responsibility of selecting the correct procedures for the required application from the software.
- The stiffness of members supporting any glass edge shall be sufficient that under design load, edge deflections shall not exceed L/175, where L denotes that length of the supported edge.
- The manufacturer states that the Safety Plus II 0.090 Polyurethane Large Missile Resistant interlayer is comparable to the PVB interlayer.

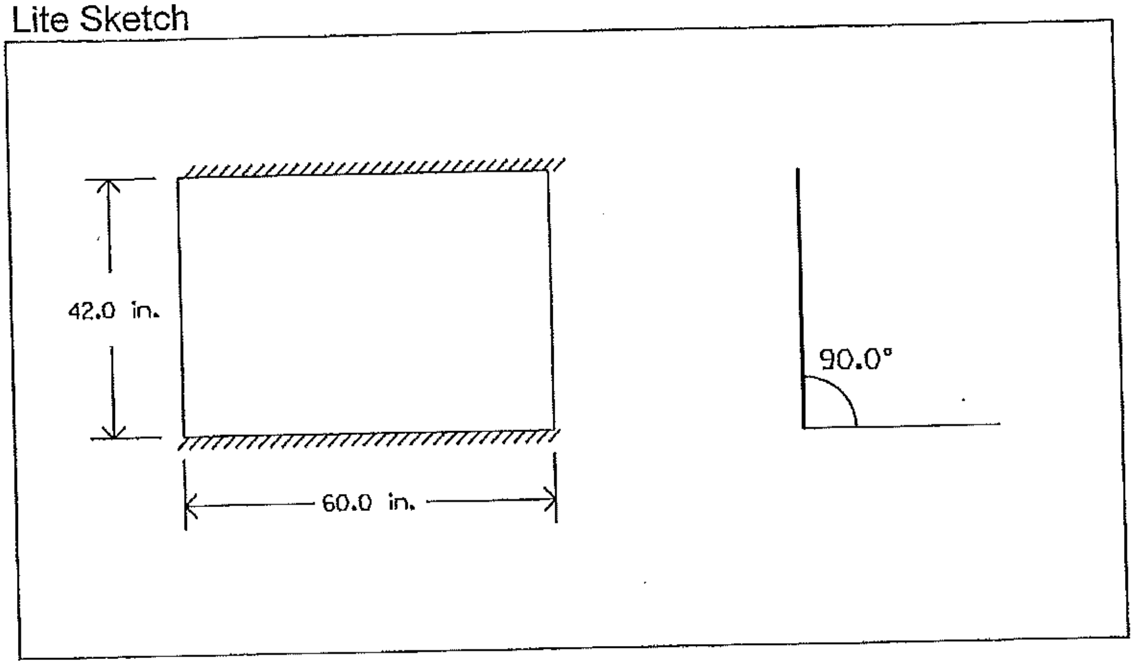
For other limiting conditions that may apply, refer to Section 5 of ASTM E1300 and local building codes.

Prepared by: ______________________ on 4/5/2017

Details Report --

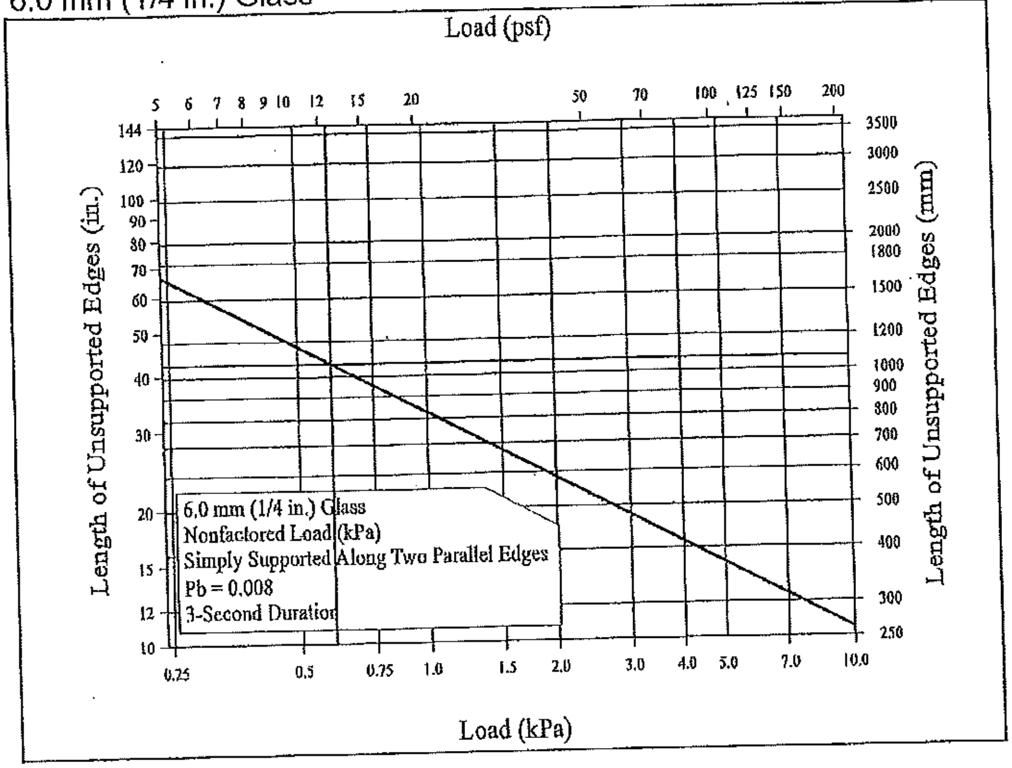
Friday, September 22, 2017

Lite Sketch



Details Report --

6.0 mm (1/4 in.) Glass



Short Duration Load

Non-Factored Load: 12.5 psf

Glass Type Factor: 4.00

Load Resistance: 50.1 psf

Approximate Deflection: 0.96 in.

Long Duration Load

Non-Factored Load: 12.5 psf

Glass Type Factor: 3.00

Load Resistance: 37.5 psf

Approximate Deflection: 0.41 in.

Glass Load Resistance Report --

Friday, September 22, 2017

Glazing Information

Edge Supports: 2 Sides
Glazing Angle: 90°
Lite Dimensions:
  Unsupported Length: 42.0 in.
  Supported Length: 60.0 in.

Project Details

Project Name:
Location:
Comments:

Glass Construction (Rectangular)

Single Glazed Lite

Glass Type: Fully Tempered
Nominal Thickness: 1/4 in.

Short Load Duration, Resistance, and Deflection Data

Load (~ 3 sec.): 31.0 psf
Load Resistance: 50.1 psf
Approximate center of glass deflection: 0.96 in.

Long Load Duration, Resistance, and Deflection Data

Load (~ 30 days): 13.2 psf
Load Resistance: 37.5 psf
Approximate center of glass deflection: 0.41 in.

Conclusion

Based on your design information, the load resistance is greater than or equal to the specified loading.

Statement of Compliance

Procedures followed in determining the resistance of this window glass are in accordance with ASTM E1300-09/12.

Disclaimer:
This software can be used to determine the load resistance of specified glass types exposed to uniform lateral loads of short or long duration subject to the following conditions:

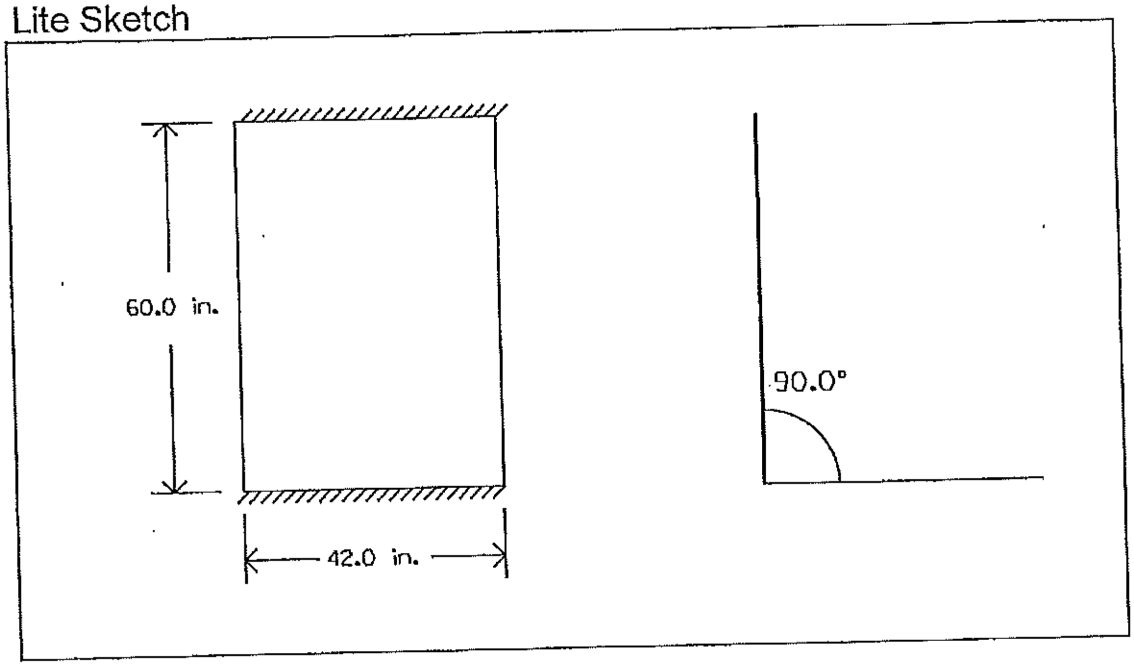
- The glass is free of edge and surface damage and has been properly glazed in the opening in conformance with the manufacturer's recommendations.
- Procedures exist to determine load resistance for rectangular glass assemblies that are:
  a. Continuously supported along all four edges,
  b. Continuously supported along three edges,
  c. Continuously supported along two parallel edges, and
  d. Continuously supported along one edge.
- The software user has the responsibility of selecting the correct procedures for the required application from the software.
- The stiffness of members supporting any glass edge shall be sufficient that under design load, edge deflections shall not exceed L/175, where L denotes that length of the supported edge.
- The manufacturor states that the Safety Plus II 0.090 Polyurethane Large Missile Resistant interlayer is comparable to the PVB interlayer.

For other limiting conditions that may apply, refer to Section 5 of ASTM E1300 and local building codes.

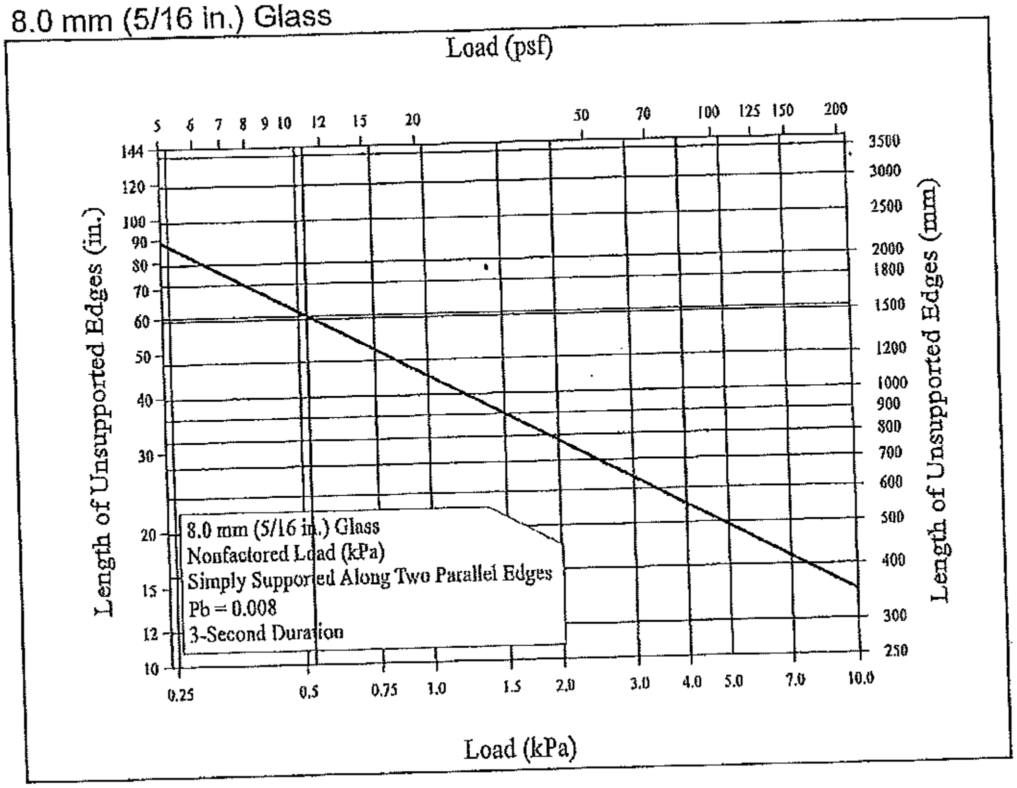
Prepared by: ____________________ on 4/5/2017

Details Report --

Lite Sketch



8.0 mm (5/16 in.) Glass

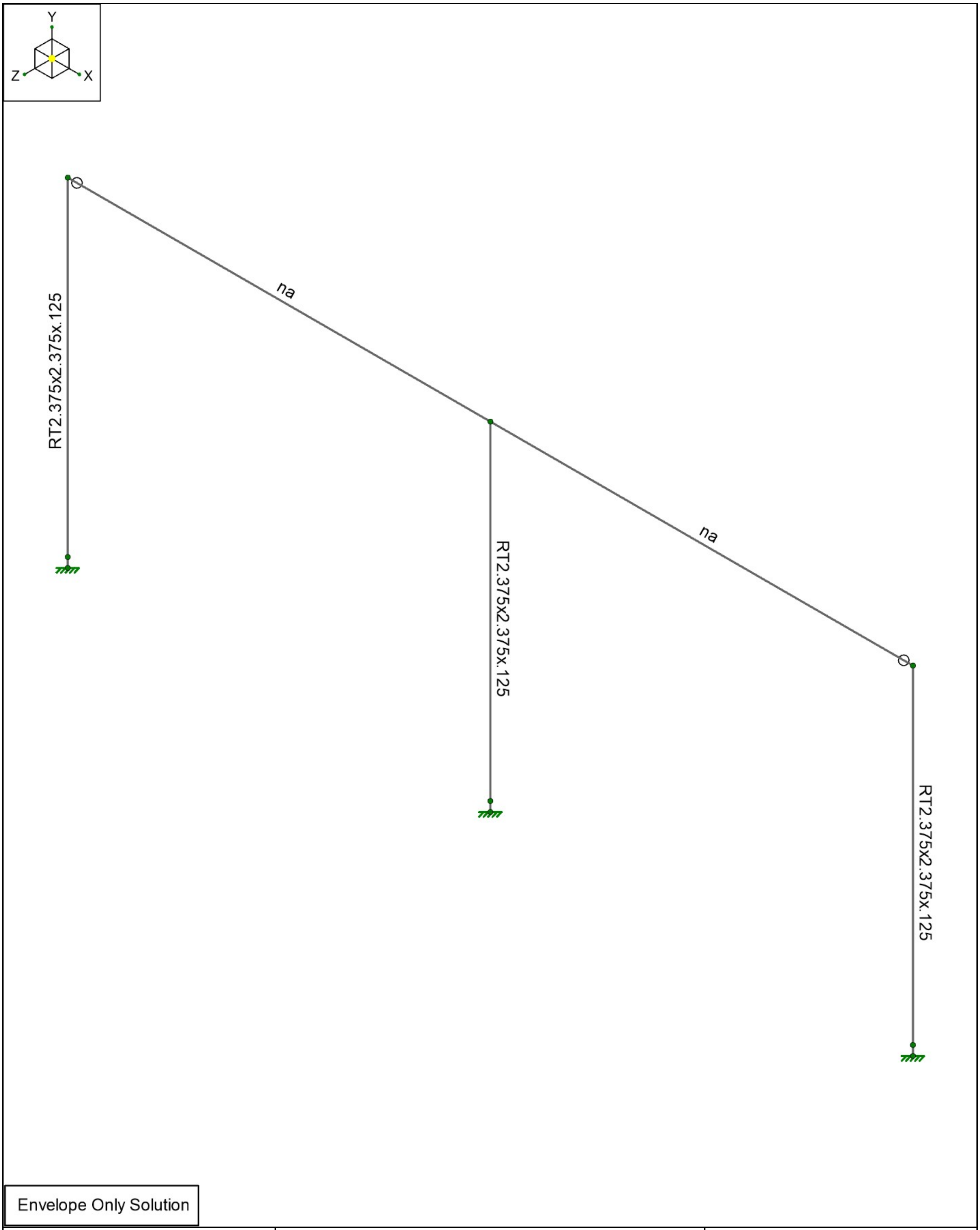


Short Duration Load

Non-Factored Load:	10.9 psf
Glass Type Factor:	4.00
Load Resistance:	43.7 psf
Approximate Deflection:	1.68 in.

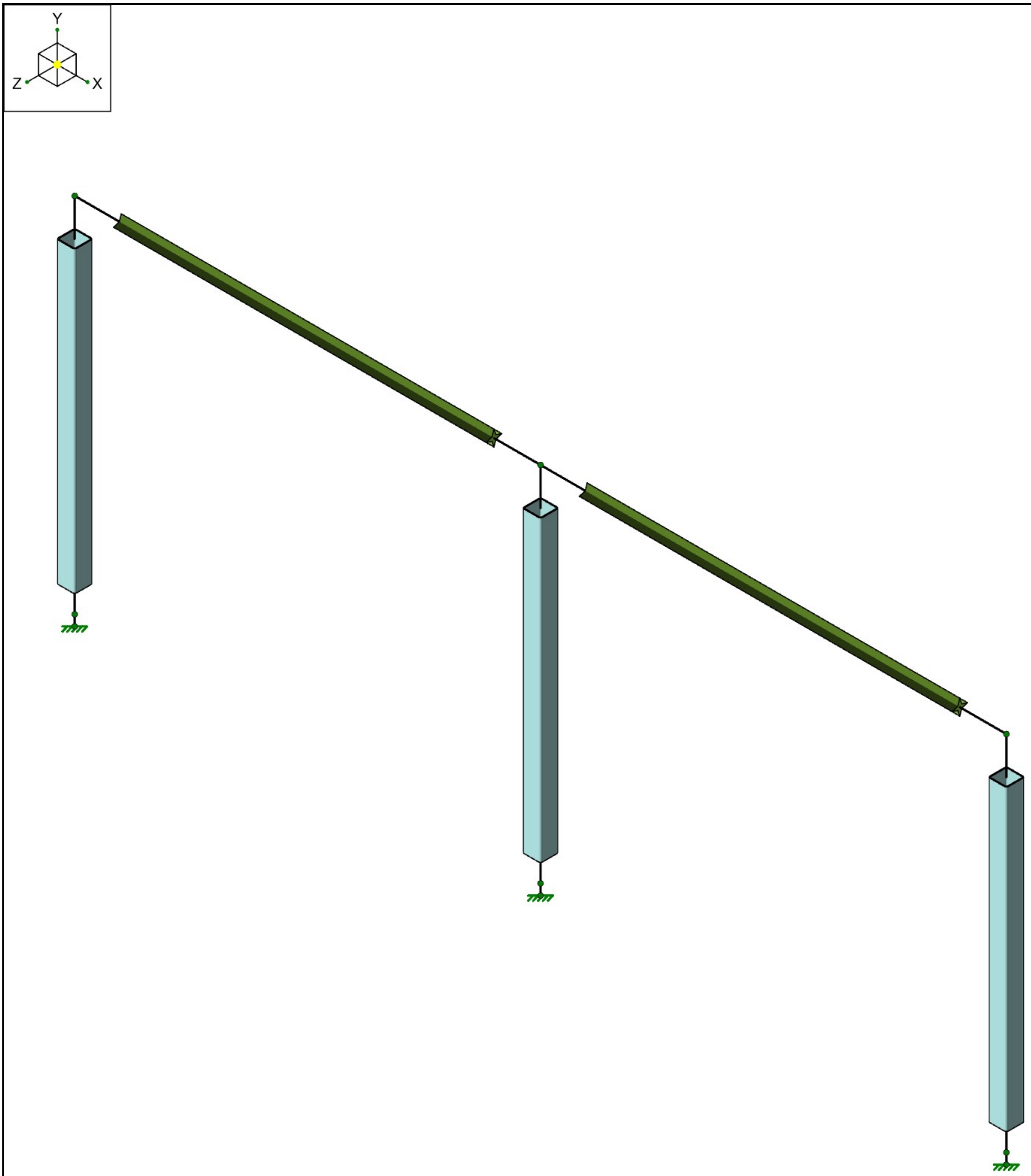
Long Duration Load

Non-Factored Load:	10.9 psf
Glass Type Factor:	3.00
Load Resistance:	32.8 psf
Approximate Deflection:	0.72 in.



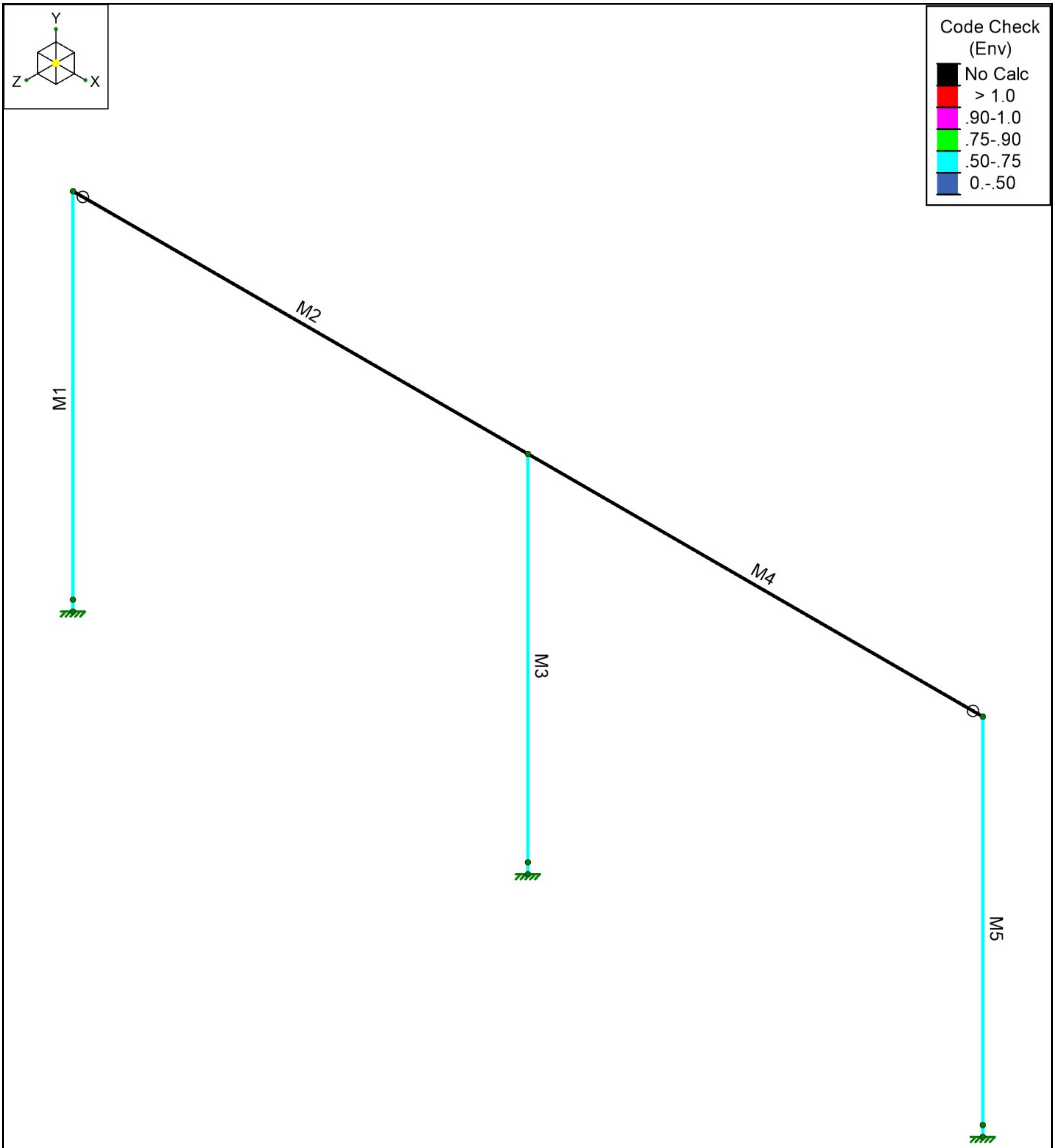
Envelope Only Solution

PSEI	Glass W/ Clips	SK-12
AF		Mar 10, 2023
Eglass 223-802		Glass w-clip.r3d



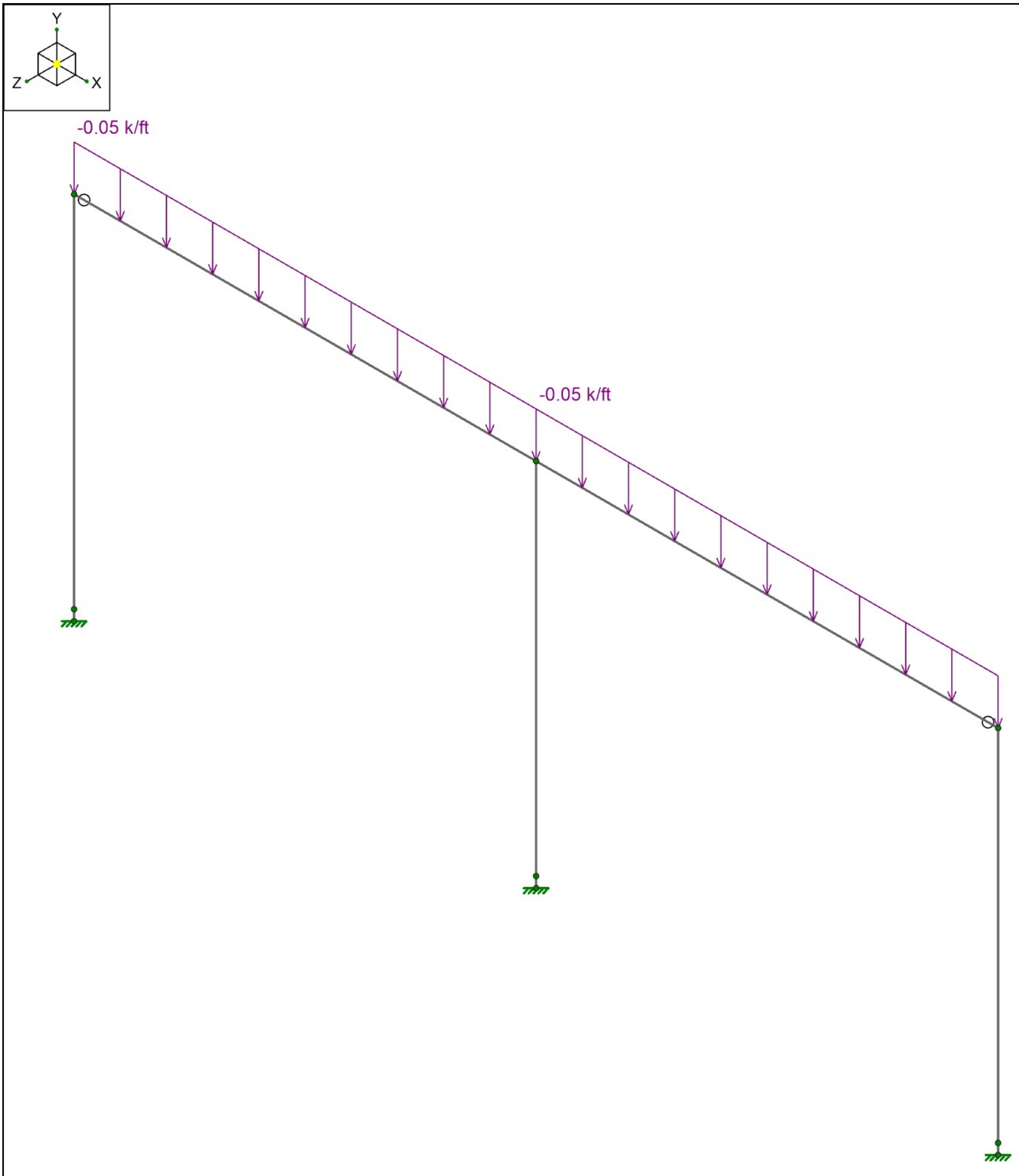
Envelope Only Solution

PSEI	Glass W/ Clips	SK-13
AF		Mar 10, 2023
Eglass 223-802		Glass w-clip.r3d



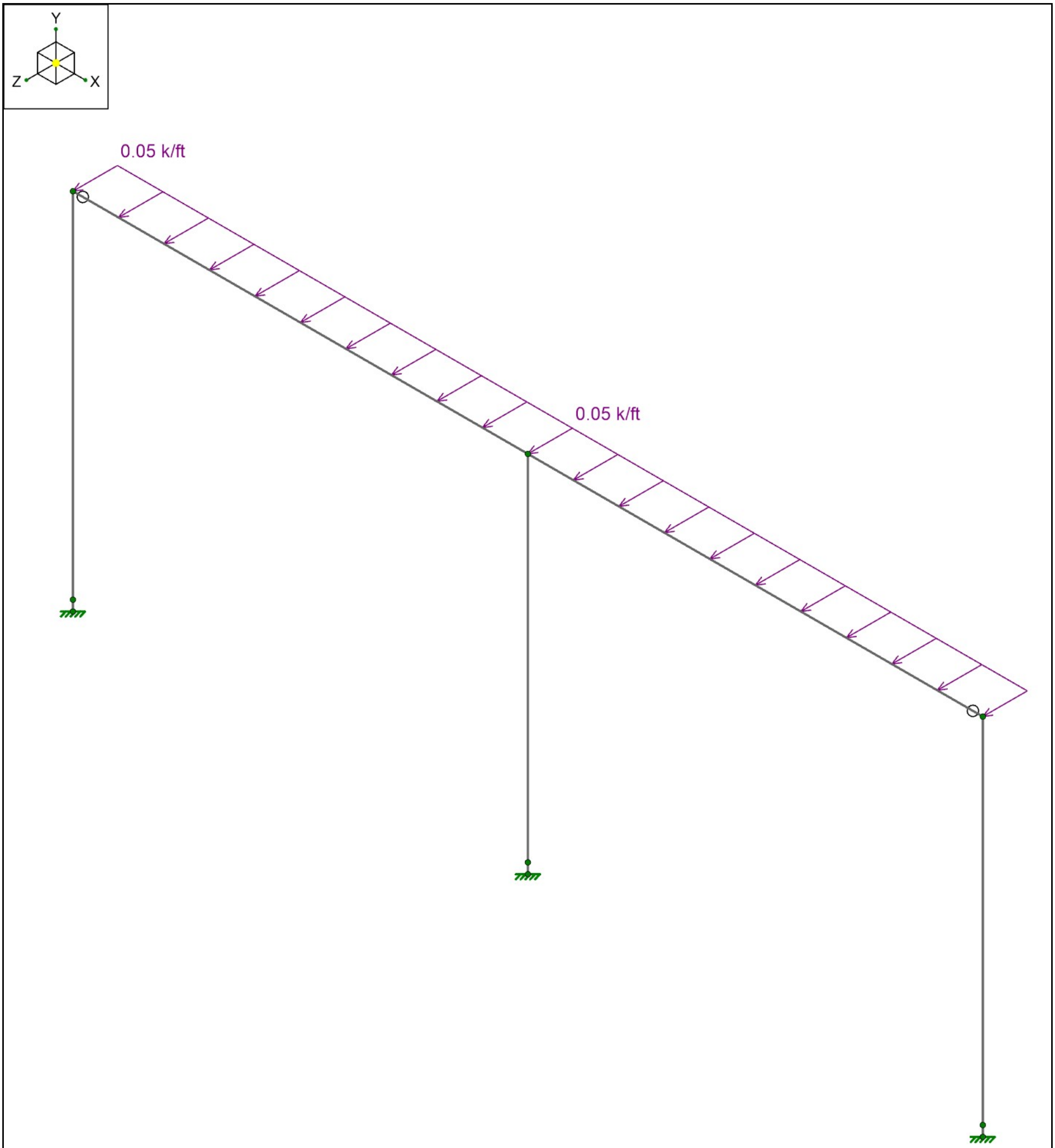
Envelope Only Solution

PSEI	Glass W/ Clips	SK-14
AF		Mar 10, 2023
Eglass 223-802		Glass w-clip.r3d



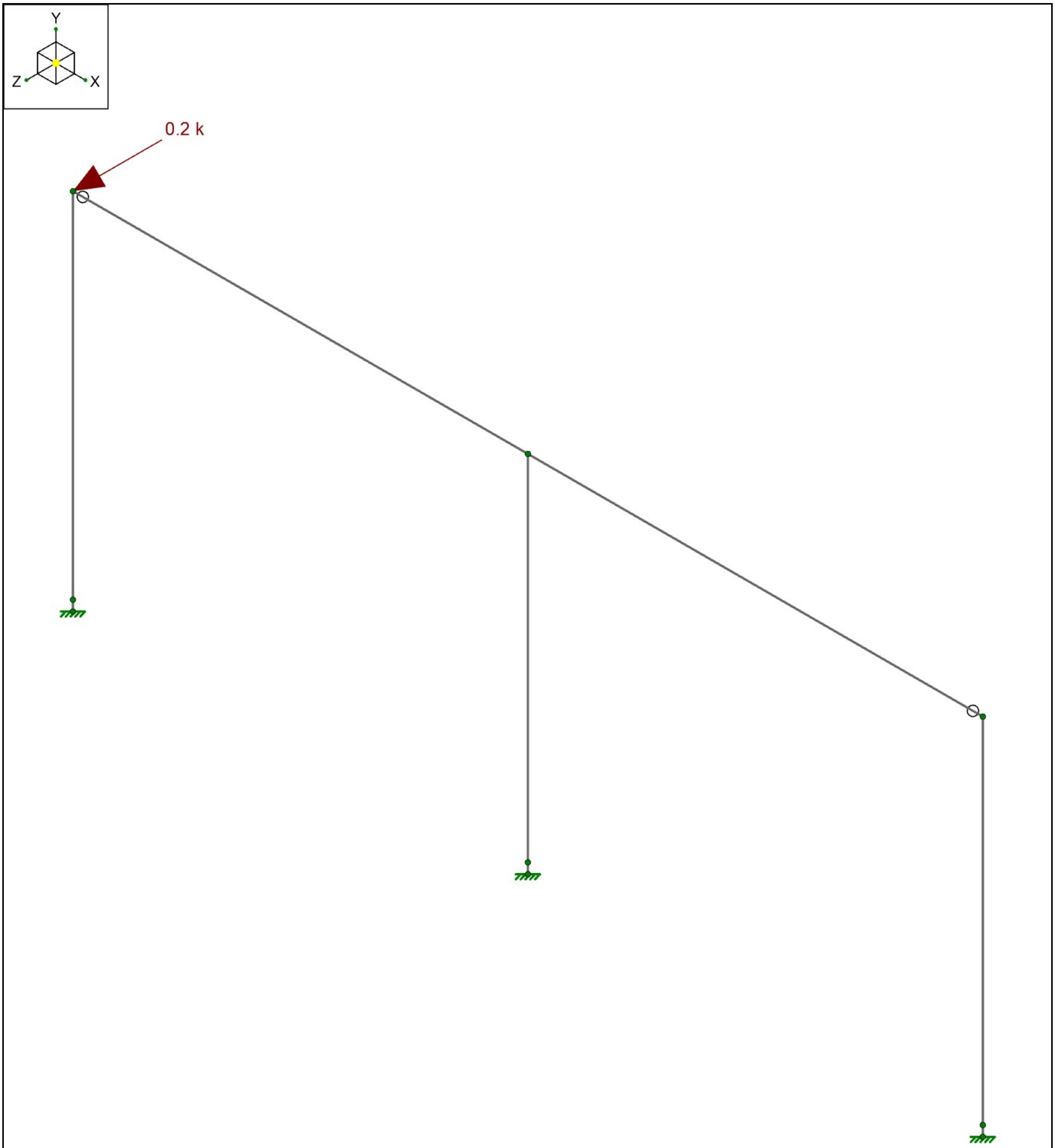
Loads: BLC 1, Distributed load-y at the top of
Envelope Only Solution

PSEI	Glass W/ Clips	SK-15
AF		Mar 10, 2023
Eglass 223-802		Glass w-clip.r3d



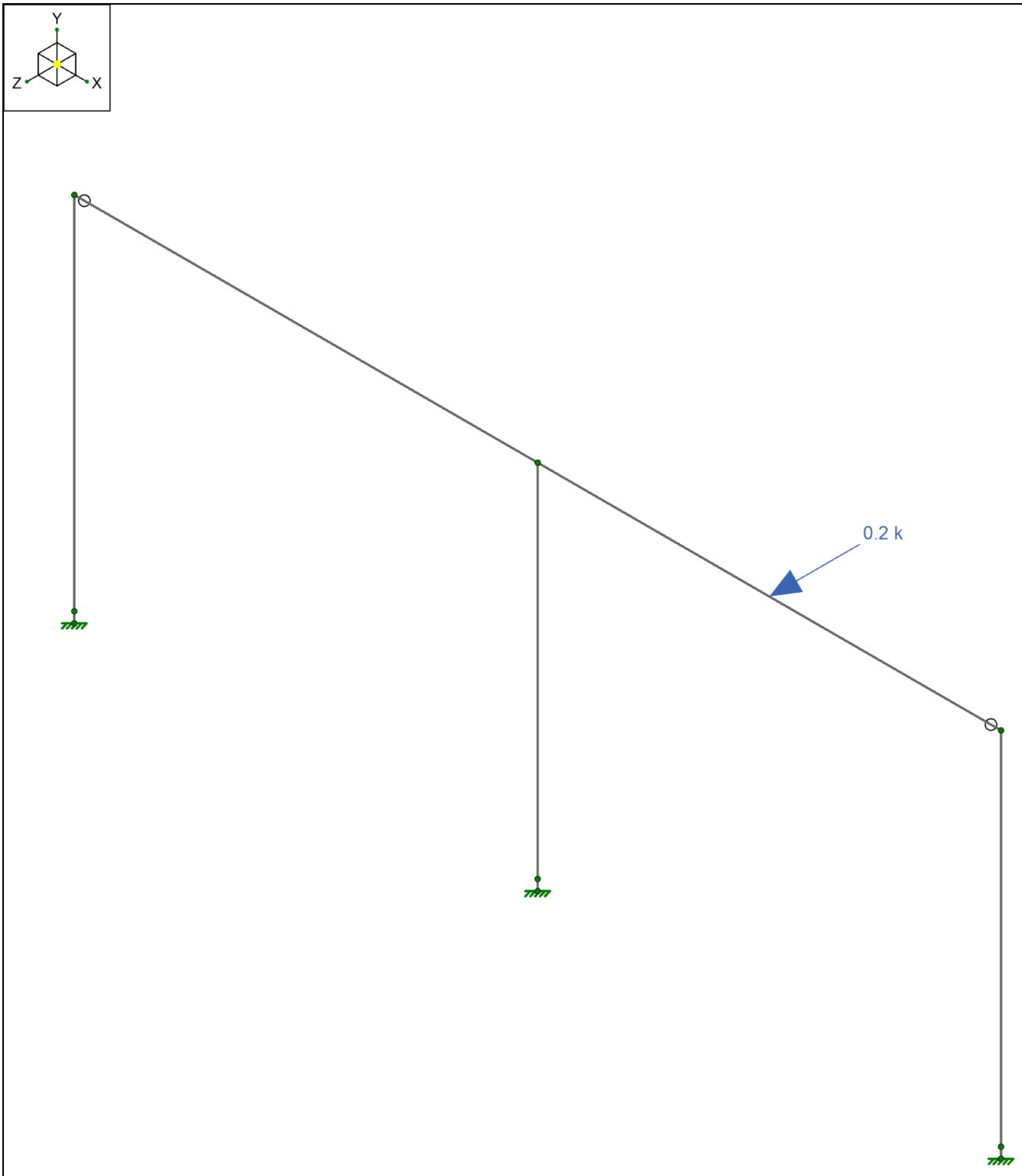
Loads: BLC 2, Distributed load-X at the side o
Envelope Only Solution

PSEI	Glass W/ Clips	SK-16
AF		Mar 10, 2023
Eglass 223-802		Glass w-clip.r3d



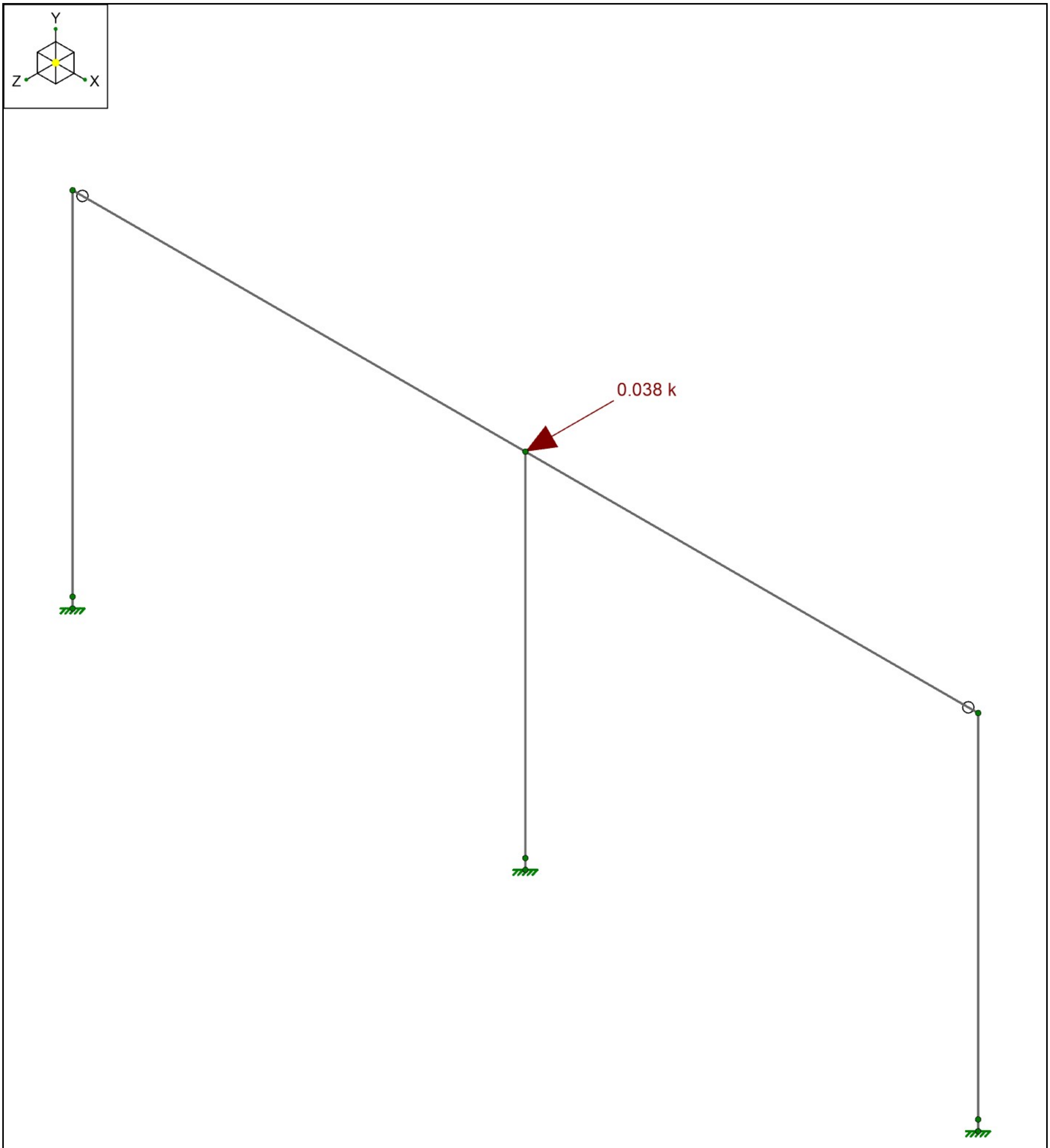
Loads: BLC 3, Point load applied at the corner
Envelope Only Solution

PSEI	Glass W/ Clips	SK-17
AF		Mar 10, 2023
Eglass 223-802		Glass w-clip.r3d



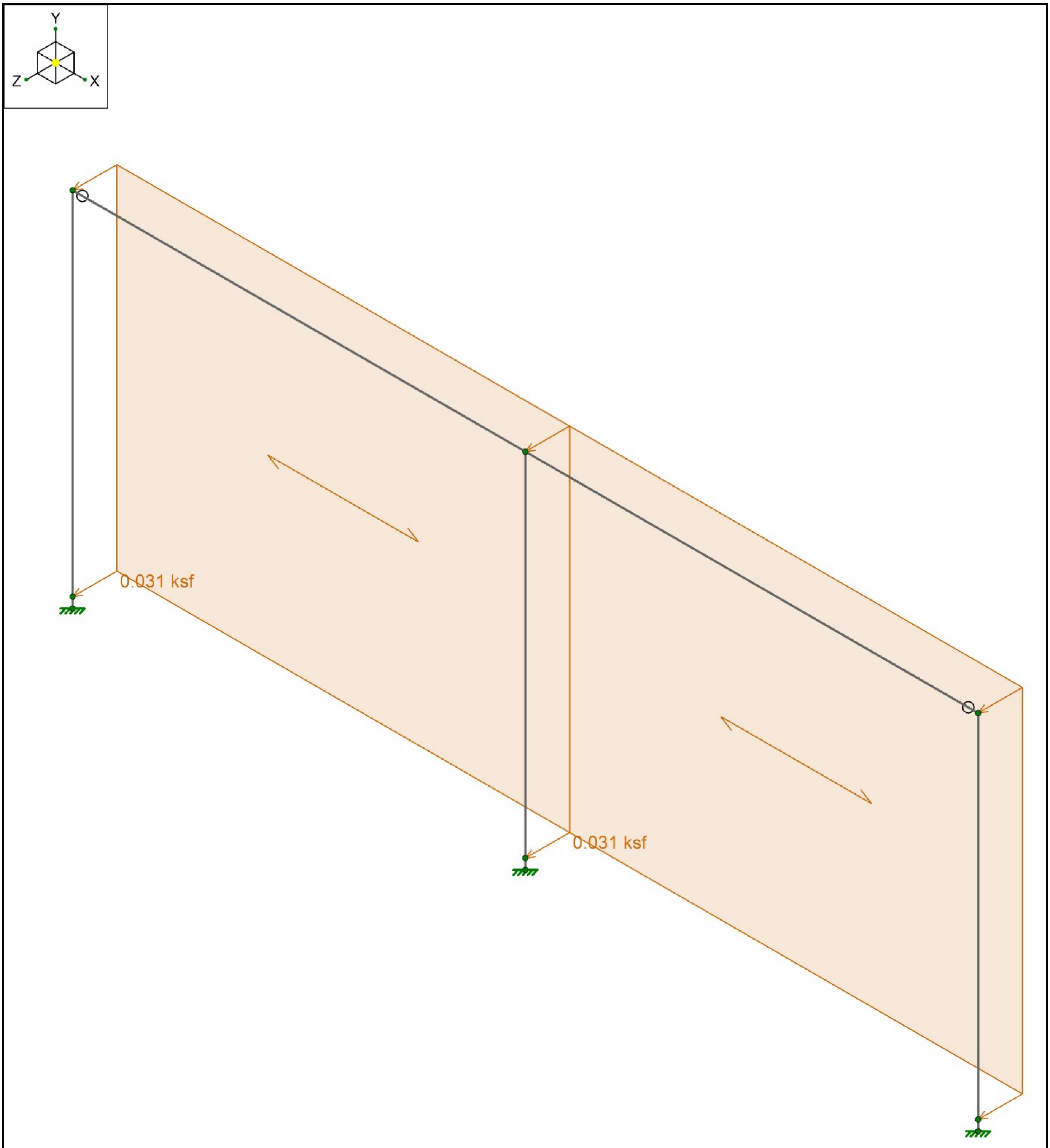
Loads: BLC 4, Point load applied at the middle
Envelope Only Solution

PSEI	Glass W/ Clips	SK-18
AF		Mar 10, 2023
Eglass 223-802		Glass w-clip.r3d



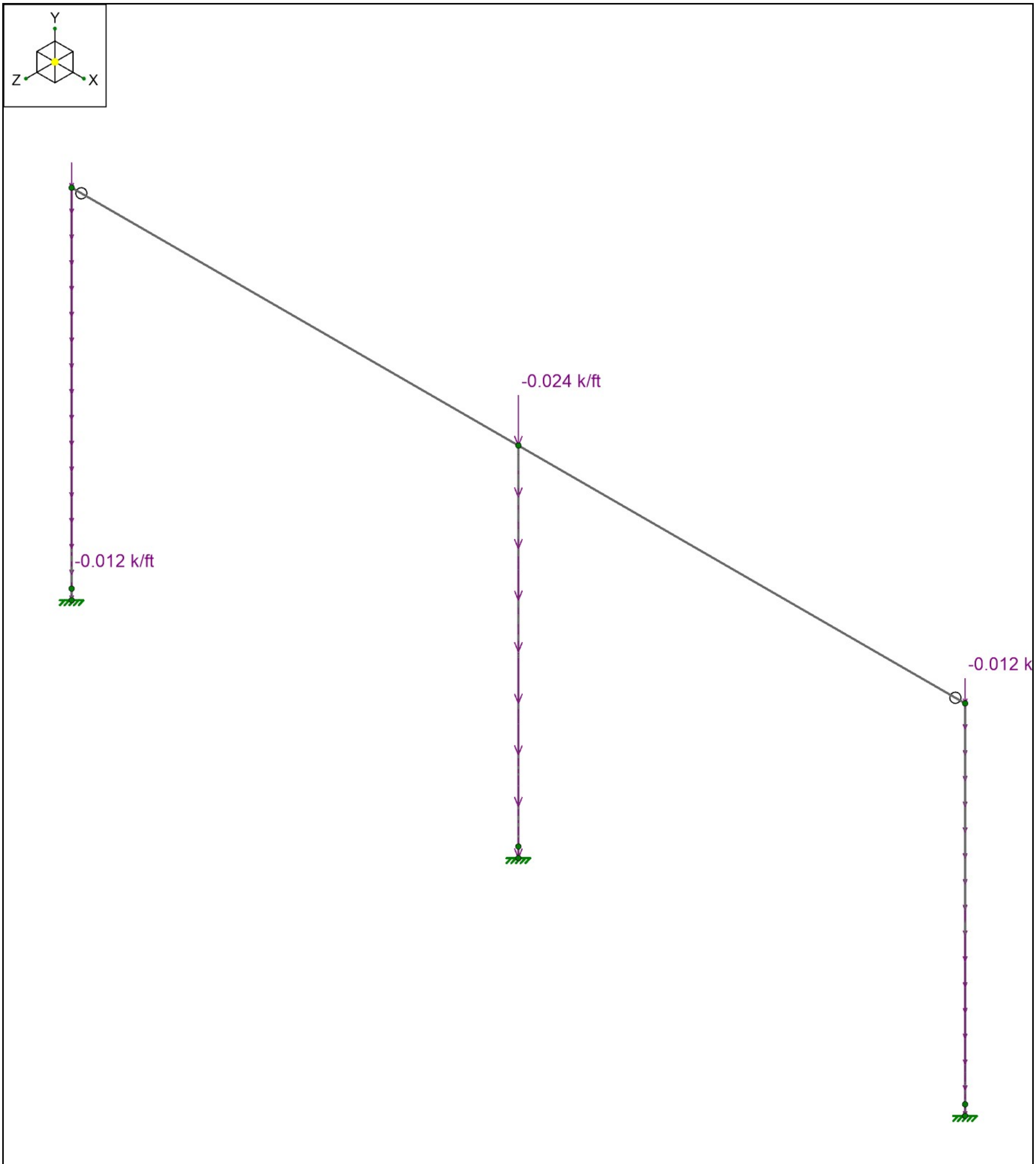
Loads: BLC 5, Infill
Envelope Only Solution

PSEI	Glass W/ Clips	SK-19
AF		Mar 10, 2023
Eglass 223-802		Glass w-clip.r3d



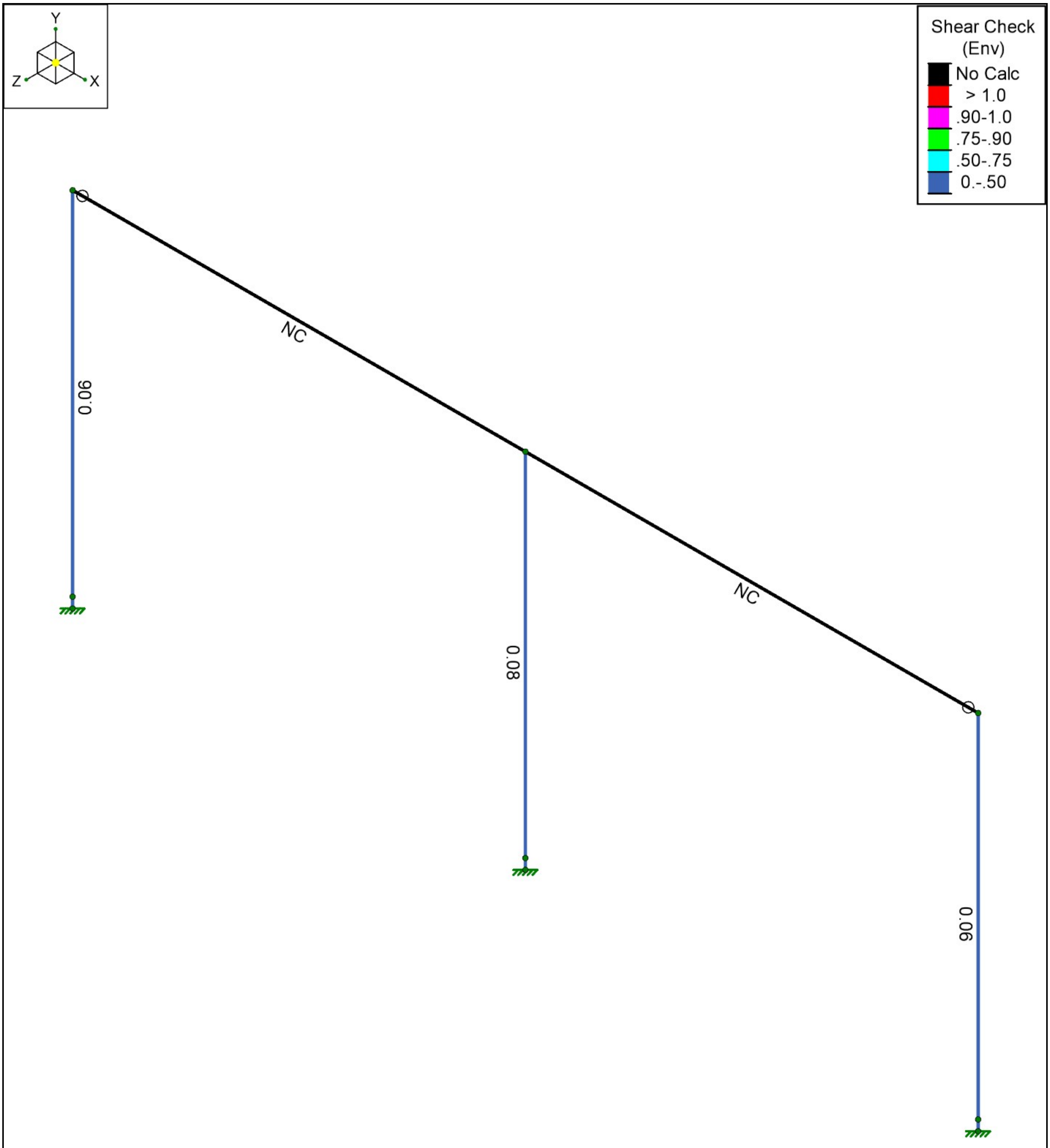
Loads: BLC 6, Wind
Envelope Only Solution

PSEI	Glass W/ Clips	SK-20
AF		Mar 10, 2023
Eglass 223-802		Glass w-clip.r3d



Loads: BLC 7, Glass weight
Envelope Only Solution

PSEI	Glass W/ Clips	SK-21
AF		Mar 10, 2023
Eglass 223-802		Glass w-clip.r3d



Member Shear Checks Displayed (Enveloped)
Envelope Only Solution

PSEI	Glass W/ Clips	SK-22
AF		Mar 10, 2023
Eglass 223-802		Glass w-clip.r3d

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	0	0	
2	N2	0	4	0	
3	N3	5	0	0	
4	N4	5	4	0	
5	N5	10	0	0	
6	N6	10	4	0	
7	N20	0	0.1125	0	
8	N55	5	0.1125	0	
9	N56	10	0.1125	0	

Aluminum Properties

	Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [1e^{5}°F^{-1}]	Density [k/ft^{3}]	Table B.4	kt	Ftu [ksi]	Fty [ksi]	Fcy [ksi]	Fsu [ksi]	Ct
1	3003-H14	10100	3787.5	0.33	1.3	0.173	Table B.4-1	1	19	16	13	12	141
2	6061-T6	10100	3787.5	0.33	1.3	0.173	Table B.4-2	1	38	35	35	24	141
3	6063-T5	10100	3787.5	0.33	1.3	0.173	Table B.4-2	1	22	16	16	13	141
4	6063-T6	10100	3787.5	0.33	1.3	0.173	Table B.4-2	1	30	25	25	19	141
5	5052-H34	10200	3787.5	0.33	1.3	0.173	Table B.4-1	1	34	26	24	20	141
6	6061-T6 W	10100	3787.5	0.33	1.3	0.173	Table B.4-1	1	24	15	15	15	141

Aluminum Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in^{2}]	Iyy [in^{4}]	Izz [in^{4}]	J [in^{4}]
1	POST	RT2.375x2.375x.125	Column	Rectangular Tubes	6061-T6	Typical	1.125	0.952	0.952	1.424
2	TOP RAIL	RT1X1X0.095	Beam	Rectangular Tubes	6061-T6	Typical	0.344	0.048	0.048	0.07
3	BOTTOM RAIL	RT1X1X0.095	Beam	Rectangular Tubes	6061-T6	Typical	0.344	0.048	0.048	0.07

Aluminum Design Parameters

	Label	Shape	Length [ft]	Lcomp top [ft]	Function
1	M1	POST	4	Lbyy	Lateral
2	M3	POST	4	Lbyy	Lateral
3	M5	POST	4	Lbyy	Lateral

Member Point Loads (BLC 4 : Point load applied at the middle)

	Member Label	Direction	Magnitude [k, k-ft]	Location [(ft, %)]
1	M4	Z	0.2	2.5

Member Distributed Loads (BLC 1 : Distributed load-y at the top of)

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M2	Y	-0.05	-0.05	0	%100
2	M4	Y	-0.05	-0.05	0	%100

Member Distributed Loads (BLC 2 : Distributed load-X at the side o)

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M2	Z	0.05	0.05	0	%100
2	M4	Z	0.05	0.05	0	%100

Member Distributed Loads (BLC 7 : Glass weight)

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M3	Y	-0.024	-0.024	0	%100
2	M1	Y	-0.012	-0.012	0	%100
3	M5	Y	-0.012	-0.012	0	%100

Member Distributed Loads (BLC 8 : BLC 6 Transient Area Loads)

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Z	0.077	0.077	0.113	4
2	M3	Z	0.078	0.078	4.94e-15	3.887
3	M3	Z	0.078	0.078	0	3.887
4	M5	Z	0.078	0.078	0	3.887

Member Area Loads (BLC 6 : Wind)

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [ksf]
1	N20	N2	N4	N55	Z	B-C	0.031
2	N55	N4	N6	N56	Z	B-C	0.031

Basic Load Cases

	BLC Description	Category	Y Gravity	Nodal	Point	Distributed	Area(Member)
1	Distributed load-y at the top of	None	-1			2	
2	Distributed load-X at the side o	None	-1			2	
3	Point load applied at the corner	None	-1	1			
4	Point load applied at the middle	None	-1		1		
5	Infill	None		1			
6	Wind	None					2
7	Glass weight	None				3	
8	BLC 6 Transient Area Loads	None				4	

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor
1	Distributed load-y at the top of	Yes	Y	1	1	7	1
2	Distributed load-X at the side o	Yes	Y	2	1	7	1
3	Point load applied at the corner	Yes	Y	3	1	7	1
4	Point load applied at the middle	Yes	Y	4	1	7	1
5	Infill	Yes	Y	5	1	7	1
6	Wind	Yes	Y	6	1	7	1

Envelope Node Reactions

	Node Label		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	N1	max	0	1	0.228	1	0	1	0	1	0	6	0	6
2		min	0	2	0.056	5	-0.353	6	-0.795	6	0	1	0	1
3	N3	max	0	6	0.252	1	0	1	0	1	0.009	4	0	6
4		min	0	1	0.08	5	-0.499	6	-0.898	6	-0.019	3	0	1
5	N5	max	0	1	0.228	1	0.031	3	0	1	0	6	0	6
6		min	0	2	0.056	5	-0.353	6	-0.795	6	0	1	0	1
7	Totals:	max	0	6	0.708	1	0	1						
8		min	0	1	0.192	5	-1.205	6						

Envelope Member Section Forces

	Member	Sec		Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torque[k-ft]	LC	y-y Moment[k-ft]	LC	z-z Moment[k-ft]	LC
1	M1	1	max	0.228	1	0	6	0	1	0	6	0.795	6	0	6
2			min	0.056	5	0	1	-0.353	6	0	1	0	1	0	1
3		2	max	0.215	1	0	6	0	1	0	6	0.503	2	0	6
4			min	0.044	5	0	1	-0.285	6	0	1	0	1	0	1
5		3	max	0.201	1	0	6	0	1	0	6	0.335	2	0	6
6			min	0.032	5	0	1	-0.207	6	0	1	0	1	0	1
7		4	max	0.188	1	0	6	0	1	0	6	0.168	2	0	6
8			min	0.02	5	0	1	-0.168	2	0	1	-0.031	3	0	1
9		5	max	0.175	1	0	6	0	1	0	6	0.098	4	0	6
10			min	0.008	2	0	1	-0.168	2	0	1	-0.197	3	0	1
11	M2	1	max	0	6	0.035	3	-0.008	4	0.197	3	0	6	0	6
12			min	0	1	-0.167	2	-0.175	1	-0.098	4	0	1	0	1
13		2	max	0	6	0.035	3	-0.008	4	0.197	3	-0.01	4	0.169	2
14			min	0	1	-0.104	2	-0.112	1	-0.098	4	-0.179	1	-0.044	3
15		3	max	0	6	0.035	3	-0.008	4	0.197	3	-0.02	4	0.26	2
16			min	0	1	-0.052	6	-0.05	1	-0.098	4	-0.28	1	-0.088	3
17		4	max	0	6	0.035	3	0.013	1	0.197	3	-0.03	4	0.273	2
18			min	0	1	-0.052	6	-0.008	5	-0.098	4	-0.303	1	-0.132	3
19		5	max	0	6	0.083	2	0.075	1	0.197	3	-0.04	4	0.258	6
20			min	0	1	-0.052	6	-0.008	5	-0.098	4	-0.248	1	-0.176	3
21	M3	1	max	0.151	1	0	6	0.103	6	0.009	4	0	1	0	6
22			min	-0.016	2	0	1	-0.168	2	-0.019	3	-0.069	6	0	1
23		2	max	0.176	1	0	6	0	1	0.009	4	0	1	0	6
24			min	0.008	5	0	1	-0.168	2	-0.019	3	-0.168	2	0	1
25		3	max	0.201	1	0	6	0	1	0.009	4	0	1	0	6
26			min	0.032	5	0	1	-0.207	6	-0.019	3	-0.335	2	0	1
27		4	max	0.227	1	0	6	0	1	0.009	4	0	1	0	6
28			min	0.056	5	0	1	-0.362	6	-0.019	3	-0.503	2	0	1
29		5	max	0.252	1	0	6	0	1	0.009	4	0	1	0	6
30			min	0.08	6	0	1	-0.499	6	-0.019	3	-0.898	6	0	1
31	M4	1	max	0	6	0.052	6	0.008	6	0.197	3	-0.04	6	0.258	6
32			min	0	1	-0.084	4	-0.075	1	-0.098	4	-0.248	1	-0.157	3
33		2	max	0	6	0.052	6	0.008	6	0.197	3	-0.03	6	0.273	2
34			min	0	1	-0.084	4	-0.013	1	-0.098	4	-0.303	1	-0.118	3
35		3	max	0	6	0.116	4	0.05	1	0.197	3	-0.02	6	0.289	4
36			min	0	1	-0.031	3	0.008	2	-0.098	4	-0.28	1	-0.079	3
37		4	max	0	6	0.116	4	0.112	1	0.197	3	-0.01	6	0.169	2
38			min	0	1	-0.031	3	0.008	2	-0.098	4	-0.179	1	-0.039	3
39		5	max	0	6	0.167	2	0.175	1	0.197	3	0	6	0	2
40			min	0	1	-0.031	3	0.008	2	-0.098	4	0	1	0	6
41	M5	1	max	0.175	1	0	6	0.031	3	0	6	0.098	4	0	6
42			min	0.008	2	0	1	-0.168	2	0	1	-0.197	3	0	1
43		2	max	0.188	1	0	6	0.031	3	0	6	0	1	0	6
44			min	0.02	5	0	1	-0.168	2	0	1	-0.168	2	0	1
45		3	max	0.201	1	0	6	0.031	3	0	6	0	1	0	6
46			min	0.032	5	0	1	-0.207	6	0	1	-0.335	2	0	1
47		4	max	0.215	1	0	6	0.031	3	0	6	0	1	0	6
48			min	0.044	5	0	1	-0.285	6	0	1	-0.503	2	0	1
49		5	max	0.228	1	0	6	0.031	3	0	6	0	1	0	6
50			min	0.056	6	0	1	-0.353	6	0	1	-0.795	6	0	1

Envelope AA ADM1-15: ASD - BUILDING Member Aluminum Code Checks

	Member	Shape	Code Check	Loc[ft]	LC	Shear Check	Loc[ft]	Dir	LC	Pnc/Om[k]	Pnt/Om[k]	Mny/Om[k-ft]	Mnz/Om[k-ft]	Vny/Om[k]	Vnz/Om[k]	Cb	Eqn
1	M1	RT2.375x2.375x.125	0.561	0	6	0.057	0.083	z	6	16.147	21.923	1.417	1.417	6.154	6.154	1	H.1-1
2	M3	RT2.375x2.375x.125	0.633	4	6	0.081	4	z	6	16.147	21.923	1.417	1.417	6.154	6.154	1	H.1-1
3	M5	RT2.375x2.375x.125	0.561	4	6	0.057	4	z	6	16.147	21.923	1.417	1.417	6.154	6.154	1	H.1-1

PSE CONSULTING ENGINEERS INC.

DECK AND FASCIA MOUNT ANALYSIS & DESIGN:

Pages 2,000 - 2,999

250-A Main Street
Klamath Falls, OR. 97601

E-Mail: info@structure1.com
Web: www.structure1.com

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Anchorage Design - Deck Mount

Project Number Eglass 217-2
Sheet
Project Name
Designed by IE
Date 9/19/2017
Subject
Checked by
Date

Base Plate Design

▨ Input
▨ Calculated

Try 4-1/4" x 4-1/4" ADC12

Max shear force, P = 354.00 lb

Plate Theckness, t >= $\ell \sqrt{3.33 P/(F_y \cdot B \cdot N)}$

ℓ = 1.00 in
B = 4.25 in
N = 4.25 in
f_y = 24 ksi

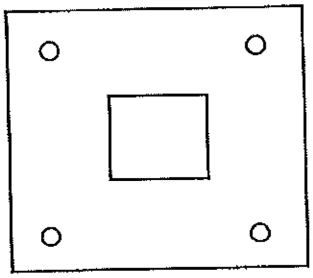


Plate Theckness, t >= 0.043 in

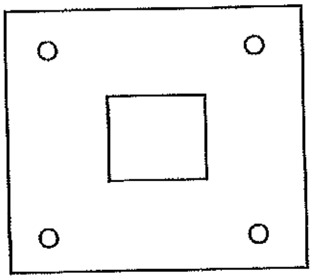
Try [4-1/2" x 4-1/2" x 3/8" , Aluminum Alloy 384 (ADC)

$F_y = 24$ Ksi

Base Plate To Concrete

Use ITW Red Head Turbolt Wedge

Anchor strength based on ESR-2427



Concrere Capacity, f_c = 3,000 psi
Bolt size = 3/8 in
Bolt Spacing, S 3.50 in
Plate Edge distance, e = 0.5 in
Concrete Edge distance, C_a = 3.25 in
Max Shear force, P = 250 lb, as per Risa Output
Max Moment, M = 700 lb-ft, (200 lb * 3.5' or 50(plf) * 4' * 3.5
Effective depth, heff = 4 in
Tension/ 2 bolts = 2100 lb
Shear/ 2 bolts = 250.0 lb

Post height

post spacing

Check of Concrete Breakout Strength

$N_{cbg} = (A_{Nc} / A_{Nco})*\Psi_{ed,N}\ \Psi_{ed,N}\ \Psi_{c,N}\ \Psi_{cp,N}\ N_b$

$A_{Nc} = (C_a + S + 1.5h_{eff})^2$ = 162.6 in^2

$A_{Nco} = 9h_{eff}^{\ 2}$ = 144.0 in^2

$\Psi_{ec,N} = 1/ [1+ (2*S/2)/3h_{eff})]$ 0.77

$\Psi_{ed,N} = 0.7 + 0.3 * [C_a/ (1.5\ h_{eff})$ = 0.86

$\Psi_{c,N}$ = 1.40

$\Psi_{cp,N}$ = 1.0

$N_b = 17\ \lambda\ f_c^{1/2}\ (h_{eff})^{1.5}$ = 7,449 lb

N_{cbg} = 7,861.3 lb

Capacity of (2) 3/8" Wedge = 8,400.0 lb

Allowable tension Load capacity = 3,193.6 lb

2100 lb < 3,193.6 lb

SAFE

USE [1/2" ø Lag Screws @ 32" o.c., Min 3" Embedment into wood blocking]

Check of Concrete Breakout Strength

$V_{cbg} = (A_{Vc} / A_{Vco})*\Psi_{ec}\,\Psi_{ed}\,\Psi_{c}\,\Psi_{h}\,V_{b}$

$A_{Vc} = [2(1.5C_a) + S]\,h_{eff}$ = 53.0 in^2

$A_{Vco} = 4.5C_a^{\,2}$ = 47.5 in^2

$\Psi_{ec} = 1/ [1+ (2*S/2)/3C_a)]$ 0.74

$\Psi_{ed} = 0.7 + 0.3 * [C_a/ (1.5\,C_a)$ = 0.90

Ψ_c = 1.00

$\Psi_h = (1.5\,C_a\,/h_{eff})^{1/2}$ = 1.10

$V_b = 8\,(h_{eff}/\phi)^{0.2}\,(\phi)^{0.5} \wedge (f_c')0.5\,C_a^{\,1.5}$ = 2,524

V_{cb} = 2,057.7 lb

Capacity of (2) 3/8" Wedge = 3,660.0 lb

Allowable Shear Load capacity = 900.2 lb

250.0 lb $<$ 900.2 lb

SAFE

Tension - Shear Interaction

Shear force, P = 250 lb, as per Risa Output

Moment, M = 942 lb-ft, as per Risa Output

Tension, T = 2,100 lb

$(T/ \phi N_{cbg} + P/V_{cbg} < 1.2$ =

$T/ \phi N_{cbg} + P/V_{cbg}$ = 1.16 < 1.2

SAFE

PROJECT NO. Eg1085 SHEET 2004A OF

PROJECT NAME DESIGNED BY AF DATE

SUBJECT CHECKED BY DATE

Base plate to wood

wood Specific weight = 0.43

$$\text{Tension} : \frac{M}{d} = \frac{200 * \frac{42''}{12} \times 12 \frac{in}{ft}}{4''} = 2{,}100 \text{ lb}$$

Adjustment for wood bearing

$$C_b = (4.5'' + 0.375) / 4.5'' = 1.083$$

$$a = \frac{2100 \text{ lb}}{1.083 * \underset{psi}{625} * 4.5} = 0.69$$

$$\text{Tension} = T = \frac{700 \text{ lb.ft} \times \frac{12 in}{ft}}{\left(4.0'' - \frac{0.69}{2}\right)} = 2{,}298 \text{ lb}$$

$\frac{3}{8}''$ ϕ lag-screw w/ 6" min Embed tension Capacity = 314 lb * 4" = 1256 lb (Page

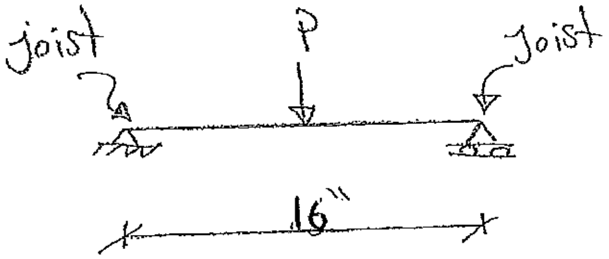
2-lag screws capacity = 2*1256 = 2512. lb > 2298 lb

use [4 - $\frac{3}{8}''$ lag screws w/ 4" min Embed]

PROJECT NO. Eglass SHEET 2004B OF
PROJECT NAME DESIGNED BY AF DATE
SUBJECT CHECKED BY DATE

Base plate to wood

$P = 2298$ lb



use blocking [3-2*8 w/4-$\frac{5}{8}$"ϕ lag screw'.]
w/Min. 4" Embed

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COMPANY

May 15, 2020 10:26

PROJECT
Stainless cable & Railing 217-1
AF
2020-05-14 wood block.wwb

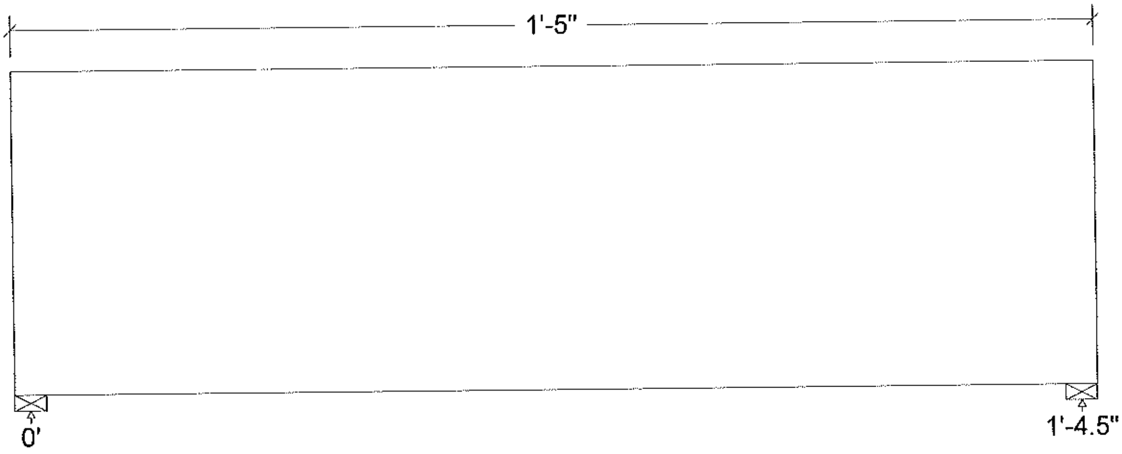
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	Location [ft] End	Magnitude Start	Magnitude End	Unit
Load1	Dead	Point		0.83		-2479		lbs
Self-weight	Dead	Full UDL				7.7		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:		
Dead	5	5
Factored:		
Uplift	-1009	-1460
Total	5	5
Bearing:		
Capacity		
Beam	2266	2266
Support	2266	2266
Des ratio		
Beam	0.00	0.00
Support	0.00	0.00
Load comb	#1	#1
Length	0.50*	0.50*
Min req'd	0.50*	0.50*
Cb	1.00	1.00
Cb min	1.00	1.00
Cb support	1.00	1.00
Fcp sup	625	625

*Minimum bearing length setting used: 1/2" for end supports

Lumber n-ply, D.Fir-L, No.2, 2x8, 3-ply (4-1/2"x7-1/4")

Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 1'-5.0"; Clear span: 1'-4.0"; volume = 0.3 cu.ft.
Lateral support: top= at supports, bottom= at supports; Oblique angle: 90.0 deg; Repetitive factor: applied where permitted (refer to online help);

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion		Analysis Value	Design Value	Unit	Analysis/Design
Shear	x-x	fv = 0	Fv' = 162	psi	fv/Fv' = 0.00
	y-y	fv = 67	Fv' = 162	psi	fv/Fv' = 0.42
Bending(-)	x-x	fb = 0	Fb' = 1118	kip-ft	fb/Fb' = 0.00
	y-y	fb = 1210	Fb' = 1285	kip-ft	fb/Fb' = 0.94
Live Defl'n		negligible			
Total Defl'n		-0.03 = L/486	0.07 = L/240	in	0.49

Additional Data:

```
FACTORS:   F/E(psi)CD     CM    Ct     CL     CF     Cfu   Cr    Cfrt  Ci    Cn   LC#
 Fvy'      180     0.90  1.00  1.00    -      -      -     -     1.00  1.00  -    1
 Fby'-     900     0.90  1.00  1.00  1.000  1.200  1.15  1.15  1.00  1.00  -    1
 Fcp'      625      -    1.00  1.00    -      -      -     -     1.00  1.00  -    -
 E'        1.6 million   1.00  1.00    -      -      -     -     1.00  1.00  -    1
 Emin'   0.58 million    1.00  1.00    -      -      -     -     1.00  1.00  -    1
```

CRITICAL LOAD COMBINATIONS:

```
 Shear     : LC #1  = D only, V max =   1464, V design =   1464 lbs
 Bending(-): LC #1  = D only, M =    822 lbs-ft
 Deflection: LC #1  = D only  (total)
 D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
 All LC's are listed in the Analysis output
 Load combinations: ASCE 7-10 / IBC 2015
```

CALCULATIONS:

```
 Deflection:  EIy =   9.79e06 lb-in2
 "Live" deflection = Deflection from all non-dead loads (live, wind, snow…)
 Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
 Lateral stability(-):   b = full member width
```

Design Notes:

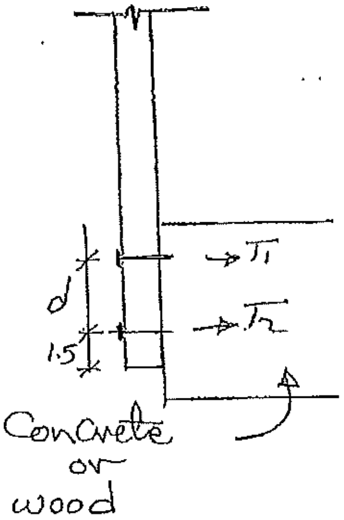
1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2015), the National Design Specification (NDS 2015), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.
4. BUILT-UP BEAMS: it is assumed that each ply is a single continuous member (that is, no butt joints are present) fastened together securely at intervals not exceeding 4 times the depth and that each ply is equally top-loaded. Where beams are side-loaded, special fastening details may be required.
5. FIRE RATING: Joists, wall studs, and multi-ply members are not rated for fire endurance.

PROJECT NO. Egless SHEET 2004 E OF

PROJECT NAME DESIGNED BY HF DATE

SUBJECT Fascia mount CHECKED BY DATE

post is directly attached with no bracket



* with Concrete

$\frac{3}{8}$" ϕ red head ITW

Allowable Tension load / bolt =

$$0.65 * \frac{4200}{1.6} \text{ lb}$$

$$= 1706 \text{ lb}$$

Applied Tension = $\frac{M}{d}$ $M = 200^{lb} * 4' = 800 \text{ lb-ft}$

\# of bolts to resist = 1.0

$$\frac{M}{d} \not> 1706 \text{ lb}$$

$$\frac{800 (\text{lb/ft}) * 12}{d} = 1{,}706 \text{ lb}$$

$$d = 5.62''$$

∴ spacing between anchors is 7"

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Tel (541) 858-8500

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PROJECT NO. Eglass
SHEET 2004F OF
PROJECT NAME
DESIGNED BY AF DATE
SUBJECT fascia Mount
CHECKED BY DATE

∴ use [2 - $\frac{3}{8}$" redhead ITW or LDT
7" apart w/min 4" Embed.
post to extend 2.5" below bottom anchor
$f'_c \nless 2500$ psi, Concrete member
thickness $\nless 3$"]

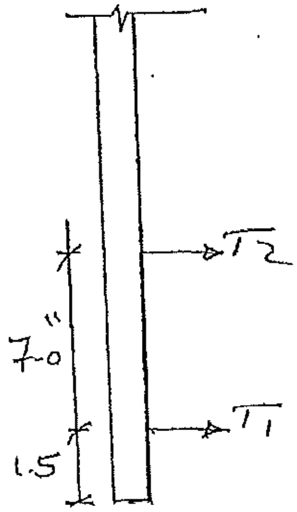
PROJECT NO. Eglass SHEET 2004G OF ______

PROJECT NAME ______ DESIGNED BY AF DATE ______

SUBJECT Fascia Mount CHECKED BY ______ DATE ______

* with wood

$d = 7"$ (spacing between lag screws)



M@ bottom of post = 800 lb-ft

Resisting moment = $T_1 * 1.5 + T_2 * 8.5$

$$T_1 = T_2 * \frac{1.5}{8.5}$$

$$\therefore \text{Resisting moment} = 1.5 * \frac{1.5}{8.5} * T_2 + 8.5 T_2$$

$= 8.76\ T_1$ (in. load)

for equilibrium = M = resisting moment

800 (lb-ft) * 12 = $8.76 T_1$

$\therefore T_1 = 1{,}096$ lb

$$\therefore \text{Embed. length} = \frac{T}{\text{withdrawl capacity}}$$

withdrawal capacity (page 2026) $\longrightarrow$ $\frac{1096 \text{ lb}}{305} = 3.6"$

$\therefore$ use [2-$\frac{3}{8}$"ϕ lag screws, 7" apart w/min 4" Emb.]

PROJECT NO. Eglass

SHEET 2005 OF

PROJECT NAME 42" post

DESIGNED BY AF

DATE

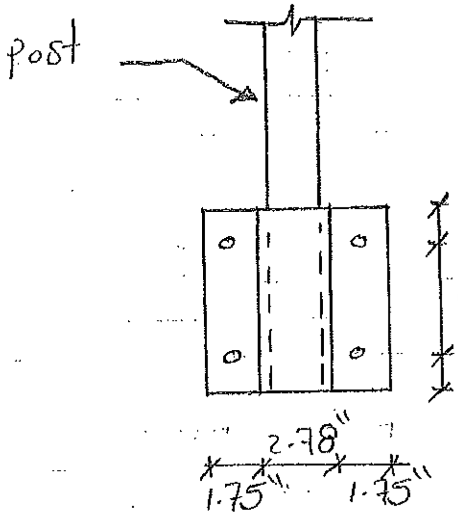
SUBJECT

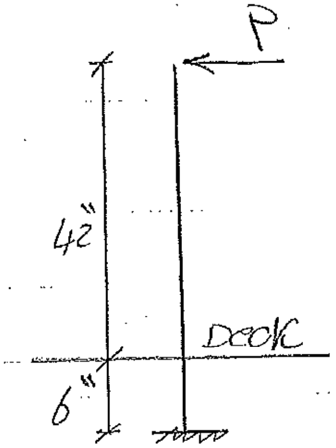
CHECKED BY

DATE

Fascia mount bracket

post = $2\frac{3}{8}'' * 2\frac{3}{8}'' * 0.125''$ (42" height, 5' apart)





$P = 50\ (lb/ft) * \overset{\text{spacing}}{5} = 250\ lb$

$M = 200\ (lb) * (42'' + 6'') = 800\ lb.ft$

$\text{Max tension} = \dfrac{800}{\dfrac{(4+1)}{12}} = 1{,}920\ lb$

Shear on bolts = 441^{lb}

use [2 - #10 Tek screws to hold post in place]

PROJECT NO. ______ SHEET ____ OF ______

PROJECT NAME ______ DESIGNED BY ______ DATE ______

SUBJECT ______ CHECKED BY ______ DATE ______

Bracket Design

Material : Aluminum 606

thickness = 3/16"

section properties :

$A = 3.913$ in

$I_{xx} = 3.913$ in^4 $\quad$ $I_{yy} = 5.453$ in^4

$S_x = 1.981$ in^3 $\quad$ $S_y = 1.846$ in^3

$F_t = 15$ Ksi (ADM, Table 2-24)

Bracket bending capacity $= F_t * S$

$= 15(\text{Ksi}) * 1.981\,(\text{in}^3)$

$= 29.7$ kip.in

$= 2.475$ kip.ft

Applied moment = 1000 lb.ft < allowable capacity = 2475 lb.ft

(OK)

PROJECT NO. ______ SHEET ______ OF ______

PROJECT NAME ______ DESIGNED BY ______ DATE ______

SUBJECT ______ CHECKED BY ______ DATE ______

Check Anchors - wood deck

Tension on 2 lag screws = 1920 lb

withdrawl capacity of 3/8" lag screw = 305 lb/in
(NDS, 11.2A)

Embed length = $\frac{1920^{lb}}{305^{lb/in}}$ = 6.29 in / 2 bolts = 3.14"/bolt

shear / bolt = $\frac{441}{4}$ = 110.25^{lb}

$\frac{3}{8}$" ϕ lag screw shear capacity = 130^{lb} (NDS 12K)

total capacity of 4 bolts = 4 × 130 = 520^{lb} > 441^{lb}
(OK)

use [4 - $\frac{3}{8}$" ϕ lag screws, w/4" min Embed]

PROJECT NO. ______ SHEET ______ OF ______

PROJECT NAME ______ DESIGNED BY ______ DATE ______

SUBJECT ______ CHECKED BY ______ DATE ______

Check anchors - Concrete deck

Tension / 2 bolts = 1,920 lb

Tension / bolt = $\frac{1920}{2}$ = 960 lb

Shear / 4 bolts = 441 lb (RISA output

Shear / bolt = $\frac{441}{4}$ = 110.25 lb (Negligible)

Concrete breakout strength ACI 318-14

$$N_{cbg} = \frac{A_{Nc}}{A_{Nco}} \cdot \psi_{ec,N} \cdot \psi_{ed,N} \cdot \psi_{c,N} \cdot \psi_{cp,N} \cdot N_b \qquad (17.4.2.1-b)$$

$$A_{Nc} = (C_{a,1} + S_1 + 1.5\, h_{ef}) * 2 * 1.5\, h_{ef}$$

$C_{a,1} = 2.5$

$h_{ef} = 4$ in

$S_1 = 4.5$ in

PROJECT NO. ______ SHEET ____ OF ______

PROJECT NAME ______ DESIGNED BY ______ DATE ______

SUBJECT ______ CHECKED BY ______ DATE ______

$$A_{NC} = (2.5+4.5+1.5*4)*2*1.5*4 = 156$$

$$A_{NCo} = 9\overline{h_{ef}}^{2} = 9*\overline{4}^{2} = 144\ in^2$$

$$\psi_{ec,N} = \frac{1}{1+\frac{2e_N'}{3h_{ef}}} = \frac{1}{1+\frac{2*4.5/2}{3*4}} = 0.727$$

$$\psi_{ed,N} = 0.7+0.3\ \frac{C_a}{1.5h_{ef}}$$

$$= 0.7+0.3*\frac{2.5}{1.5*4} = 0.825$$

$\psi_{c,N} = 1.4$, $C_{cp,N} = 1.0$

$$N_b = K_c \cdot \lambda_a \sqrt{f_c'} \cdot \overline{h_{ef}}^{1.5} \qquad (f_c' = 2500\ psi)$$

$$= 17*1\ (2500)^{1/2} \cdot \overline{4}^{1.5} = 6800\ lb$$

$$N_{cbg} = \frac{156}{144}*0.727*0.825*1.4*6800 = 6185\ lb$$

per ESR-2427, Table 3, $\frac{3}{8}$"ϕ bolt ten. capacity = 4200 lb

so Tensile strength of 2bolts = 2*4200 = 8400 lb

PROJECT NO. ____________ SHEET ______ OF ______

PROJECT NAME ____________ DESIGNED BY ____________ DATE ____________

SUBJECT ____________ CHECKED BY ____________ DATE ____________

Tension capacity = 8400 lb > Concrete breakout = 6701 lb
(bolts)
"Concrete Controls"

$\therefore$ Allowable Tension Load $= 0.65 * \frac{6185}{1.6} = 2512$ lb

$\therefore$ Allowable Tension = 2512 lb > Applied Tension = 1920 lb
(OK)

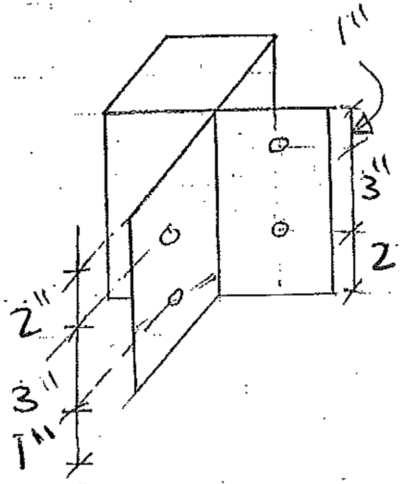
Use [4 - $\frac{3}{8}$" ϕ Red head ITW or LDT
w/min 4" Embed, & 3" Edge distance
$f'_c \not< 2500$ psi]

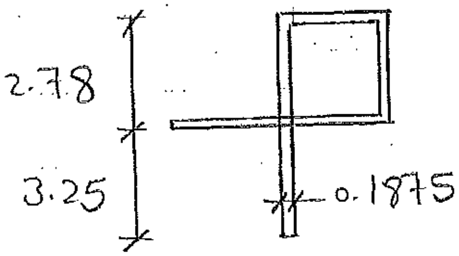
PROJECT NO. ____________ SHEET ____ OF ____

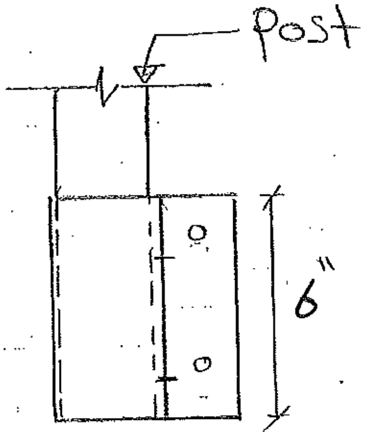
PROJECT NAME ____________ DESIGNED BY ____________ DATE ____________

SUBJECT ____________ CHECKED BY ____________ DATE ____________

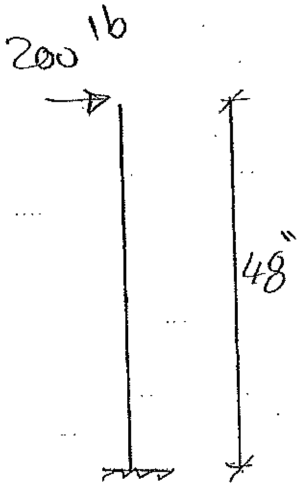
Corner fascia bracket







Bracket properties



$A = 3.28 \text{ in}^2$

$I_x = I_y = 8.538 \text{ in}^4$

$S_x = S_y = 2.067 \text{ in}^3$

$F_t = 15 \text{ psi}$

$\therefore$ Bracket bending capacity $= 15 \text{ (Ksi)} * 2.067 \text{ (in}^3\text{)}$
$= 31.0 \text{ Kip.in} = 2583 \text{ lb.ft}$

Max applied moment $= 200 * 4 \text{ lb.ft} < 2583 \text{ lb.ft}$
$= 800$

(ok)

2012

Company :
Designer :
Job Number :

Jun 30, 2017
13:29 PM
Checked By:______

Section Properties: Section1_1.dxf

Section Information:

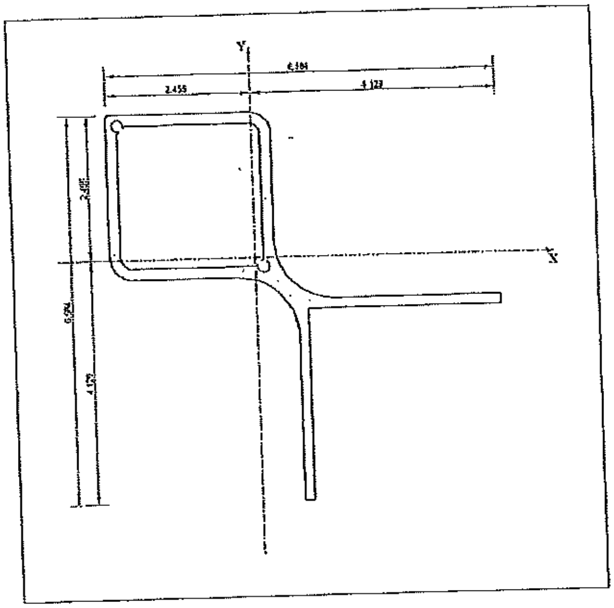
Material Type	=	General	
Shape Type	=	Arbitrary	
Number of Shapes	=	1	

Basic Properties:

Total Width	=	6.584	in
Total Height	=	6.584	in
Centroid, Xo	=	1.599	in
Centroid, Yo	=	-2.033	in
X-Bar (Right)	=	4.129	in
X-Bar (Left)	=	2.455	in
Y-Bar (Top)	=	2.455	in
Y-Bar (Bot)	=	4.129	in
Max Thick	=	6.584	in

Equivalent Properties:

Area, Ax	=	3.283	in^2
Inertia, Ixx	=	8.534	in^4
Inertia, Iyy	=	8.534	in^4
Inertia, Ixy	=	-4.405	in^4
Sx (Top)	=	3.476	in^3
Sx (Bot)	=	2.067	in^3
Sy (Left)	=	3.476	in^3
Sy (Right)	=	2.067	in^3
rx	=	1.612	in
ry	=	1.612	in
Plastic Zx	=	4.101	in^3
Plastic Zy	=	4.098	in^3
Torsional J	=	3.341	in^4
As-xx Def	=	1.000	
As-yy Def	=	1.000	
As-xx Stress	=	1.000	
As-yy Stress	=	1.000	



Section Diagram

2013

Summary of Section Properties

Section Information:

Sn.No.	1
Section	Section1_1...

Basic Properties:

Total Width (in)	6.584
Total Height (in)	6.584
Centroid, Xo (in)	1.599
Centroid, Yo (in)	-2.033
X-Bar (Right) (in)	4.129
X-Bar (Left) (in)	2.455
Y-Bar (Top) (in)	2.455
Y-Bar (Bot) (in)	4.129

Equivalent Properties:

Area, Ax (in^2)	3.283
Inertia, Ixx (in^4)	8.534
Inertia, Iyy (in^4)	8.534
Inertia, Ixy (in^4)	-4.405
Sx (Top) (in^3)	3.476
Sx (Bot) (in^3)	2.067
Sy (Left) (in^3)	3.476
Sy (Right) (in^3)	2.067
rx (in)	1.612
ry (in)	1.612
Plastic Zx (in^3)	4.101
Plastic Zy (in^3)	4.098
Torsional J (in^4)	3.341

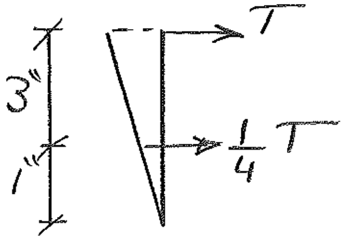
Project No: Eglass ______
Project Name: ______
Subject: ______

SHEET # ______ OF ______
DESIGNED BY ______ DATE ______
CHECKED BY ______ DATE ______

Check anchor - wood deck

Max moment = 800 lb.ft

50% of moment will be resisted by shear in 2 bolts and 50% will be resisted by tension in the other 2 bolts



- Check for Tension

$\frac{1}{2}$ Moment $= 4T + \frac{1}{4}T$

$\frac{1}{2} * 800 * 12 \frac{in}{ft} = 4.25T$

$T = 1{,}129$ lb

$\frac{3}{8}$" ⌀ lag screw withdrawal capacity = 305 lb

Embed length $= \frac{1129 \text{ lb}}{305 * 1.6} = 2.3"$

C_d factor ↑

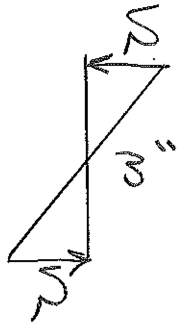
Project No: Eglass ________
Project Name: ________
Subject: ________

SHEET #________ OF ________
DESIGNED BY AF DATE________
CHECKED BY ________ DATE________

Check for shear

$\frac{1}{2}$" lag screw shear capacity = 520 lb

$\frac{1}{2}$ Moment = 3" S ↳ S = shear



$\frac{1}{2} * 800$ (lb.ft) $* 12 = 3$" S

S = 1,600 lb

$\# \text{ Screws} = \frac{1600}{520 * 1.6} = 1.92$

use [4 - $\frac{1}{2}$" ϕ lag screw w/ 4" min. Embed
2 screws each side]

PROJECT NO. ____ SHEET ____ OF ____

PROJECT NAME ____ DESIGNED BY ____ DATE ____

SUBJECT ____ CHECKED BY ____ DATE ____

check anchor - Concrete deck

Single bolt in tension, Max Tension = 1600^{lb}

$$N_{cb} = \frac{A_{Nc}}{A_{Nco}} \cdot \psi_{ed,N} \cdot \psi_{c,N} \cdot \psi_{cp,N} \cdot N_b \qquad (17.4.2.1\text{-}a)$$

$\frac{1}{2}$ of Tension will be shear on the other 2 bolts

∴ Tension = $\frac{1600}{2}$ $= 800$ lb

$$A_{Nc} = (C_{a1} + 1.5 h_{ef}) * 2 * 1.5 h_{ef}$$

$$= (1.5 + 1.5*4) * 2 * 1.5 * 3 = 54 \text{ in}^2$$

$$A_{Nco} = 9 \overline{h_{ef}}^2 = 9 * \overline{3}^2 = 81 \text{ in}^2$$

$$N_b = 17 \sqrt{2800} * \overline{3}^{1.5} = 4416 \text{ lb}$$

$$\psi_{ed,N} = 0.7 + 0.3 * \frac{1.5}{1.5*3} = 0.8$$

$$\psi_{c,N} = 1.4 \qquad \psi_{cp,N} = 1.0$$

$$N_{cb} = \frac{54}{81} * 0.80 * 1.4 * 1.0 * 4416 = 3297^{lb} < 8925^{lb}$$

$\frac{1}{2}''\phi$ bolt tensile strength ↑

∴ Concrete breakout controls

PROJECT NO. ______ SHEET ____ OF ______

PROJECT NAME ______ DESIGNED BY ______ DATE ______

SUBJECT ______ CHECKED BY ______ DATE ______

∴ Allowable tensile strength $= 0.65 * \frac{3297}{1.6} = 1339^{lb}$

$>$ applied tension $= 800^{lb}$ (OK)

Use [4 - $\frac{1}{2}$" φ Red head ITW or LDT
w/ min 3" Embed, 1.5" edge dist.
$f'_c \nless 2500$ psi]

PROJECT NO. ______ SHEET ______ OF ______

PROJECT NAME ______ DESIGNED BY ______ DATE ______

SUBJECT ______ CHECKED BY ______ DATE ______

135° post, 42" post, Deck mount

Section properties

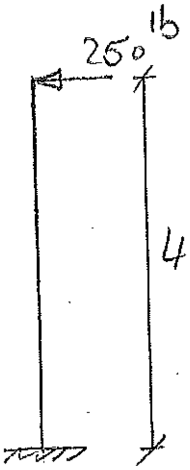
$A = 0.931 \text{ in}^2$, $J = 1.442 \text{ in}^4$

$I_x = 0.851 \text{ in}^4$

$I_y = 1.038 \text{ in}^4$

$S_x = 0.579 \text{ in}^3$

$S_y = 0.596 \text{ in}^3$



$M = 250^{lb} * \frac{42''}{12} = 875 \text{ lb.ft}$

Equivalent section

RT 1.75 * 2.5 * 0.125

AS per RISA model, post is safe

2018

Section Properties: Section1_1.dxf

Section Information:

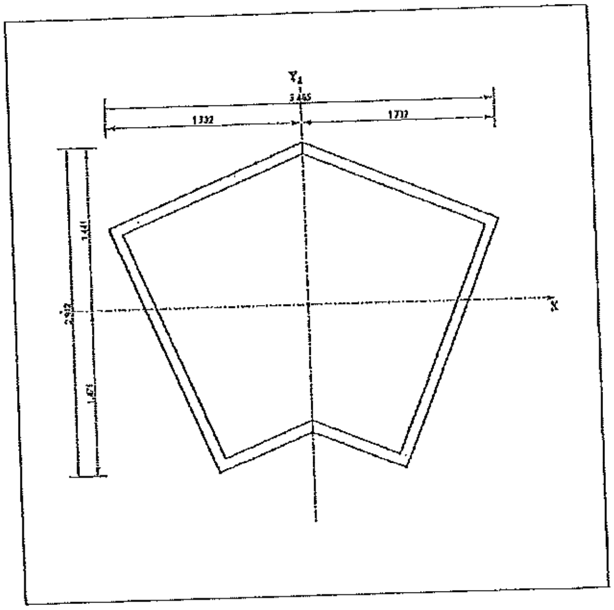
Material Type	=	Hot Rolled Steel	
Shape Type	=	Pipe	
Number of Shapes	=	1	

Basic Properties:

Total Width	=	3.465	in
Total Height	=	2.912	in
Centroid, Xo	=	0.000	in
Centroid, Yo	=	-0.034	in
Shear Center, Xs	=	0.000	in
Shear Center, Ys	=	0.000	in
X-Bar (Right)	=	1.732	in
X-Bar (Left)	=	1.732	in
Y-Bar (Top)	=	1.441	in
Y-Bar (Bot)	=	1.471	in
Thickness	=	0.102	in

Equivalent Properties:

Area, Ax	=	0.931	in^2
Inertia, Ixx	=	0.851	in^4
Inertia, Iyy	=	1.033	in^4
Inertia, Ixy	=	0.000	in^4
Sx (Top)	=	0.591	in^3
Sx (Bot)	=	0.579	in^3
Sy (Left)	=	0.596	in^3
Sy (Right)	=	0.596	in^3
rx	=	0.956	in
ry	=	1.053	in
Plastic Zx	=	0.808	in^3
Plastic Zy	=	0.879	in^3
Torsional J	=	1.442	in^4



Section Diagram

2019

Summary of Section Properties

Section Information:

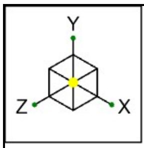
Sn.No.	1
Section	Section1_1...

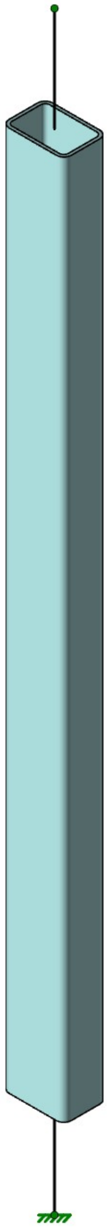
Basic Properties:

Total Width (in)	3.465
Total Height (in)	2.912
Centroid, Xo (in)	0.000
Centroid, Yo (in)	-0.034
X-Bar (Right) (in)	1.732
X-Bar (Left) (in)	1.732
Y-Bar (Top) (in)	1.441
Y-Bar (Bot) (in)	1.471

Equivalent Properties:

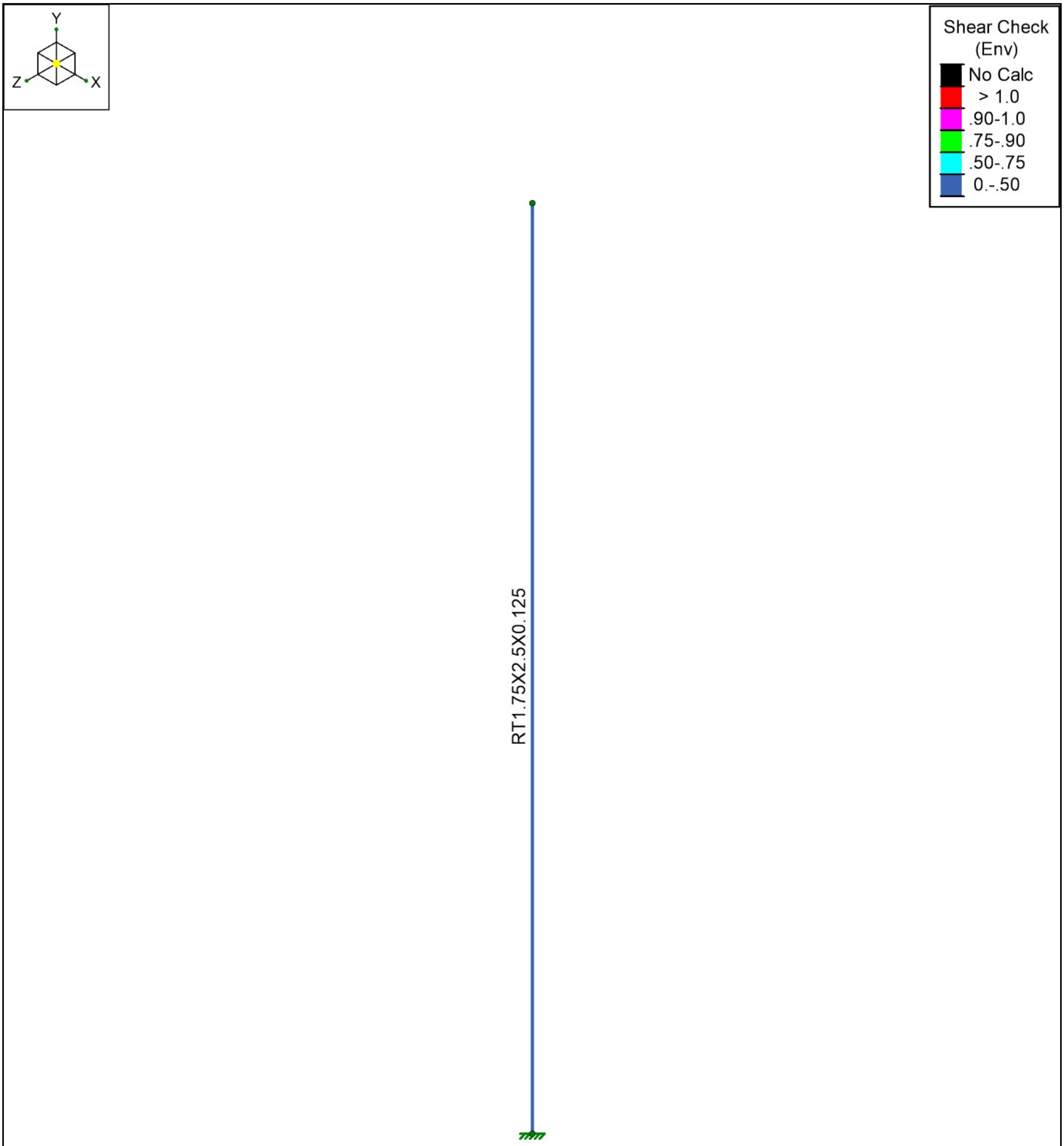
Area, Ax (in^2)	0.931
Inertia, Ixx (in^4)	0.851
Inertia, Iyy (in^4)	1.033
Inertia, Ixy (in^4)	0.000
Sx (Top) (in^3)	0.591
Sx (Bot) (in^3)	0.579
Sy (Left) (in^3)	0.596
Sy (Right) (in^3)	0.596
rx (in)	0.956
ry (in)	1.053
Plastic Zx (in^3)	0.808
Plastic Zy (in^3)	0.879
Torsional J (in^4)	1.442





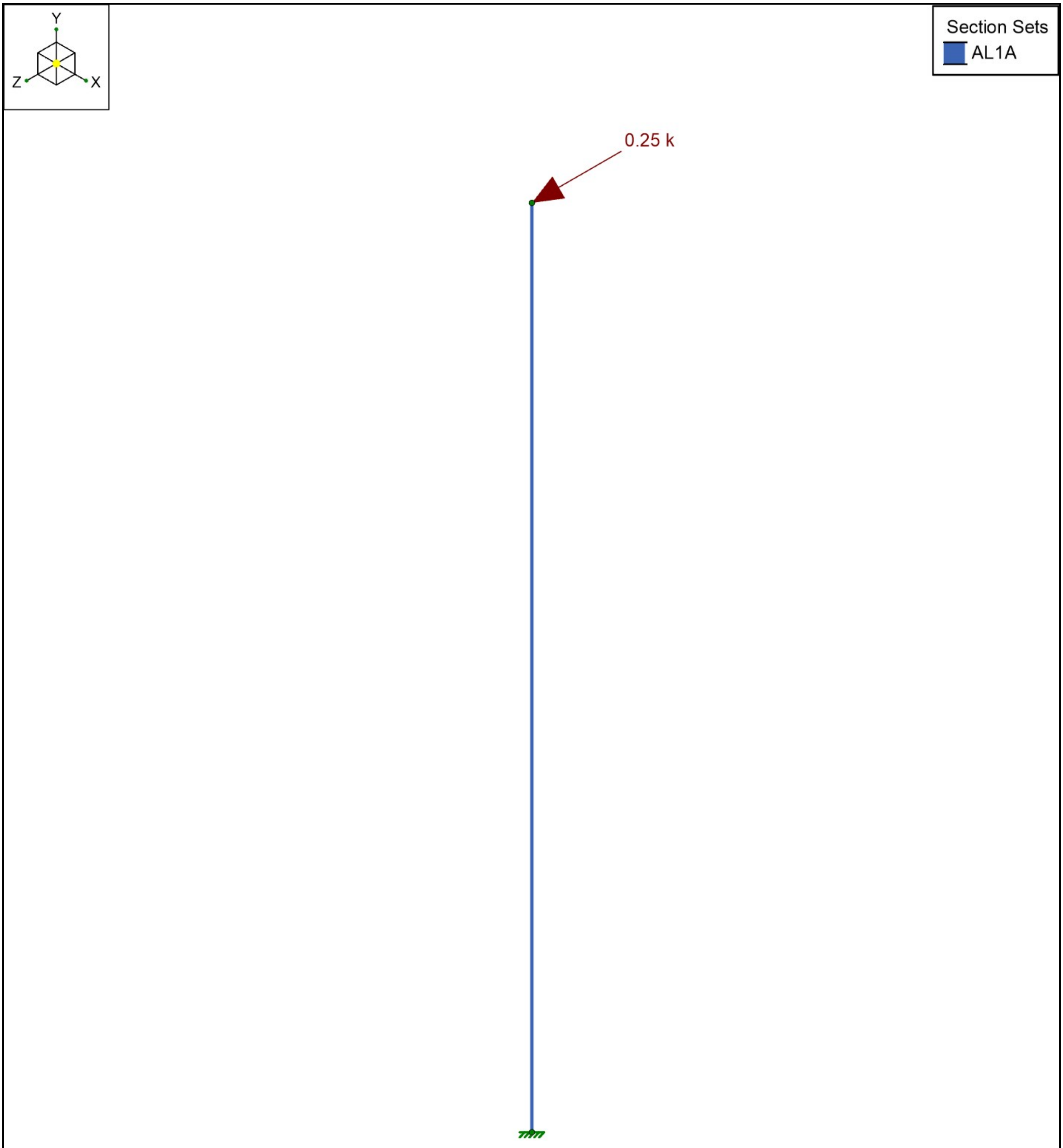
Envelope Only Solution

PSE	42" tall - 135 degree post	SK-23
AF		Mar 10, 2023
Eglass 223-802		135 post.r3d



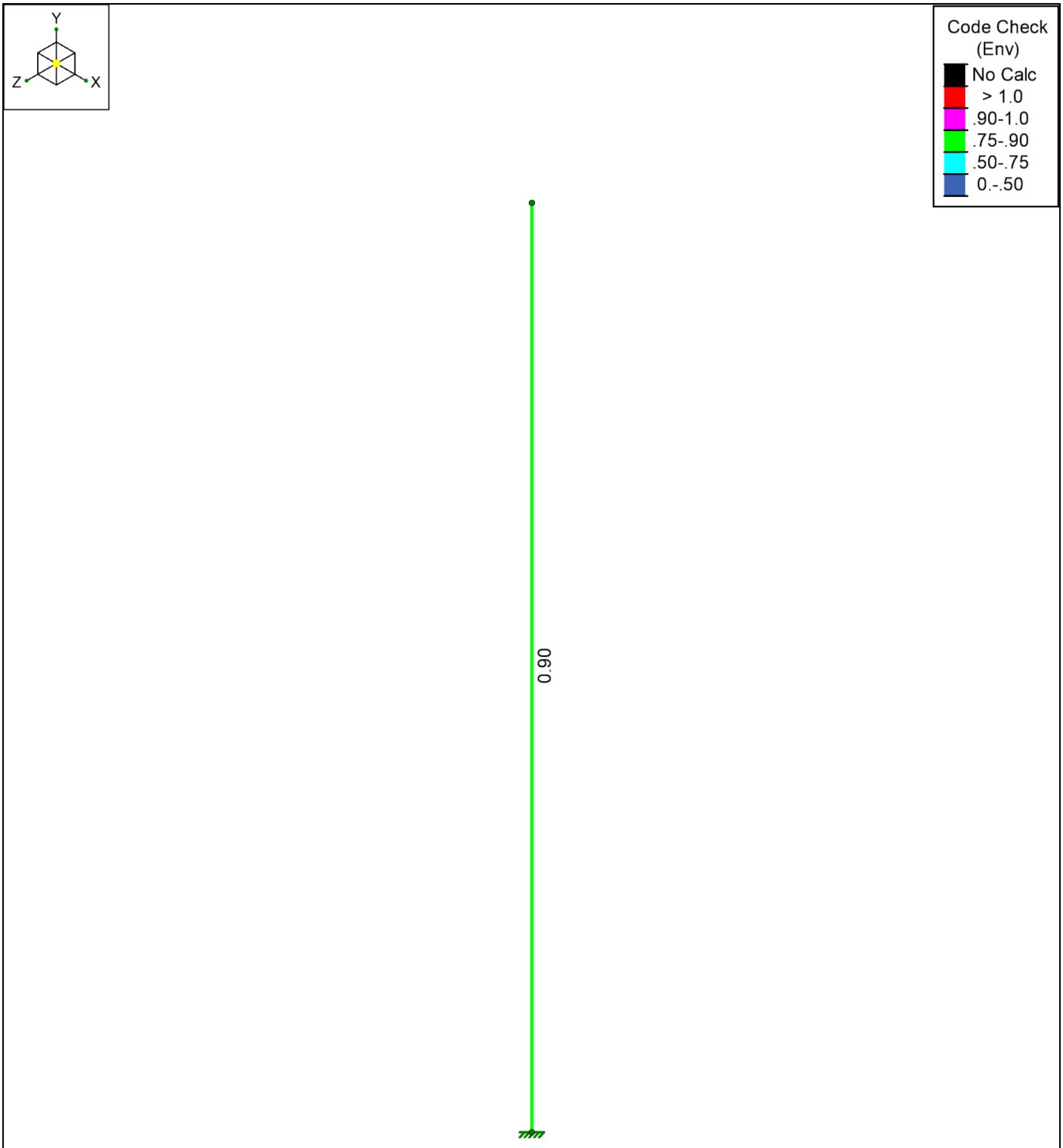
Envelope Only Solution

PSE	42" tall - 135 degree post	SK-24
AF		Mar 10, 2023
Eglass 223-802		135 post.r3d



Loads: BLC 1, dl
Envelope Only Solution

PSE	42" tall - 135 degree post	SK-25
AF		Mar 10, 2023
Eglass 223-802		135 post.r3d



Member Code Checks Displayed (Enveloped)
Envelope Only Solution

PSE	42" tall - 135 degree post	SK-26
AF		Mar 10, 2023
Eglass 223-802		135 post.r3d

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	0	0	
2	N2	0	3.5	0	

Node Boundary Conditions

	Node Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot [k-ft/rad]	Y Rot [k-ft/rad]	Z Rot [k-ft/rad]
1	N1	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction

Aluminum Properties

	Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. $[1e^{5\circ}F^{-1}]$	Density $[k/ft^3]$	Table B.4	kt	Ftu [ksi]	Fty [ksi]	Fcy [ksi]	Fsu [ksi]	Ct
1	3003-H14	10100	3787.5	0.33	1.3	0.173	Table B.4-1	1	19	16	13	12	141
2	6061-T6	10100	3787.5	0.33	1.3	0.173	Table B.4-2	1	38	35	35	24	141
3	6063-T5	10100	3787.5	0.33	1.3	0.173	Table B.4-2	1	22	16	16	13	141
4	6063-T6	10100	3787.5	0.33	1.3	0.173	Table B.4-2	1	30	25	25	19	141
5	5052-H34	10200	3787.5	0.33	1.3	0.173	Table B.4-1	1	34	26	24	20	141
6	6061-T6 W	10100	3787.5	0.33	1.3	0.173	Table B.4-1	1	24	15	15	15	141

Aluminum Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area $[in^2]$	Iyy $[in^4]$	Izz $[in^4]$	J $[in^4]$
1	AL1A	RT1.75X2.5X0.125	Column	Rectangular Tubes	6061-T6	Typical	1	0.484	0.855	0.931

Aluminum Design Parameters

	Label	Shape	Length [ft]	Lcomp top [ft]	Function
1	M1	AL1A	3.5	Lbyy	Lateral

Member Point Loads

No Data to Print...

Basic Load Cases

	BLC Description	Category	Y Gravity	Nodal
1	dl	DL	-1	1

Load Combinations

	Solve	P-Delta	BLC	Factor
1	Yes	Y	1	1

Envelope Node Reactions

	Node Label		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	N1	max	0	1	0.004	1	-0.25	1	-0.875	1	0	1	0	1
2		min	0	1	0.004	1	-0.25	1	-0.875	1	0	1	0	1
3	Totals:	max	0	1	0.004	1	-0.25	1						
4		min	0	1	0.004	1	-0.25	1						

Envelope Member Torsion Stresses

	Member	Sec		Torque[k-ft]	LC	Torsion Shear[ksi]	LC	y-y Warp Shear[ksi]	z-z Warp Shear[ksi]	z-Top Warp Bend[ksi]	z-Bot Warp Bend[ksi]
1	M1	1	max	0	1	0	1	NC	NC	NC	NC
2			min	0	1	0	1	NC	NC	NC	NC
3		2	max	0	1	0	1	NC	NC	NC	NC
4			min	0	1	0	1	NC	NC	NC	NC
5		3	max	0	1	0	1	NC	NC	NC	NC
6			min	0	1	0	1	NC	NC	NC	NC
7		4	max	0	1	0	1	NC	NC	NC	NC
8			min	0	1	0	1	NC	NC	NC	NC
9		5	max	0	1	0	1	NC	NC	NC	NC
10			min	0	1	0	1	NC	NC	NC	NC

Envelope Member Section Deflections - Service

No Data to Print...

Envelope AA ADM1-15: ASD - BUILDING Member Aluminum Code Checks

	Member	Shape	Code Check	Loc[ft]	LC	Shear Check	Loc[ft]	Dir	LC	Pnc/Om[k]	Pnt/Om[k]	Mny/Om[k-ft]	Mnz/Om[k-ft]	Vny/Om[k]	Vnz/Om[k]	Cb	Eqn
1	M1	RT1.75X2.5X0.125	0.895	0	1	0.059	3.5	z	1	12.883	19.487	0.978	1.209	6.538	4.231	1	H.1-1

Precision Structural Engineering, Inc.
250 Main Street, Suite A • Klamath Falls, OR 97601
Tel (541) 850-6300 • FAX (541) 850-6233

Medford Office
836 Mason Way (off Sage Road) • Medford, OR 97501
Tel (541) 858-8500

www.structure1.com • Email: info@structure1.com

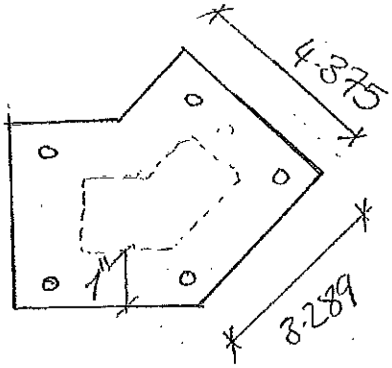
PROJECT NO. ______ SHEET ____ OF ______

PROJECT NAME ______ DESIGNED BY ______ DATE ______

SUBJECT ______ CHECKED BY ______ DATE ______

135° post base plate

Assume $t = 0.39$ in



$$t \geqq e\sqrt{\frac{2P_u}{0.9 A f_y}} \quad , e = 1''$$

$A = 20.85 \text{ in}^2$, $F_y = 28$ Ksi

$P_u = 441^{lb} * 1.5 = 661.5$ lb

$$t \geqq \sqrt{\frac{2 * 661.5}{28{,}000 * 0.9 * 20.85}} = 0.05 \text{ in}$$

use [0.39" * shape as shown , Aluminum

PROJECT NO. ____________ SHEET ______ OF ______

PROJECT NAME ____________ DESIGNED BY ____________ DATE ____________

SUBJECT ____________ CHECKED BY ____________ DATE ____________

Anchors

Tension on one anchor: $\frac{M}{d} = T$

(Anchor @ middle)

d = distance between anchor & base plate farther edge = 4.2 in

$$M = T \cdot d$$

$$= 4.2T + 3.77 * \frac{3.77}{4.2} T + \frac{0.65 * 0.65}{4.2} T$$

$$= 7.7T$$

$$M = 1000 \text{ lb.ft}$$

$$1000 = \frac{7.7 * T}{12} \Rightarrow T = 1561 \text{ lb}$$

PROJECT NO. Eg1285 SHEET 2022 OF

PROJECT NAME DESIGNED BY AF DATE

SUBJECT CHECKED BY DATE

Anchors with Concrete

$$N_{cb} = \frac{A_{NC}}{A_{NCo}} \psi_{ed,N} \cdot \psi_{c,N} \cdot \psi_{cp,N} \cdot N_b$$

$$A_{NC} = (3 + 1.5*3)*(2*1.5*3) = 67.5 \text{ in}^2$$

$$A_{NCo} = 9*\bar{3}^2 = 81 \text{ in}^2$$

$$N_b = 17\sqrt{2500} * \bar{3}^{1.5} = 4,416 \text{ lb}$$

$$\psi_{ed} = 0.7 + 0.3 \frac{*3}{1.5*3} = 0.9$$

$$\psi_{c,N} = 1.4$$

$$\psi_{cp,N} = 1.0$$

$$N_{cb} = \frac{67.5}{81} * 0.9 * 1.4 * 1 * 4416 = 4686 \text{ lb}$$

$\frac{3}{8}$" ϕ bolt tension capacity = 4200 lb < 4686 lb

∴ bolt capacity controls

Allowable Ten. load = $0.65 * \frac{4200}{1.6} = 1575$ lb

$$\frac{\text{Applied Tension}}{\text{allowable Tension}} = \frac{1561}{1575} = 0.99$$

PROJECT NO: E91285 SHEET 2023 OF

PROJECT NAME

DESIGNED BY AF DATE

SUBJECT

CHECKED BY DATE

* check for shear

$$V_{cb} = \frac{A_{vc}}{A_{vco}} \cdot \psi_{ed,v} \cdot \psi_{c,v} \cdot \psi_{h,v} \cdot V_b$$

$$A_{vc} = 1.5*3*(1.5*3+3) = 33.75\ in^2$$

$$A_{vco} = 4.5*\overline{3}^{2} = 40.5\ in^2$$

$$V_b = 7*\left(\left(\frac{3}{3/8}\right)^{0.2}\sqrt{3/8}\right)*\sqrt{2500}*\overline{3}^{1.5} = 1688\ lb$$

$$\psi_{ed,v} = 1.0$$

$$\psi_{c,v} = 1.4$$

$$\psi_{h,v} = \sqrt{\frac{1.5*3}{3}} = 1.22$$

$$V_{cb} = \frac{33.75}{40.5} * 1*1.4*1.22*1688 = 2402\ lb$$

$\frac{3}{8}$" ϕ bolt shear capacity = 1880^{lb} (Controls)

$$\text{Allowable shear} = 0.7*\frac{1880}{1.6} = 800\ lb$$

$$\text{Shear/bolt} = \frac{400}{5} = 80^{lb}$$

$$\frac{\underline{\text{Applied shear}}}{\text{Allowable shear}} = \frac{80}{800} = 0.1.0 < 0.2$$

PROJECT NO. Eg1285 SHEET 2624 OF

PROJECT NAME DESIGNED BY AF DATE

SUBJECT CHECKED BY DATE

∴ Interaction of shear & Tension won't reduce allowable Tension load

∴ use : [5- $\frac{3''}{8}\phi$ Red head ITW or LDT
w/min 4" Embed & 8" edge distance
$f'_c \not< 2500$ psi]

PROJECT NO. Eglass SHEET 2025 OF

PROJECT NAME DESIGNED BY AF DATE

SUBJECT CHECKED BY DATE

Anchors with wood

$\frac{1}{2}''$ ϕ lag screw withdrawl capacity = 302^{lb}

Embed length = $\frac{1561^{lb}}{302 * 1.6}$ = 3.2 in

use : [5 - $\frac{1}{2}''$ ϕ lag screw w/ 4" min Embed]

Table 2.3.2 Frequently Used Load Duration Factors, C_D[1]

Load Duration	C_D	Typical Design Loads
Permanent	0.9	Dead Load
Ten years	1.0	Occupancy Live Load
Two months	1.15	Snow Load
Seven days	1.25	Construction Load
Ten minutes	1.6	Wind/Earthquake Load
Impact[2]	2.0	Impact Load

1. Load duration factors shall not apply to reference modulus of elasticity, E, reference modulus of elasticity for beam and column stability, E_{min}, nor to reference compression perpendicular to grain design values, $F_{c\perp}$, based on a deformation limit.
2. Load duration factors greater than 1.6 shall not apply to structural members pressure-treated with water-borne preservatives (see Reference 30), or fire retardant chemicals. The impact load duration factor shall not apply to connections.

2.3.3 Temperature Factor, C_t

Reference design values shall be multiplied by the temperature factors, C_t, in Table 2.3.3 for structural members that will experience sustained exposure to elevated temperatures up to 150°F (see Appendix C).

2.3.4 Fire Retardant Treatment

The effects of fire retardant chemical treatment on strength shall be accounted for in the design. Adjusted design values, including adjusted connection design values, for lumber and structural glued laminated timber pressure-treated with fire retardant chemicals shall be obtained from the company providing the treatment and redrying service. Load duration factors greater than 1.6 shall not apply to structural members pressure-treated with fire retardant chemicals (see Table 2.3.2).

2.3.5 Format Conversion Factor, K_F (LRFD Only)

For LRFD, reference design values shall be multiplied by the format conversion factor, K_F, specified in Table 2.3.5. The format conversion factor, K_F, shall not apply for designs in accordance with ASD methods specified herein.

2.3.6 Resistance Factor, ϕ (LRFD Only)

For LRFD, reference design values shall be multiplied by the resistance factor, ϕ, specified in Table 2.3.6. The resistance factor, ϕ, shall not apply for designs in accordance with ASD methods specified herein.

2.3.7 Time Effect Factor, λ (LRFD Only)

For LRFD, reference design values shall be multiplied by the time effect factor, λ, specified in Appendix N.3.3. The time effect factor, λ, shall not apply for designs in accordance with ASD methods specified herein.

Table 2.3.3 Temperature Factor, C_t

Reference Design Values	In-Service Moisture Conditions[1]	C_t		
		T≤100°F	100°F<T≤125°F	125°F<T≤150°F
F_t, E, E_{min}	Wet or Dry	1.0	0.9	0.9
F_b, F_v, F_c, and $F_{c\perp}$	Dry	1.0	0.8	0.7
	Wet	1.0	0.7	0.5

1. Wet and dry service conditions for sawn lumber, structural glued laminated timber, prefabricated wood I-joists, structural composite lumber, wood structural panels and cross-laminated timber are specified in 4.1.4, 5.1.4, 7.1.4, 8.1.4, 9.3.3, and 10.1.5 respectively.

Table 12.2A Lag Screw Reference Withdrawal Design Values, W[1]

Tabulated withdrawal design values (W) are in pounds per inch of thread penetration into side grain of wood member. Length of thread penetration in main member shall not include the length of the tapered tip (see 12.2.1.1).

Specific Gravity, G[2]	Lag Screw Diameter, D										
	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	7/8"	1"	1-1/8"	1-1/4"
0.73	397	469	538	604	668	789	905	1016	1123	1226	1327
0.71	381	450	516	579	640	757	868	974	1077	1176	1273
0.68	357	422	484	543	600	709	813	913	1009	1103	1193
0.67	349	413	473	531	587	694	796	893	987	1078	1167
0.58	281	332	381	428	473	559	641	719	795	869	940
0.55	260	307	352	395	437	516	592	664	734	802	868
0.51	232	274	314	353	390	461	528	593	656	716	775
0.50	225	266	305	342	378	447	513	576	636	695	752
0.49	218	258	296	332	367	434	498	559	617	674	730
0.47	205	242	278	312	345	408	467	525	580	634	686
0.46	199	235	269	302	334	395	453	508	562	613	664
0.44	186	220	252	283	312	369	423	475	525	574	621
0.43	179	212	243	273	302	357	409	459	508	554	600
0.42	173	205	235	264	291	344	395	443	490	535	579
0.41	167	198	226	254	281	332	381	428	473	516	559
0.40	161	190	218	245	271	320	367	412	455	497	538
0.39	155	183	210	236	261	308	353	397	438	479	518
0.38	149	176	202	227	251	296	340	381	422	461	498
0.37	143	169	194	218	241	285	326	367	405	443	479
0.36	137	163	186	209	231	273	313	352	389	425	460
0.35	132	156	179	200	222	262	300	337	373	407	441
0.31	110	130	149	167	185	218	250	281	311	339	367

1. Tabulated withdrawal design values, W, for lag screw connections shall be multiplied by all applicable adjustment factors (see Table 11.3.1).
2. Specific gravity, G, shall be determined in accordance with Table 12.3.3A.

12.2.3.2 For calculation of the fastener reference withdrawal design value in pounds, the unit reference withdrawal design value in lbs/in. of fastener penetration from 12.2.3.1 shall be multiplied by the length of fastener penetration, p_t, into the wood member.

12.2.3.3 The reference withdrawal design value, in lbs/in. of penetration, for a single post-frame ring shank nail driven in the side grain of the main member, with the nail axis perpendicular to the wood fibers, shall be determined from Table 12.2D or Equation 12.2-4, within the range of specific gravities and nail diameters given in Table 12.2D. Reference withdrawal design values, W, shall be multiplied by all applicable adjustment factors (see Table 11.3.1) to obtain adjusted withdrawal design values, W'.

$$W = 1800\,G^2\,D \qquad (12.2\text{-}4)$$

12.2.3.4 For calculation of the fastener reference withdrawal design value in pounds, the unit reference withdrawal design value in lbs/in. of ring shank penetration from 12.2.3.3 shall be multiplied by the length of ring shank penetration, p_t, into the wood member.

12.2.3.5 Nails and spikes shall not be loaded in withdrawal from end grain of wood (C_{eg}=0.0).

12.2.3.6 Nails, and spikes shall not be loaded in withdrawal from end-grain of laminations in cross-laminated timber (C_{eg}=0.0).

12.2.4 Drift Bolts and Drift Pins

Reference withdrawal design values, W, for connections using drift bolt and drift pin connections shall be determined in accordance with 11.1.1.3.

Table 12K LAG SCREWS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections[1,2,3,4]

for sawn lumber or SCL with ASTM A653, Grade 33 steel side plate (for t_s<1/4") or ASTM A 36 steel side plate (for t_s=1/4")
(tabulated lateral design values are calculated based on an assumed length of lag screw penetration, p, into the main member equal to 8D)

Side Member Thickness	Lag Screw Diameter	G=0.67 Red Oak		G=0.55 Mixed Maple Southern Pine		G=0.5 Douglas Fir-Larch		G=0.49 Douglas Fir-Larch (N)		G=0.46 Douglas Fir(S) Hem-Fir(N)		G=0.43 Hem-Fir		G=0.42 Spruce-Pine-Fir		G=0.37 Redwood (open grain)		G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods		G=0.35 Northern Species	
t_s in.	D in.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.
0.075	1/4	170	130	160	120	150	110	150	110	150	100	140	100	140	100	130	90	130	90	130	90
(14 gage)	5/16	220	160	200	140	190	130	190	130	190	130	180	120	180	120	170	110	170	110	160	100
	3/8	220	160	200	140	200	130	190	130	190	120	180	120	180	120	170	110	170	100	170	100
0.105	1/4	180	140	170	130	160	120	160	120	160	110	150	110	150	110	140	100	140	100	140	90
(12 gage)	5/16	230	170	210	150	200	140	200	140	190	130	190	130	190	120	180	110	170	110	170	110
	3/8	230	160	210	140	200	140	200	130	200	130	190	120	190	120	180	110	180	110	170	110
0.120	1/4	190	150	180	130	170	120	170	120	160	120	160	110	160	110	150	100	150	100	140	100
(11 gage)	5/16	230	170	210	150	210	140	200	140	200	140	190	130	190	130	180	120	180	120	180	110
	3/8	240	170	220	150	210	140	210	140	200	130	200	130	190	120	180	110	180	110	180	110
0.134	1/4	200	150	180	140	180	130	170	130	170	120	160	120	160	110	150	110	150	100	150	100
(10 gage)	5/16	240	180	220	160	210	150	210	140	200	140	200	130	200	130	190	120	180	120	180	120
	3/8	240	170	220	150	220	140	210	140	210	140	200	130	200	130	190	120	190	120	180	110
0.179	1/4	220	170	210	150	200	150	200	140	190	140	190	130	190	130	180	120	170	120	170	120
(7 gage)	5/16	260	190	240	170	230	160	230	160	230	150	220	150	220	150	210	130	200	130	200	130
	3/8	270	190	250	170	240	160	240	160	230	150	220	140	220	140	210	130	210	130	200	130
0.239	1/4	240	180	220	160	210	150	210	150	200	140	190	140	190	130	180	120	180	120	180	120
(3 gage)	5/16	300	220	280	190	270	180	260	180	260	170	250	160	250	160	230	150	230	150	230	140
	3/8	310	220	280	190	270	180	270	180	260	170	250	160	250	160	240	140	230	140	230	140
	7/16	420	290	390	260	380	240	370	240	360	230	350	220	360	220	330	200	330	200	320	190
	1/2	510	340	470	300	460	290	450	280	440	270	430	260	420	260	400	240	400	230	390	230
	5/8	770	490	710	430	680	400	680	400	660	380	640	370	630	360	600	330	590	330	580	320
	3/4	1110	670	1020	590	980	560	970	550	950	530	920	500	910	500	860	450	850	450	840	440
	7/8	1510	880	1390	780	1330	730	1320	710	1280	690	1250	650	1230	650	1170	590	1160	590	1140	570
	1	1940	1100	1780	960	1710	910	1700	890	1650	860	1600	820	1590	810	1500	740	1480	730	1460	710
1/4	1/4	240	180	220	160	210	150	210	150	200	140	200	140	190	130	180	120	180	120	180	120
	5/16	310	220	280	200	270	180	270	180	260	170	250	170	250	160	230	150	230	150	230	140
	3/8	320	220	290	190	280	180	270	180	270	170	260	160	250	160	240	150	240	140	230	140
	7/16	480	320	440	280	420	270	420	260	410	250	390	240	390	230	370	220	360	210	360	210
	1/2	580	390	540	340	520	320	510	320	500	310	480	290	480	290	460	270	450	260	440	260
	5/8	850	530	780	470	750	440	740	440	720	420	700	400	690	400	660	370	650	360	640	350
	3/4	1200	730	1100	640	1060	600	1050	590	1020	570	990	540	980	530	930	490	920	480	900	470
	7/8	1600	930	1470	820	1410	770	1400	750	1360	720	1320	690	1310	680	1240	630	1220	620	1200	600
	1	2040	1150	1870	1000	1800	950	1780	930	1730	900	1680	850	1660	840	1570	770	1550	760	1530	740

1. Tabulated lateral design values, Z, shall be multiplied by all applicable adjustment factors (see Table 11.3.1).
2. Tabulated lateral design values, Z, are for "reduced body diameter" lag screws (see Appendix Table L2) inserted in side grain with screw axis perpendicular to wood fibers; screw penetration, p, into the main member equal to 8D; dowel bearing strengths, F_e, of 61,850 psi for ASTM A653, Grade 33 steel and 87,000 psi for ASTM A36 steel and screw bending yield strengths, F_{yb}, of 70,000 psi for D = 1/4", 60,000 psi for D = 5/16", and 45,000 psi for D ≥3/8".
3. Where the lag screw penetration, p, is less than 8D but not less than 4D, tabulated lateral design values, Z, shall be multiplied by p/8D or lateral design values shall be calculated using the provisions of 12.3 for the reduced penetration.
4. The length of lag screw penetration, p, not including the length of the tapered tip, E (see Appendix Table L2), of the lag screw into the main member shall not be less than 4D. See 12.1.4.6 for minimum length of penetration, p_{min}.