



Salvatore R. Granata. P.E., C.E.

Phone: (678) 367-3151
Cell: (770) 301-5817
Toll Free: (877) 346-5126

11509 Lodgepole Court
Spanish Fort, AL 36527

Fax: (866) 815-4682
sal@srgpe.net
salgranata.com

STRUCTURAL CALCULATIONS

Project No: 26037

Ramp Calculations

Live Load = 100 psf

Dead Load = 5 psf

For

Quick-Deck

137 Pine Forest Drive

Locust, NC 28097

(704)-888-0327

Designed by: S. Granata

Florida P.E. #: 53467

Date: 03/20/26

This document has been
electronically signed and
sealed by Salvatore Ray Granata
Professional Engineer of the
State of Florida, United States.
Printed Copies of this document
Are not considered signed and
The signature must be verified
on any electronic copies.



03/20/26

Salvatore Ray Granata, PE, CE

11509 Lodgepole Court
Spanish Fort, AL 36527
770-301-5817 sal@srgpe.net
salgranata.com

JOB TITLE Ramp Calcs

Quick Deck

JOB NO.

SHEET NO.

CALCULATED BY SRG

DATE

CHECKED BY

DATE

www.struware.com

Code Search**Code:** International Building Code 2021 & 2024**Occupancy:**

Occupancy Group = E Educational

Risk Category & Importance Factors:

Risk Category = III

Wind Factor = 1.00 use 0.60 NOTE: Output will be nominal wind pressures

Snow Factor = 1.00

Seismic Importance factor = 1.25

Type of Construction:

Fire Rating:

Roof = 0.0 hr

Floor = 0.0 hr

Building Geometry:Roof angle (θ) 0.00 / 12 0.0 deg

Building length 6.5 ft

Least width 6.5 ft

Mean Roof Ht (h) 2.7 ft

Parapet ht above grd 0.0 ft

Minimum parapet ht 0.0 ft

hb for Elevated bldg 0.0 ft

Live Loads:

Roof 0 to 200 sf: 20 psf
200 to 600 sf: 24 - 0.02Area, but not less than 12 psf
over 600 sf: 12 psf

Stairs and exit ways 100 psf

Floor:

Typical Floor 100 psf

Partitions N/A

Stairs and exit ways 100 psf

0 psf

Salvatore Ray Granata, PE, CE

11509 Lodgepole Court
 Spanish Fort, AL 36527
 770-301-5817 sal@srgpe.net
 salgranata.com

JOB TITLE Ramp Calcs

Quick Deck

JOB NO.

SHEET NO.

CALCULATED BY SRG

DATE

CHECKED BY

DATE

Wind Loads :

ASCE 7- 22

Ultimate Wind Speed 200 mph
 Nominal Wind Speed 154.9 mph
 Risk Category III
 Exposure Category C
 Enclosure Classif. Open Building
 Internal pressure +/-0.00
 Bldg Directionality (Kd) 0.85
 Kh MWFRS<=60 0.851
 Kh all other 0.851
 Type of roof Monoslope

Topographic Factor (Kzt)

Topography Flat
 Hill Height (H) 80.0 ft
 Half Hill Length (Lh) 100.0 ft
 Actual H/Lh = 0.80
 Use H/Lh = 0.50
 Modified Lh = 160.0 ft
 From top of crest: x = 50.0 ft
 Bldg up/down wind? downwind

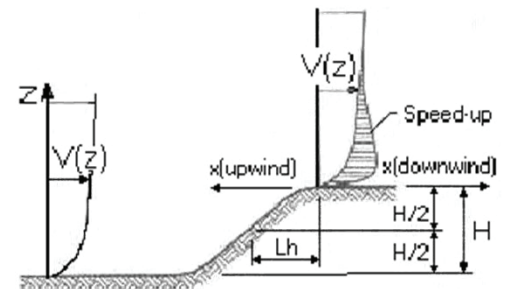
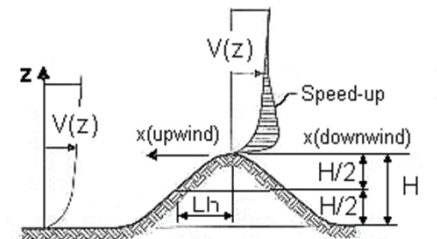
$$H/Lh = 0.50 \quad K_1 = 0.000$$

$$x/Lh = 0.31 \quad K_2 = 0.792$$

$$z/Lh = 0.09 \quad K_3 = 1.000$$

At Mean Roof Ht:

$$K_{zt} = (1 + K_1 K_2 K_3)^2 = 1.00$$

**ESCARPMENT****2D RIDGE or 3D AXISYMMETRICAL HILL****Gust Effect Factor**

h = 2.7 ft
 B = 6.5 ft
 /z (0.6h) = 15.0 ft

Flexible structure if natural frequency < 1 Hz (T > 1 second).

If building h/B > 4 then may be flexible and should be investigated.

$$h/B = 0.42$$

Rigid structure (low rise bldg)

G = 0.85 Using rigid structure default**Rigid Structure**

$\bar{e} = 0.20$
 $l = 500$ ft
 $z_{min} = 15$ ft
 $c = 0.20$
 $g_Q, g_v = 3.4$
 $L_z = 427.1$ ft
 $Q = 0.97$
 $I_z = 0.23$
 $G = 0.91$ use $G = 0.85$

Flexible or Dynamically Sensitive StructureNatural Frequency (η_1) = 0.0 HzDamping ratio (β) = 0.01

$$/b = 0.660$$

$$/\alpha = 0.156$$

$$V_z = 171.2$$

$$N_1 = 0.00$$

$$R_n = 0.000$$

$$R_h = 28.282$$

$$R_B = 28.282$$

$$R_L = 28.282$$

$$g_R = 0.000$$

$$R = 0.000$$

$$G_f = 0.000$$

$$\eta = 0.000$$

$$\eta = 0.000$$

$$\eta = 0.000$$

$$h = 2.7$$
 ft

Salvatore Ray Granata, PE, CE

11509 Lodgepole Court
 Spanish Fort, AL 36527
 770-301-5817 sal@srgpe.net
 salgranata.com

JOB TITLE Ramp Calcs

Quick Deck

JOB NO.

SHEET NO.

CALCULATED BY SRG

DATE

CHECKED BY

DATE

Wind Loads - Rooftop Structures & Canopies

Nominal Wind Pressures

Building (L) = 6.5 ft
 Building (B) = 6.5 ft
 Directionality (Kd) = 0.85

Rooftop Structures & Equipment #1

Equipment length parallel to L = 6.5 ft
 Equipment length parallel to B = 4.5 ft
 Height of equipment = 6.9 ft

Base pressure (Kd qh) = **44.5 psf**

<u>Vertical wind pressure</u>		<u>Wind normal to building B</u>		<u>Wind normal to building L</u>	
Ar =	29.3 sf	Af =	30.9 sf	Af =	44.7 sf
GCr =	1.171	GCr =	1.00	GCr =	1.00
F = KdqhGCr Ar =	52.0 Ar (psf)	F = KdqhGCr Af =	44.5 Af (psf)	F = KdqhGCr Af =	44.5 Af (psf)
Fv =	1.5 kips	Fh =	1.4 kips	Fh =	2.0 kips

Horizontal Wind Load : $V_w = 52.0 \text{ psf} * 3 \text{ ft}^2 = 156 \text{ lb (Nom.)} / 260 \text{ lbs (Ult.)}$

Rooftop Structures & Equipment #2

Equipment length parallel to L = 3.0 ft
 Equipment length parallel to B = 3.0 ft
 Height of equipment = 10.0 ft

Base pressure (Kd qh) = **44.5 psf**

<u>Vertical wind pressure</u>		<u>Wind normal to building B</u>		<u>Wind normal to building L</u>	
Ar =	9.0 sf	Af =	30.0 sf	Af =	30.0 sf
GCr =	1.437	GCr =	1.00	GCr =	1.00
F = KdqhGCr Ar =	63.9 Ar (psf)	F = KdqhGCr Af =	44.5 Af (psf)	F = KdqhGCr Af =	44.5 Af (psf)
Fv =	0.6 kips	Fh =	1.3 kips	Fh =	1.3 kips

Attached Canopies on Buildings : $h \leq 60'$

Mean Roof Ht (h) = 2.7 ft
 Mean eave height (he) = 60.0 ft
 Mean Canopy height (hc) = 45.0 ft
 hc/he = 0.75

Base pressure (Kd qh) = **44.5 psf**

Area	C&C Surface Pressure (psf)				User input
	10 sf	20 sf	50 sf	100 sf	75 sf
Separate Individual Surfaces:					
Upper surface negative pressure	-51.1	-45.8	-38.7	-33.3	-35.6
Lower surface negative pressure	-35.6	-33.6	-30.9	-28.9	-29.7
Upper or Lower surface pos pressure	35.6	32.9	29.3	26.7	27.8
Combined Upper & Lower Surfaces (net):					
Negative pressure	-40.0	-36.7	-32.2	-28.9	-30.3
Positive pressure	40.0	36.7	32.2	28.9	30.3

Salvatore Ray Granata, PE, CE

11509 Lodgepole Court
 Spanish Fort, AL 36527
 770-301-5817 sal@srgpe.net
 salgranata.com

JOB TITLE **Ramp Calcs**

Quick Deck

JOB NO.

SHEET NO.

CALCULATED BY **SRG**

DATE

CHECKED BY

DATE

Snow Loads : ASCE 7- 22

Ultimate Snow Forces

Roof slope = 0.0 deg
 Horiz. eave to ridge dist (W) = 6.5 ft
 Roof length parallel to ridge (L) = 6.5 ft

Type of Roof Monoslope
 Ground Snow Load Pg = 20.0 psf
 Risk Category = III
 Snow Factor = 1.0
 Roof R value Rroof = 30
 Thermal Factor Ct = 1.190
 Exposure Factor Ce = 1.10
 $P_f = 0.7 \cdot C_e \cdot C_t \cdot I \cdot P_g = 18.3 \text{ psf}$
 Unobstructed Slippery Surface yes

Sloped-roof Factor Cs = 1.00
 Balanced Snow Load = **18.3 psf**

Rain on Snow Surcharge Angle 0.13 deg
 Code Maximum Rain Surcharge 8.0 psf
 Rain on Snow Surcharge = 8.0 psf
 Ps plus rain surcharge = 26.3 psf
 Minimum Snow Load Pm = 20.0 psf

Uniform Roof Design Snow Load = **26.3 psf**

Near ground level surface balanced snow load = **20.0 psf**

NOTE: Alternate spans of continuous beams shall be loaded with half the design roof snow load so as to produce the greatest possible effect - see code for loading diagrams and exceptions for gable roofs

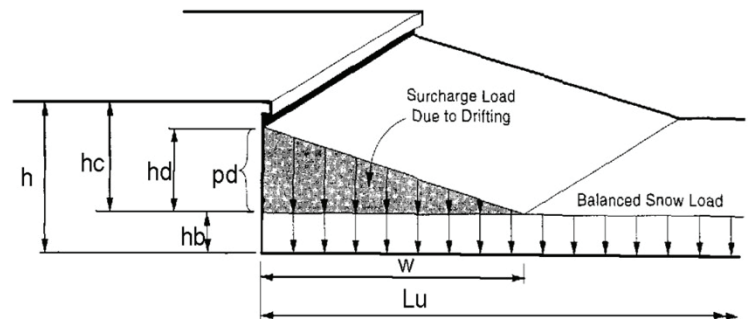
Winter Wind Parameter W2 = 0.55

Snow Drift 1 - Against roof projections, parapets, etc

Up or downwind fetch lu = 12.0 ft
 Projection height h = 8.5 ft
 Projection width/length lp = 4.5 ft
 Snow density $\gamma = 16.6 \text{ pcf}$
 Balanced snow height hb = 1.10 ft
 $h_d = 1.20 \text{ ft}$
 $h_c = 7.40 \text{ ft}$
 $h_c/h_b > 0.2 = 6.7$
lp < 15', drift not req'd
 Drift height (hd) = 1.20 ft
 Drift width w = 9.61 ft
 Surcharge load: $pd = \gamma \cdot h_d = 19.9 \text{ psf}$
 Balanced Snow load: = 18.3 psf
 38.3 psf

Snow Drift 2- Against roof projections, parapets, etc

Up or downwind fetch lu = 160.0 ft
 Projection height h = 4.0 ft
 Projection width/length lp = 20.0 ft
 Snow density $\gamma = 16.6 \text{ pcf}$
 Balanced snow height hb = 1.10 ft
 $h_d = 2.97 \text{ ft}$
 $h_c = 2.90 \text{ ft}$
 $h_c/h_b > 0.2 = 2.6$
Therefore, design for drift
 Drift height (hc) = 2.90 ft
 Drift width w = 23.17 ft
 Surcharge load: $pd = \gamma \cdot h_d = 48.1 \text{ psf}$
 Balanced Snow load: = 18.3 psf
 66.4 psf



Note: If bottom of projection is at least 2 feet above h_b then snow drift is not required.

Salvatore Ray Granata, PE, CE

11509 Lodgepole Court

Spanish Fort, AL 36527

770-301-5817 sal@srgpe.net

salgranata.com

JOB TITLE Ramp Calcs

Quick Deck

JOB NO.**SHEET NO.****CALCULATED BY** SRG**DATE****CHECKED BY****DATE****Seismic Loads:**

IBC 2021 & 2024

Strength Level Forces

Risk Category : III
Importance Factor (I_e) : 1.25

Site Class : D

S_s (0.2 sec) = 0.37 g
S₁ (1.0 sec) = 0.15 g

Site specific ground motion analysis performed:

S_{ms} = 3.690 S_{DS} = 2.460 Design Category = D
S_{m1} = 2.550 S_{D1} = 1.700 Design Category = DSeismic Design Category = D
Redundancy Coefficient ρ = 1.30
Number of Stories: 1

Structure Type: All other building systems

Horizontal Struct Irregularities: No plan Irregularity

Vertical Structural Irregularities: No vertical Irregularity

Flexible Diaphragms: No

Building System: **Cantilevered Column Systems detailed to conform to the requirements for:**Seismic resisting system: **Steel ordinary cantilever column system**System Structural Height Limit: **System not permitted for this seismic design category**Actual Structural Height (h_n) = 2.7 ft

See ASCE7 Section 12.2.5 for exceptions and other system limitations

DESIGN COEFFICIENTS AND FACTORSResponse Modification Coefficient (R) = 1.25 To = 0.2(S_{d1}/S_{ds}) = 0.138
Over-Strength Factor (Ω_o) = 1.25 Ts = S_{d1}/S_{ds} = 0.691
Deflection Amplification Factor (C_d) = 1.25 Long Period Transition Period (T_L) = 6 secS_{DS} = 2.460
S_{D1} = 1.700Seismic Load Effect (E) = E_h +/- E_v = ρ Q_E +/- 0.2S_{DS}D = 1.3Q_E +/- 0.492D Q_E = horizontal seismic force
Special Seismic Load Effect (E_m) = E_{mh} +/- E_v = Ω_o Q_E +/- 0.2S_{DS}D = 1.25Q_E +/- 0.492D D = dead load**ALLOWABLE STORY DRIFT**

Structure Type: All other structures

Allowable story drift Δ_a = 0.015h_{sx} where h_{sx} is the story height below level x**PERMITTED ANALYTICAL PROCEDURES****Index Force Analysis** - Method Not Permitted (only applies to Seismic Category A)**Model & Seismic Response Analysis** - Permitted (see code for procedure)**Equivalent Lateral-Force (ELF) Analysis** - PermittedBuilding period coer. (C_T) = 0.020Approx fundamental period (T_a) = C_Th_n^x = 0.042 sec x = 0.75

User calculated fundamental period =

C_u = 1.40T_{max} = C_uT_a = 0.059 sec

T = 0.042 sec

Method 2: Seismic response coef. (C_s) = S_{ds}/R = 2.460
need not exceed C_s = S_{d1}/R_T = 40.355
but not less than C_s = 0.044S_{ds}*I = 0.135
USE C_s = 2.460**Design Base Shear V = 2.460W****Method 1:** Enter S_a =
Seismic response coef. (C_s) = S_a/R = 0.000
but not less than C_s = 0.044S_{ds}*I = 0.135
C_s = Method not applicable

Salvatore Ray Granata, PE, CE

11509 Lodgepole Court
 Spanish Fort, AL 36527
 770-301-5817 sal@srgpe.net
 salgranata.com

JOB TITLE Ramp Calcs

Quick Deck

JOB NO.

SHEET NO.

CALCULATED BY SRG

DATE

CHECKED BY

DATE

Seismic Loads - cont. :

Strength Level Forces

Seismic Design Category (SDC)= D

I_e = 1.25S_{ds} = 2.460**CONNECTIONS****Force to connect smaller portions of structure to remainder of structure**

$$F_p = 0.133 S_{ds} w_p = 0.327 w_p$$

$$\text{or } F_p = 0.05 w_p = 0.05 w_p \quad \text{Use } F_p = 0.33 w_p \quad w_p = \text{weight of smaller portion}$$

Beam, girder or truss connection for resisting horizontal force parallel to member

F_p = no less than 0.05 times dead plus live load vertical reaction

Anchorage of Structural Walls to elements providing lateral support

F_p = not less than $0.2 K_a I_e W_p$

Flexible diaphragm span L_f =Enter L_f to calculate F_p for flexible diaphragm

$F_p = 0.4 S_{ds} K_a I_e W_p = 1.23 W_p$, but not less than $0.25 W_p$ (rigid diaphragm) $K_a = 1$ $F_p = 1.230 W_p$
 w/ anchor adjustment factor but F_p shall not be less than 5 psf

$h =$	2.7	Flexible Diaphragm:	$F_p =$	W_p	
$z =$	2.7	Rigid Diaphragm:	$F_p =$	$1.230 W_p$	factor = 1.000

MEMBER DESIGN**Bearing Walls and Shear Walls (out of plane force)**

$$F_p = 0.4 S_{ds} I_e W_w = 1.230 w_w$$

but not less than $0.10 w_w$ Use $F_p = 1.230 w_w$

Diaphragms

$$F_p = (\text{Sum } F_i / \text{Sum } W_i) W_{px} + V_{px} = (\text{Sum } F_i / \text{Sum } W_i) W_{px} + V_{px}$$

need not exceed $0.4 S_{ds} I_e W_{px} + V_{px} = 1.230 W_{px} + V_{px}$
 but not less than $0.2 S_{ds} I_e W_{px} + V_{px} = 0.615 W_{px} + V_{px}$

ARCHITECTURAL COMPONENTS SEISMIC COEFFICIENTS

Architectural Component : Egress stairways not part of the building seismic force-resisting system

0

Importance Factor (I_p) : 1.0Comp Resonance ductility factor (C_{ar}) = 1 $h =$ 2.7 feetComp Response Modification Factor (R_{po}) = 1.5 $z =$ 2.7 feetOver-Strength Factor (Ω_{po}) = 2 $z/h =$ 1.00 $H_f =$ 3.50 $R_u = (1.1 R / I_e / \Omega_o)^{.5} = 0.94$

$$F_p = 0.4 S_{ds} I_p W_p H_f C_{ar} / R_u / R_{po} = 1.766 W_p$$

use $R_u = 1.3$ since calculated $R_u < 1.3$

$$\text{not greater than } F_p = 1.6 S_{ds} I_p W_p = 3.936 W_p$$

$$\text{but not less than } F_p = 0.3 S_{ds} I_p W_p = 0.738 W_p$$

$$\text{use } F_p = 1.766 W_p$$

MECH AND ELEC COMPONENTS SEISMIC COEFFICIENTS

Seismic Design Category D & $I_p = 1.0$, therefore
 see ASCE7 Section 13.1.4 for exceptions

Mech or Electrical Component : Wet-side HVAC, boilers, furnaces, atmospheric tanks and bins, chillers, water heaters, etc
 plus other mechanical components constructed of high-deformability materials.

Importance Factor (I_p) : 1.0Comp Resonance ductility factor (C_{ar}) = 1 $h =$ 2.7 feetComp Response Modification Factor (R_{po}) = 1.5 $z =$ 2.7 feetOver-Strength Factor (Ω_{po}) = 2 $z/h =$ 1.00 $H_f =$ 3.50 $R_u = (1.1 R / I_e / \Omega_o)^{.5} = 0.94$

$$F_p = 0.4 S_{ds} I_p W_p H_f C_{ar} / R_u / R_{po} = 1.766 W_p$$

use $R_u = 1.3$ since calculated $R_u < 1.3$

$$\text{not greater than } F_p = 1.6 S_{ds} I_p W_p = 3.936 W_p$$

$$\text{but not less than } F_p = 0.3 S_{ds} I_p W_p = 0.738 W_p$$

$$\text{use } F_p = 1.766 W_p$$

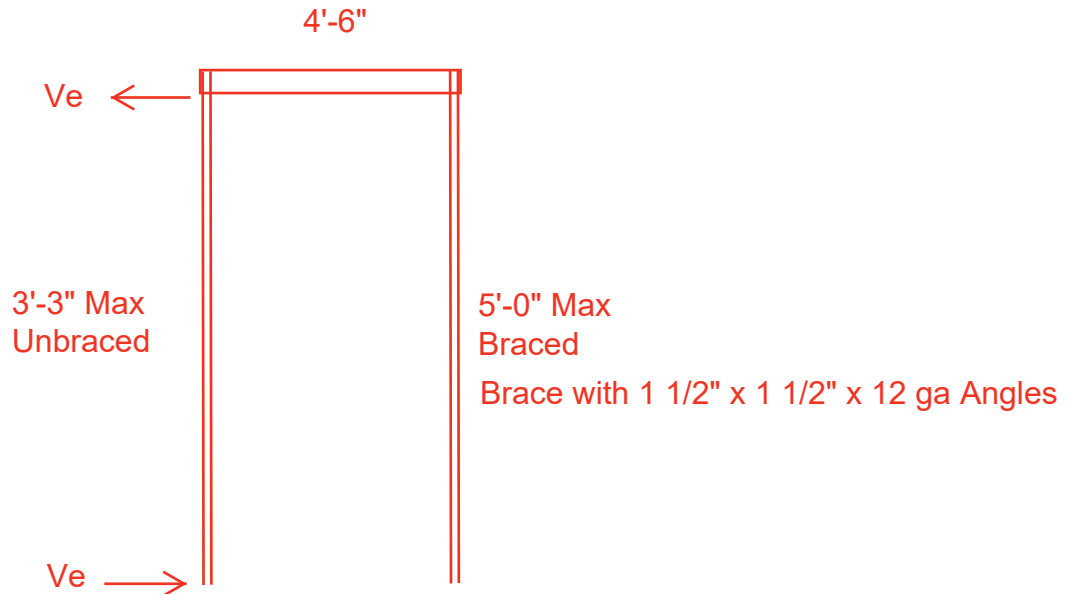


Salvatore R. Granata P.E., C.E.

Phone: (678) 367-3151
Cell: (770) 301-5817
Toll Free: (877) 346-5126

11509 Lodgepole Ct
Spanish Fort, AL 36527-6700

Fax: (866)815-4682
sal@srgpe.net
salgranata.com



$$D = 6.5' * 12' * 5 \text{ psf} / 8 \text{ legs} = 48.75 \text{ lbs}$$

$$Ve = 2 \text{ legs} * 48.75 \text{ lbs} * 0.7 = 68.25 \text{ lbs (Nom.) per (2) legs}$$

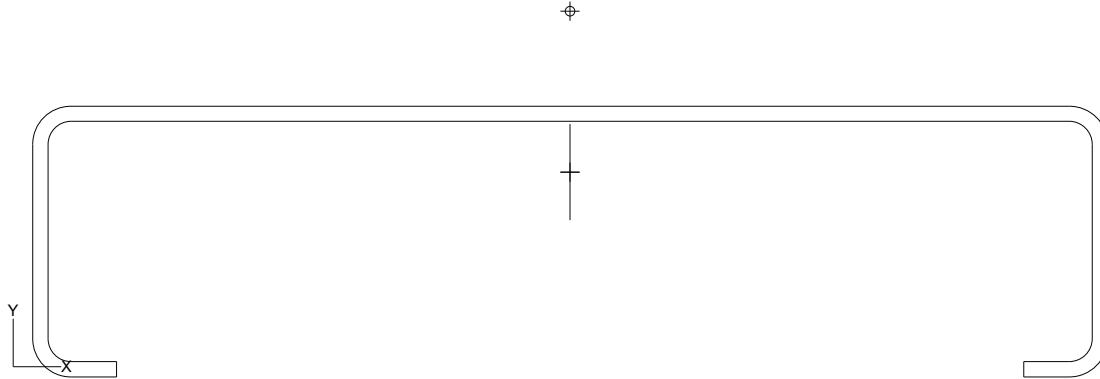
$$Me = 68.25 \text{ lbs} * 3.25' * 12' / 1000 = 2.66175 \text{ k-in}$$

$$P = 3' * 4.5' * 5 \text{ psf} = 67.5 \text{ lbs (Nom.) Dead Load}$$

$$P = 3' * 4.5' * 100 \text{ psf} = 1350 \text{ lbs (Nom.) Live Load}$$

Rev. Date: 2/21/2023 8:27:09 AM
By: Sal
Printed: 2/13/2026 11:02:18 AM

Item 3: Walking Surface
Trib Width = 4"



Section Inputs

Material: A653 SS Grade 33
No cold work of forming strength increase.
No inelastic reserve strength increase.
Modulus of Elasticity, E 29500 ksi
Yield Strength, Fy 33 ksi
Tensile Strength, Fu 45 ksi
Min Elongation in 2 inches 20 %
Torsion Constant Override, J 0 in⁴
Warping Constant Override, Cw 0 in⁶

Stiffened Channel, Thickness 0.0566 in (54 mil)

Placement of Part from Origin:

X to center of gravity 0 in

Y to center of gravity 0 in

Outside dimensions, Open shape

	Length (in)	Angle (deg)	Radius (in)	Web	k Coef.	Hole Size (in)	Distance (in)
1	0.3100	180.000	0.084900	None	0.000	0.0000	0.1550
2	1.0000	90.000	0.084900	Single	0.000	0.0000	0.5000
3	3.9700	0.000	0.084900	Cee	0.000	0.0000	1.9850
4	1.0000	-90.000	0.084900	Single	0.000	0.0000	0.5000
5	0.3100	-180.000	0.084900	None	0.000	0.0000	0.1550

Full Section Properties

Area	0.34918 in ²	Wt.	0.0011872 k/ft	Flat	6.1693 in
Ix	0.03888 in ⁴	rx	0.3337 in	Ixy	0.00000 in ⁴
Sx(t)	0.15942 in ³	y(t)	0.2439 in	α	-90.000 deg
Sx(b)	0.05141 in ³	y(b)	0.7561 in		
Zx	0.07709 in ³	Height	1.0000 in		
Iy	0.75426 in ⁴	ry	1.4697 in	x _o	0.0000 in
Sy(1)	0.37998 in ³	x(1)	1.9850 in	y _o	0.5945 in
Sy(r)	0.37998 in ³	x(r)	1.9850 in	jx	0.0000 in
Zy	0.46190 in ³	Width	3.9700 in	jy	-2.2063 in

Rev. Date: 2/21/2023 8:27:09 AM
By: Sal
Printed: 2/13/2026 11:02:18 AM

I_1	0.75426 in ⁴	r_1	1.4697 in	Cw	0.11666 in ⁶
I_2	0.03888 in ⁴	r_2	0.3337 in	J	0.00037287 in ⁴
I_c	0.79314 in ⁴	r_c	1.5071 in		
I_o	0.91655 in ⁴	r_o	1.6201 in		

Fully Braced Strength - AISI S100-24, US, ASD

Material Type: A653 SS Grade 33, Fy=33 ksi

Axial		Positive Bending		Positive Bending	
Pao	5.2736 k	Maxo	1.0160 k-in	Mayo	7.5086 k-in
Ae	0.28765 in ²	Ixe	0.03888 in ⁴	Iye	0.75426 in ⁴
Ta	6.9000 k	Sxe(t)	0.15942 in ³	Sye(l)	0.37998 in ³
		Sxe(b)	0.05141 in ³	Sye(r)	0.37998 in ³
Shear		Negative Bending		Negative Bending	
Vay	0.9623 k	Maxo	1.0160 k-in	Mayo	7.5086 k-in
Vax	2.2217 k	Ixe	0.03888 in ⁴	Iye	0.75426 in ⁴
Torsion		Sxe(t)	0.15942 in ³	Sye(l)	0.37998 in ³
Ba	1.5725 k-in ²	Sxe(b)	0.05141 in ³	Sye(r)	0.37998 in ³

Rev. Date: 2/13/2026 10:55:00 AM
 By: Salvatore Granata
 Printed: 2/13/2026 11:02:20 AM



Analysis Inputs

General

Member Orientation: Horizontal
 Calculate global buckling using specification equations
 Do not include torsion in member checks

Members

Section File				Revision Date and Time			
1 8 - Walking Surface.cfss				2/21/2023 8:27:09 AM			
Material	Area (in ²)	Length (ft)	Weight (k)				
1 A653 SS Grade 33	0.34918	2.0000	0.0023744				
Total		2.0000	0.0023744				
Start Loc. (ft)	End Loc. (ft)	Braced Flange	R	kφ (k)	Lm (ft)	ex (in)	ey (in)
1 0.0000	2.0000	None	0.0000	0.0000	6.0000	0.000	0.000

Supports

Type	Location (ft)	Bearing (in)	Fastened	K
1 XYT	0.0000	2.00	No	1.0000
2 XYT	2.0000	2.00	No	1.0000

Loading: Dead Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude	
1 Distributed	90.000	0.0000	2.0000	-0.001665	-0.001665	k/ft

Loading: Live Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude	
1 Distributed	90.000	0.0000	2.0000	-0.033300	-0.033300	k/ft

Analysis: Walking Surface Analysis.cfsa
2 ft Span Simple Beam

Rev. Date: 2/13/2026 10:55:00 AM

By: Salvatore Granata

Printed: 2/13/2026 11:02:20 AM

Load Combination: D

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000

Load Combination: D+L

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Live Load	1.000
4 Product Load	1.000

Load Combination: D+0.75(L+Lr)

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Live Load	0.750
4 Product Load	0.750
5 Roof Live Load	0.750

Load Combination: 0.6D+0.6W

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	0.600
2 Dead Load	0.600
3 Wind Load	0.600

Load Combination: D+0.7E

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Earthquake Load	0.700

Load Combination: D+0.525E+0.75L+0.1S

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Earthquake Load	0.525
4 Live Load	0.750
5 Product Load	0.750
6 Snow Load	0.100

Rev. Date: 2/13/2026 10:55:00 AM
By: Salvatore Granata
Printed: 2/13/2026 11:02:20 AM

Load Combination: 0.6D+0.7E
Specification: AISI S100-24, US, ASD
Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	0.600
2 Dead Load	0.600
3 Earthquake Load	0.700

Member Check - AISI S100-24, US, ASD

Load Combination: D+L

Design Parameters at 1.0000 ft:

Lx	2.0000 ft	Ly	2.0000 ft	Lt	2.0000 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000

Section: 8 - Walking Surface.cfss

Material Type: A653 SS Grade 33, Fy=33 ksi

Cbx	1.1364	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in
Braced Flange: None	kφ	0 k			
Red. Factor, R: 0	Lm	6.0000 ft			

Loads:	P (k)	Mx (k-in)	Vy (k)	My (k-in)	Vx (k)
Total	0.0000	0.2169	0.0000	0.0000	0.0000
Applied	0.0000	0.2169	0.0000	0.0000	0.0000
Strength	4.3274	1.0160	0.9623	7.5086	2.2217

Interaction Equations

Eq. H1.2-1	(P, Mx, My)	$0.000 + 0.214 + 0.000 = 0.214 \leq 1.0$
Eq. H2-1	(Mx, Vy)	$\text{Sqrt}(0.046 + 0.000) = 0.214 \leq 1.0$
Eq. H2-1	(My, Vx)	$\text{Sqrt}(0.000 + 0.000) = 0.000 \leq 1.0$

Calculation of Mndy used αs=1 from DSM inputs.

Web Crippling Check - AISI S100-24, US, ASD

Load Combination: D+L

Parameters at 0.0000 ft:

Total Load: 0.036152 k on bottom flange

Total Moment: 0.0000 k-in

Bearing: 2.0000 in

Flange fastened to bearing surface: No

Distance from edge of bearing to edge of opposite load: 2.0000 ft

Section: 8 - Walking Surface.cfss

Material Type: A653 SS Grade 33, Fy=33 ksi

Applied Load: 0.03615 k on bottom flange

Applied Moment: 0.0000 k-in

Distance from edge of bearing to end of member: 0.0000 ft

Analysis: Walking Surface Analysis.cfsa
2 ft Span Simple Beam

Rev. Date: 2/13/2026 10:55:00 AM

By: Salvatore Granata

Printed: 2/13/2026 11:02:20 AM

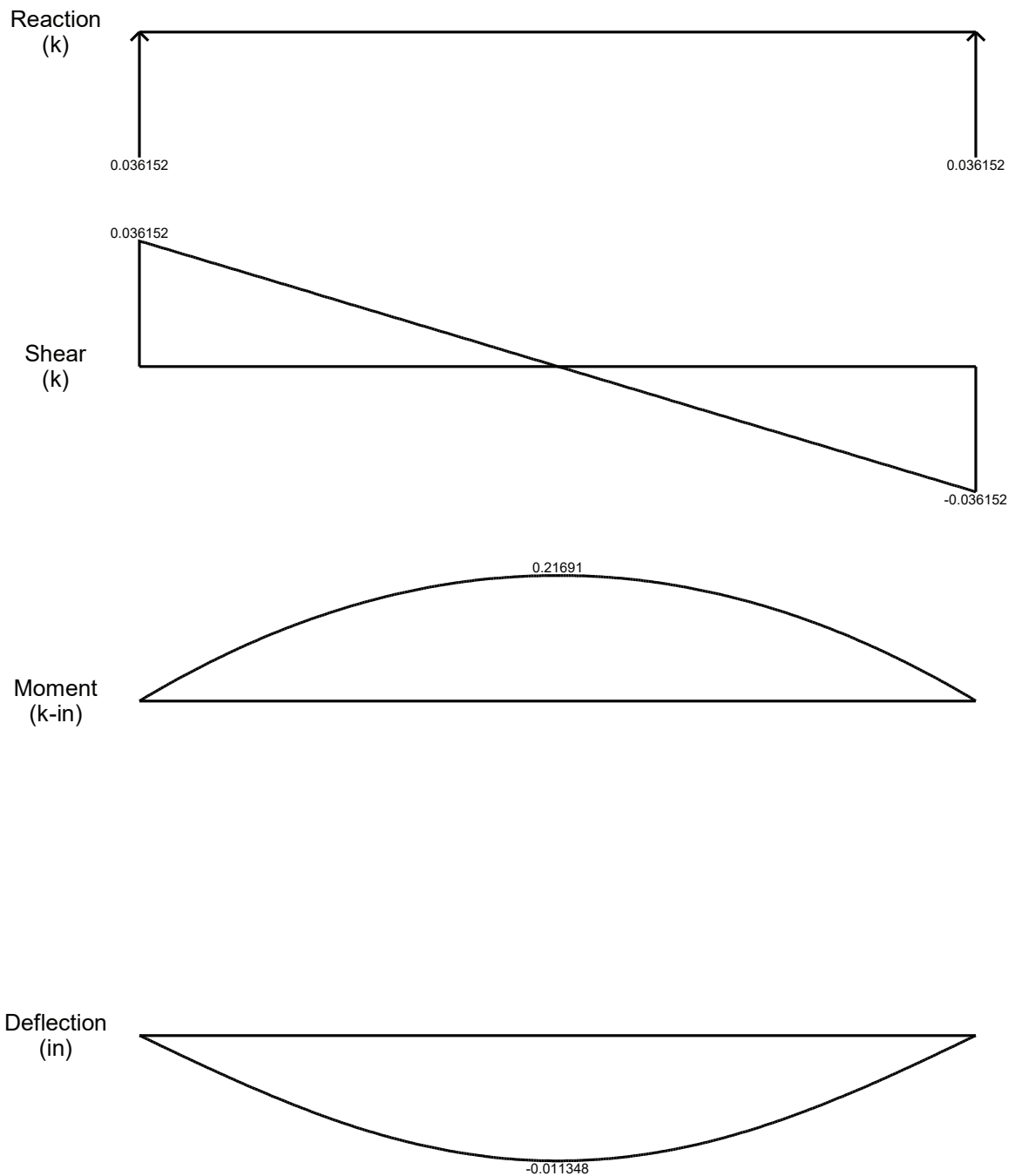
Part	Elem	Calculation Type	Pa (k)	Pay (k)	Notes
1	2	Single, UU-EOF	0.43994	0.43994	N/h>2
1	4	Single, UU-EOF	0.43994	0.43994	N/h>2
		Web Crippling Strength		0.87987	

Web Crippling Check: 0.03615 k <= 0.87987 k
 Moment Check: 0.0000 k-in <= 1.0160 k-in
 Interaction Equations
 Eq. H3-1a (P, M) $0.019 + 0.000 = 0.019 <= 0.665$

Rev. Date: 2/13/2026 10:55:00 AM
By: Salvatore Granata
Printed: 2/13/2026 10:57:40 AM

Item 3: Walking Surface

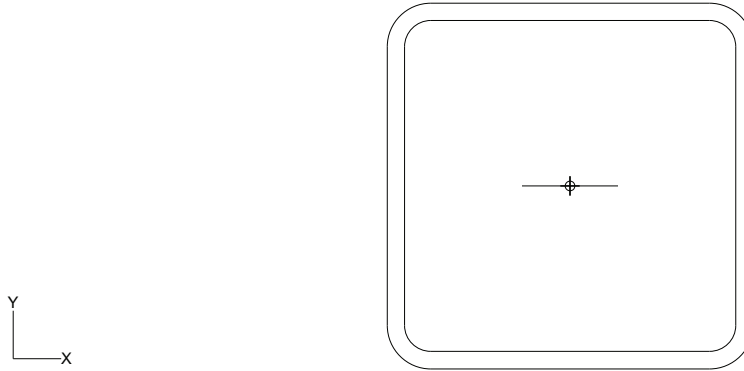
Load Combination: D+L, Y Direction



Allowable Deflection: $L / 240 = 2' * 12" / 240 = 0.10"$ OK

Rev. Date: 2/17/2023 6:16:26 PM
By: Sal
Printed: 2/13/2026 11:22:11 AM

Item 4: Stair Stinger



Section Inputs

Material: A653 SS Grade 33
No cold work of forming strength increase.
No inelastic reserve strength increase.
Modulus of Elasticity, E 29500 ksi
Yield Strength, Fy 33 ksi
Tensile Strength, Fu 45 ksi
Min Elongation in 2 inches 20 %
Torsion Constant Override, J 0 in⁴
Warping Constant Override, Cw 0 in⁶

Tube, Thickness 0.0713 in (68 mil)

Placement of Part from Origin:

X to center of gravity 0 in

Y to center of gravity 0 in

Outside dimensions, Closed shape

	Length (in)	Angle (deg)	Radius (in)	Web	k Coef.	Hole Size (in)	Distance (in)
1	1.5000	0.000	0.10690	Single	0.000	0.0000	0.7500
2	1.5000	90.000	0.10690	Single	0.000	0.0000	0.7500
3	1.5000	180.000	0.10690	Single	0.000	0.0000	0.7500
4	1.5000	-90.000	0.10690	Single	0.000	0.0000	0.7500

Full Section Properties

Area	0.39002 in ²	Wt.	0.0013261 k/ft	Flat	5.4701 in
Ix	0.12939 in ⁴	rx	0.57599 in	Ixy	0.00000 in ⁴
Sx(t)	0.17253 in ³	y(t)	0.75000 in	α	0.000 deg
Sx(b)	0.17253 in ³	y(b)	0.75000 in		
Zx	0.20555 in ³	Height	1.50000 in		
Iy	0.12939 in ⁴	ry	0.57599 in	x _o	0.00000 in
Sy(l)	0.17253 in ³	x(l)	0.75000 in	y _o	0.00000 in
Sy(r)	0.17253 in ³	x(r)	0.75000 in	jx	0.00000 in
Zy	0.20555 in ³	Width	1.50000 in	jy	0.00000 in

Rev. Date: 2/17/2023 6:16:26 PM
By: Sal
Printed: 2/13/2026 11:22:11 AM

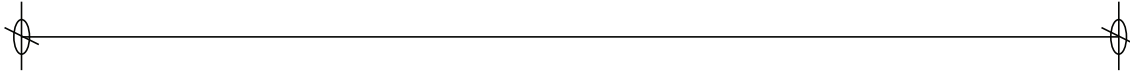
I_1	0.12939 in ⁴	r_1	0.57599 in	Cw	0.00003 in ⁶
I_2	0.12939 in ⁴	r_2	0.57599 in	J	0.21353 in ⁴
I_c	0.25879 in ⁴	r_c	0.81458 in		
I_o	0.25879 in ⁴	r_o	0.81458 in		

Fully Braced Strength - AISI S100-24, US, ASD

Material Type: A653 SS Grade 33, Fy=33 ksi

Axial		Positive Bending		Positive Bending	
Pao	7.1503 k	Maxo	3.4092 k-in	Mayo	3.4092 k-in
Ae	0.39002 in ²	Ixe	0.12939 in ⁴	Iye	0.12939 in ⁴
Ta	7.7069 k	Sxe(t)	0.17253 in ³	Sye(l)	0.17253 in ³
		Sxe(b)	0.17253 in ³	Sye(r)	0.17253 in ³
Shear		Negative Bending		Negative Bending	
Vay	1.9335 k	Maxo	3.4092 k-in	Mayo	3.4092 k-in
Vax	1.9335 k	Ixe	0.12939 in ⁴	Iye	0.12939 in ⁴
Torsion		Sxe(t)	0.17253 in ³	Sye(l)	0.17253 in ³
Ba	0.041099 k-in ²	Sxe(b)	0.17253 in ³	Sye(r)	0.17253 in ³

Rev. Date: 2/13/2026 11:19:52 AM
 By: Salvatore Granata
 Printed: 2/13/2026 11:22:12 AM



Analysis Inputs

General

Member Orientation: Horizontal
 Calculate global buckling using specification equations
 Do not include torsion in member checks

Members

Section File				Revision Date and Time			
1 9 - Stair Stringers.cfss				2/17/2023 6:16:26 PM			
Material	Area (in ²)	Length (ft)	Weight (k)				
1 A653 SS Grade 33	0.39002	4.1000	0.0054368				
Total		4.1000	0.0054368				
Start Loc. (ft)	End Loc. (ft)	Braced Flange	R	kφ (k)	Lm (ft)	ex (in)	ey (in)
1 0.0000	4.1000	None	0.0000	0.0000	4.1000	0.000	0.000

Supports

Type	Location (ft)	Bearing (in)	Fastened	K
1 Y	0.0000	2.00	No	1.0000
2 XT	0.0000	2.00	No	1.0000
3 Y	4.1000	2.00	No	1.0000
4 XT	4.1000	2.00	No	1.0000

Loading: Dead Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude
1 Distributed	90.000	0.0000	4.1000	-0.00563	-0.00563 k/ft

Loading: Live Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude
1 Distributed	90.000	0.0000	4.1000	-0.11260	-0.11260 k/ft

Analysis: Stair Stringer Analysis.cfsa
4.1 ft Span Simple Beam

Rev. Date: 2/13/2026 11:19:52 AM

By: Salvatore Granata

Printed: 2/13/2026 11:22:12 AM

Load Combination: D

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000

Load Combination: D+L

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Live Load	1.000
4 Product Load	1.000

Load Combination: D+0.75(L+Lr)

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Live Load	0.750
4 Product Load	0.750
5 Roof Live Load	0.750

Load Combination: 0.6D+0.6W

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	0.600
2 Dead Load	0.600
3 Wind Load	0.600

Load Combination: D+0.7E

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Earthquake Load	0.700

Load Combination: D+0.525E+0.75L+0.1S

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Earthquake Load	0.525
4 Live Load	0.750
5 Product Load	0.750
6 Snow Load	0.100

Analysis: Stair Stringer Analysis.cfsa
4.1 ft Span Simple Beam

Rev. Date: 2/13/2026 11:19:52 AM
By: Salvatore Granata
Printed: 2/13/2026 11:22:12 AM

Load Combination: 0.6D+0.7E
Specification: AISI S100-24, US, ASD
Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	0.600
2 Dead Load	0.600
3 Earthquake Load	0.700

Member Check - AISI S100-24, US, ASD

Load Combination: D+L

Design Parameters at 2.0500 ft:

Lx	4.1000 ft	Ly	4.1000 ft	Lt	4.1000 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000

Section: 9 - Stair Stringers.cfss

Material Type: A653 SS Grade 33, Fy=33 ksi

Cbx	1.1364	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in
Braced Flange: None	kφ	0 k			
Red. Factor, R: 0	Lm	4.1000 ft			

Loads:	P (k)	Mx (k-in)	Vy (k)	My (k-in)	Vx (k)
Total	0.0000	3.0146	0.0000	0.0000	0.0000
Applied	0.0000	3.0146	0.0000	0.0000	0.0000
Strength	5.0583	3.4092	1.9335	3.4092	1.9335

Interaction Equations

Eq. H1.2-1	(P, Mx, My)	$0.000 + 0.884 + 0.000 = 0.884 \leq 1.0$
Eq. H2-1	(Mx, Vy)	$\text{Sqrt}(0.782 + 0.000) = 0.884 \leq 1.0$
Eq. H2-1	(My, Vx)	$\text{Sqrt}(0.000 + 0.000) = 0.000 \leq 1.0$

Web Crippling Check - AISI S100-24, US, ASD

Load Combination: D+L

Parameters at 4.1000 ft:

Total Load: 0.24509 k on bottom flange

Total Moment: 0.0000 k-in

Bearing: 2.0000 in

Flange fastened to bearing surface: No

Distance from edge of bearing to edge of opposite load: 4.1000 ft

Section: 9 - Stair Stringers.cfss

Material Type: A653 SS Grade 33, Fy=33 ksi

Applied Load: 0.2451 k on bottom flange

Applied Moment: 0.0000 k-in

Distance from edge of bearing to end of member: 0.0000 ft

Analysis: Stair Stringer Analysis.cfsa
4.1 ft Span Simple Beam

Rev. Date: 2/13/2026 11:19:52 AM

By: Salvatore Granata

Printed: 2/13/2026 11:22:12 AM

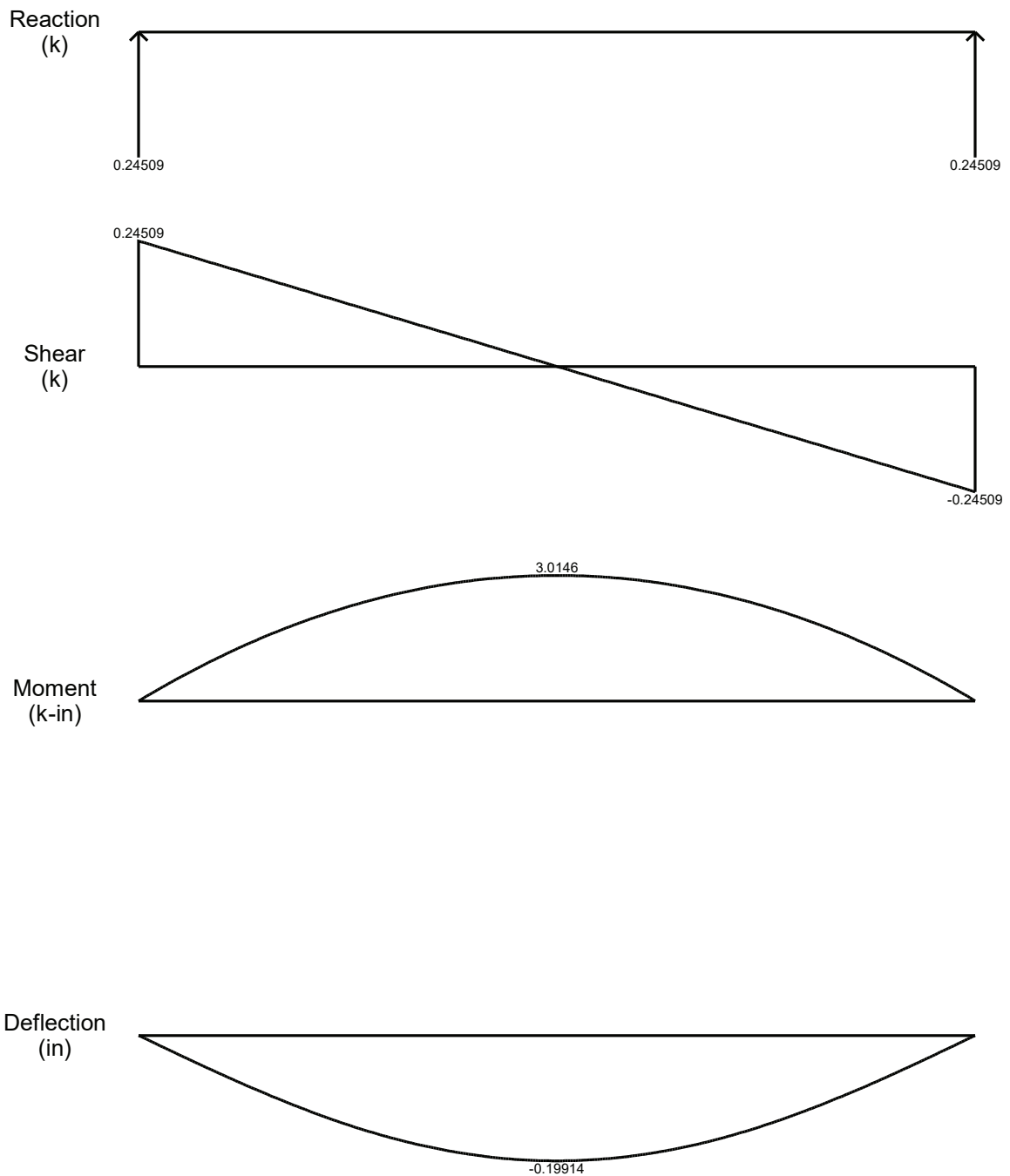
Part	Elem	Calculation Type	Pa (k)	Pay (k)	Notes
1	2	Single, US-EOF	0.7890	0.7890	
1	4	Single, US-EOF	0.7890	0.7890	
		Web Crippling Strength		1.5779	

Web Crippling Check: 0.2451 k <= 1.5779 k
 Moment Check: 0.0000 k-in <= 3.4092 k-in
 Interaction Equations
 Eq. H3-1a (P, M) $0.076 + 0.000 = 0.076 <= 0.782$

Rev. Date: 2/13/2026 11:19:52 AM
By: Salvatore Granata
Printed: 2/13/2026 11:22:27 AM

Item 4: Stair Stinger

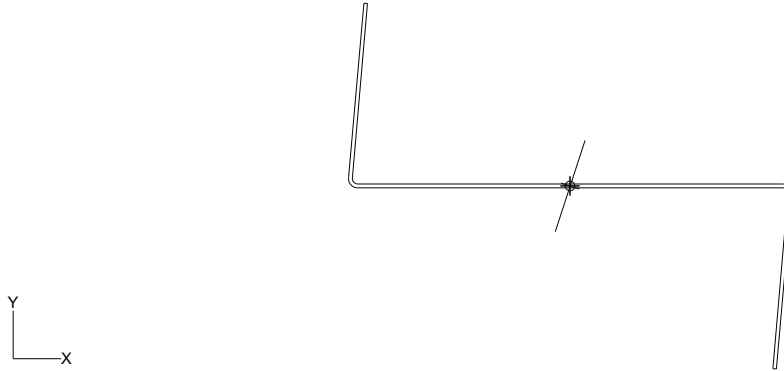
Load Combination: D+L, Y Direction



Allowable Deflection: $L / 240 = 4' * 12" / 240 = 0.20"$ OK

Rev. Date: 2/23/2023 5:50:56 PM
By: Sal
Printed: 2/13/2026 11:29:08 AM

Item 5: Stair Treads



Section Inputs

Material: A653 SS Grade 33
Apply cold work of forming strength increase.
No inelastic reserve strength increase.
Modulus of Elasticity, E 29500 ksi
Yield Strength, Fy 33 ksi
Tensile Strength, Fu 45 ksi
Min Elongation in 2 inches 20 %
Torsion Constant Override, J 0 in⁴
Warping Constant Override, Cw 0 in⁶

Angle, Thickness 0.1017 in (97 mil)

Placement of Part from Origin:

X to center of gravity 0 in

Y to center of gravity 0 in

Outside dimensions, Open shape

	Length (in)	Angle (deg)	Radius (in)	Web	k Coef.	Hole Size (in)	Distance (in)
1	5.000	-95.000	0.15250	Single	0.000	0.000	2.500
2	12.000	0.000	0.15250	Single	0.000	0.000	6.000
3	5.000	265.000	0.15250	Single	0.000	0.000	2.500

Full Section Properties

Area	2.1931 in ²	Wt.	0.0074566 k/ft	Flat	21.565 in
Ix	8.135 in ⁴	rx	1.9259 in	Ixy	-14.015 in ⁴
Sx(t)	1.6500 in ³	y(t)	4.9301 in	α	71.923 deg
Sx(b)	1.6500 in ³	y(b)	4.9301 in		
Zx	2.5069 in ³	Height	9.8602 in		
Iy	46.496 in ⁴	ry	4.6044 in	x _o	0.0000 in
Sy(l)	7.7794 in ³	x(l)	5.9768 in	y _o	0.0000 in
Sy(r)	7.7794 in ³	x(r)	5.9768 in	jx	0.0000 in
Zy	9.2261 in ³	Width	11.9536 in	jy	0.0000 in

Rev. Date: 2/23/2023 5:50:56 PM
By: Sal
Printed: 2/13/2026 11:29:08 AM

I_1	51.071 in ⁴	r_1	4.8256 in	Cw	188.18 in ⁶
I_2	3.560 in ⁴	r_2	1.2741 in	J	0.007561 in ⁴
I_c	54.631 in ⁴	r_c	4.9910 in		
I_o	54.631 in ⁴	r_o	4.9910 in		

Fully Braced Strength - AISI S100-24, US, ASD

Material Type: A653 SS Grade 33, Fy=33 ksi

Axial		Positive Bending		Positive Bending	
Pao	17.284 k	Maxo	18.48 k-in	Mayo	101.90 k-in
Ae	0.94274 in ²	Ixe	4.170 in ⁴	Iye	35.432 in ⁴
Ta	44.136 k	Sxe(t)	1.3986 in ³	Sye(l)	6.9710 in ³
		Sxe(b)	0.9353 in ³	Sye(r)	5.1569 in ³
Shear		Negative Bending		Negative Bending	
Vay	11.346 k	Maxo	18.48 k-in	Mayo	101.90 k-in
Vax	9.257 k	Ixe	4.170 in ⁴	Iye	35.432 in ⁴
Torsion		Sxe(t)	0.9353 in ³	Sye(l)	5.1569 in ³
Ba	164.87 k-in ²	Sxe(b)	1.3986 in ³	Sye(r)	6.9710 in ³

Rev. Date: 2/13/2026 11:27:49 AM

Printed: 2/13/2026 11:29:10 AM



Analysis Inputs

General

Member Orientation: Horizontal
 Calculate global buckling using specification equations
 Do not include torsion in member checks

Members

Section File				Revision Date and Time			
1 10 - Stair Tread.cfss				2/23/2023 5:50:56 PM			
Material	Area (in ²)	Length (ft)	Weight (k)				
1 A653 SS Grade 33	2.1931	3.6667	0.027341				
Total		3.6667	0.027341				
Start Loc. (ft)	End Loc. (ft)	Braced Flange	R	kφ (k)	Lm (ft)	ex (in)	ey (in)
1 0.0000	3.6667	None	0.0000	0.0000	3.6667	0.000	0.000

Supports

Type	Location (ft)	Bearing (in)	Fastened	K
1 XYT	0.0000	2.00	No	1.0000
2 XYT	3.6667	2.00	No	1.0000

Loading: Dead Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude
1 Distributed	90.000	0.0000	3.6667	-0.00500	-0.00500 k/ft

Loading: Live Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude
1 Distributed	90.000	0.0000	3.6667	-0.10000	-0.10000 k/ft

Analysis: Stair Tread Analysis.cfsa
3.6667 ft Span Simple Beam

Rev. Date: 2/13/2026 11:27:49 AM

Printed: 2/13/2026 11:29:10 AM

Load Combination: D

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000

Load Combination: D+L

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Live Load	1.000
4 Product Load	1.000

Load Combination: D+0.75(L+Lr)

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Live Load	0.750
4 Product Load	0.750
5 Roof Live Load	0.750

Load Combination: 0.6D+0.6W

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	0.600
2 Dead Load	0.600
3 Wind Load	0.600

Load Combination: D+0.7E

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Earthquake Load	0.700

Load Combination: D+0.525E+0.75L+0.1S

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Earthquake Load	0.525
4 Live Load	0.750
5 Product Load	0.750
6 Snow Load	0.100

Rev. Date: 2/13/2026 11:27:49 AM

Printed: 2/13/2026 11:29:10 AM

Load Combination: 0.6D+0.7E
Specification: AISI S100-24, US, ASD
Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	0.600
2 Dead Load	0.600
3 Earthquake Load	0.700

Member Check - AISI S100-24, US, ASD

Load Combination: D+L

Design Parameters at 1.8334 ft:

Lx	3.6667 ft	Ly	3.6667 ft	Lt	3.6667 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000

Section: 10 - Stair Tread.cfss

Material Type: A653 SS Grade 33, Fy=33 ksi

Cbx	1.1364	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in
Braced Flange:	None	kφ	0 k		
Red. Factor, R:	0	Lm	3.6667 ft		

Loads:	P (k)	Mx (k-in)	Vy (k)	My (k-in)	Vx (k)
Total	0.000	2.27	0.000	0.00	0.000
Applied	0.000	2.27	0.000	0.00	0.000
Strength	16.717	18.48	11.346	101.90	9.257

Interaction Equations

Eq. H1.2-1 (P, Mx, My) $0.000 + 0.123 + 0.000 = 0.123 \leq 1.0$
Eq. H2-1 (Mx, Vy) $\text{Sqrt}(0.015 + 0.000) = 0.123 \leq 1.0$
Eq. H2-1 (My, Vx) $\text{Sqrt}(0.000 + 0.000) = 0.000 \leq 1.0$

Web Crippling Check - AISI S100-24, US, ASD

Load Combination: D+L

Parameters at 0.0000 ft:

Total Load: 0.20617 k on bottom flange

Total Moment: 0.0000 k-in

Bearing: 2.0000 in

Flange fastened to bearing surface: No

Distance from edge of bearing to edge of opposite load: 3.6667 ft

Section: 10 - Stair Tread.cfss

Material Type: A653 SS Grade 33, Fy=33 ksi

Applied Load: 0.2062 k on bottom flange

Applied Moment: 0.000 k-in

Distance from edge of bearing to end of member: 0.0000 ft

Analysis: Stair Tread Analysis.cfsa
 3.6667 ft Span Simple Beam

Rev. Date: 2/13/2026 11:27:49 AM

Printed: 2/13/2026 11:29:10 AM

Part	Elem	Calculation Type	Pa (k)	Pay (k)	Notes
1	1	Single, US-EOF	1.2420	1.2420	$\theta > 90^\circ$
1	3	Single, US-EOF	1.6267	1.6329	
		Web Crippling Strength		2.8749	

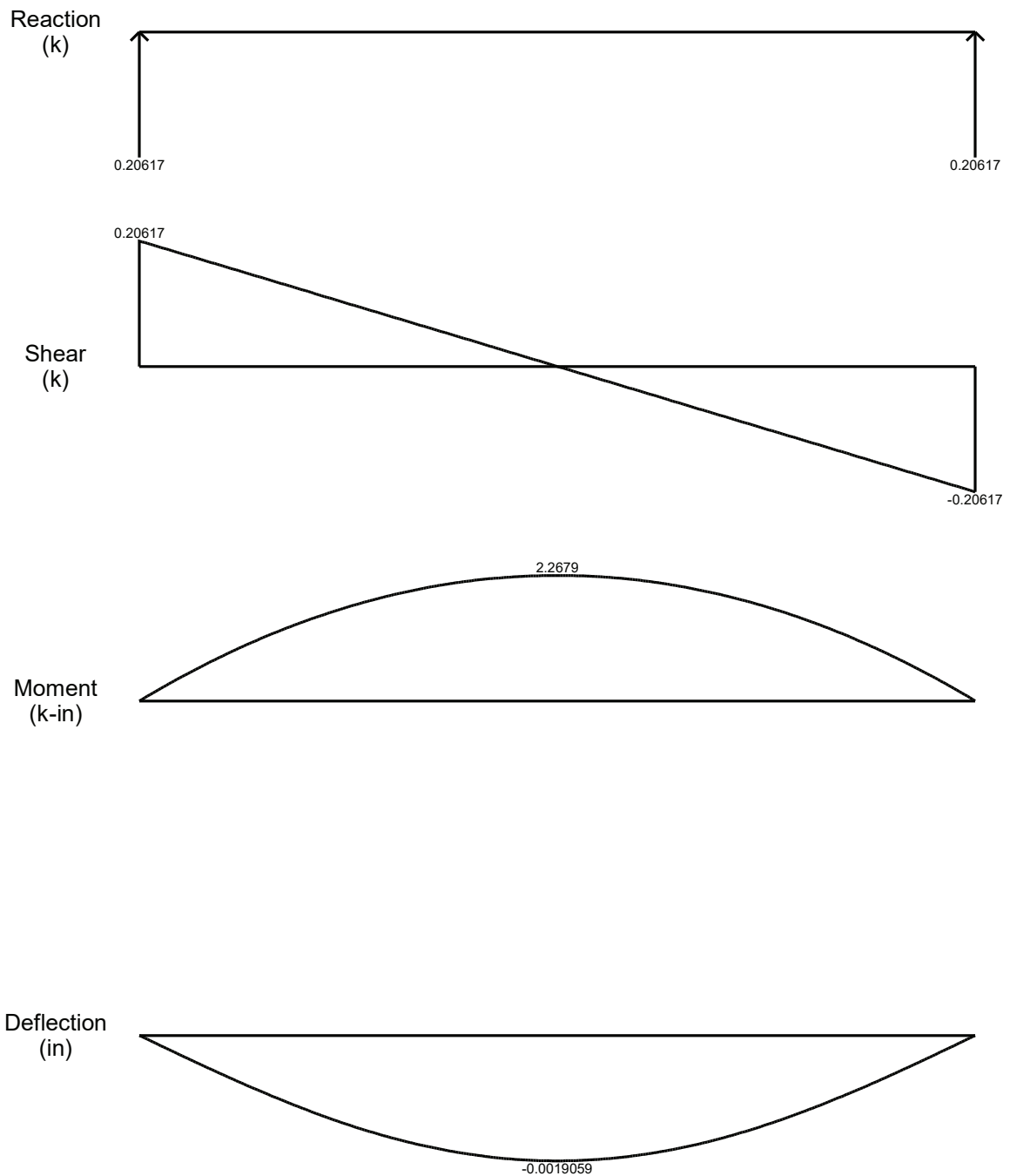
Web Crippling Check: 0.2062 k <= 2.8749 k
 Moment Check: 0.000 k-in <= 18.481 k-in
 Interaction Equations
 Eq. H3-1a (P, M) $0.034 + 0.000 = 0.034 <= 0.665$

Rev. Date: 2/13/2026 11:27:49 AM

Printed: 2/13/2026 11:29:23 AM

Item 6: Stair Treads

Load Combination: D+L, Y Direction



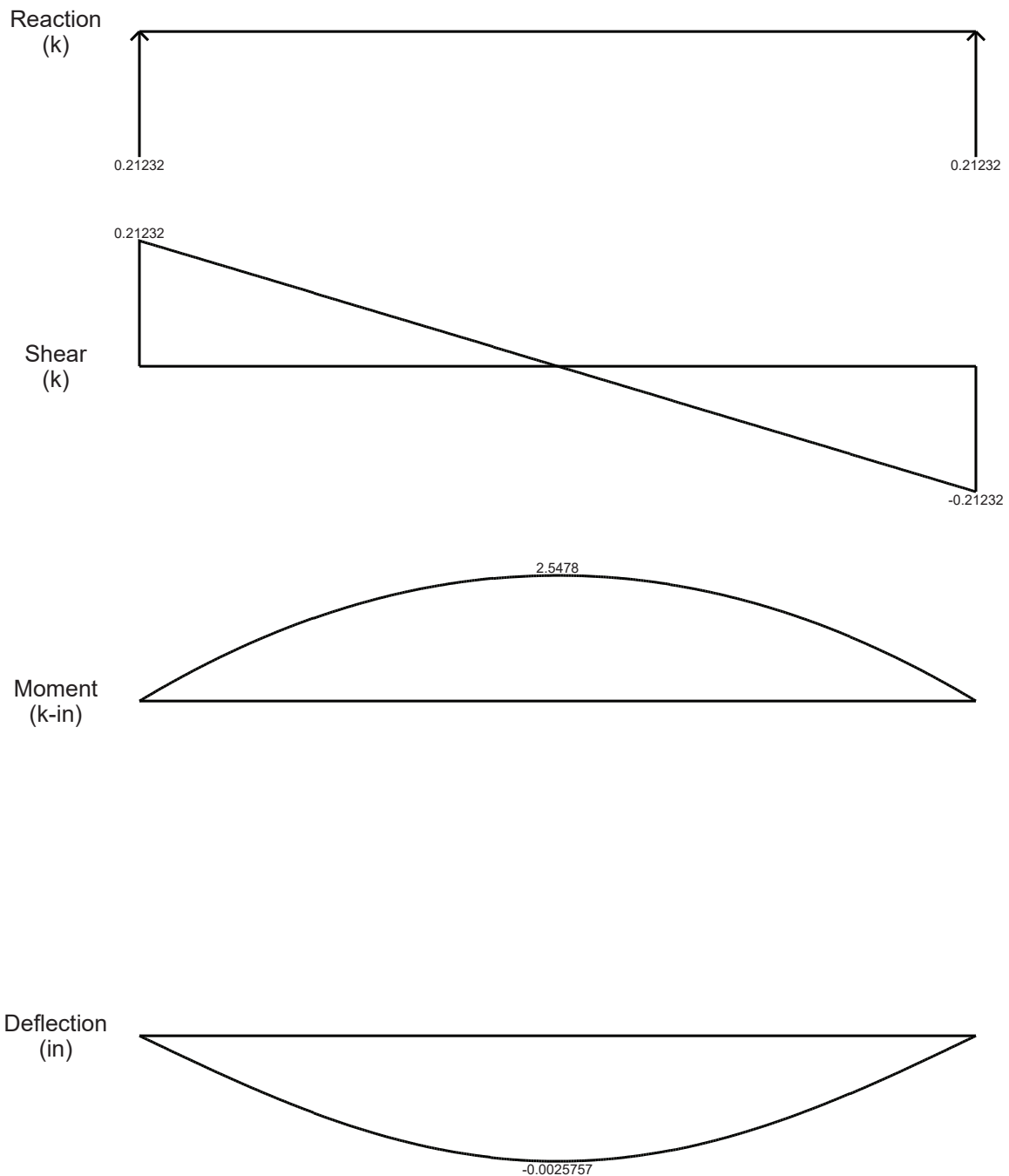
Allowable Deflection: $L / 240 = 4' * 12" / 240 = 0.20"$ OK

Rev. Date: 2/13/2026 11:27:49 AM

Printed: 2/13/2026 11:29:23 AM

Item 5: Stair Treads

Load Combination: D+L, Y Direction



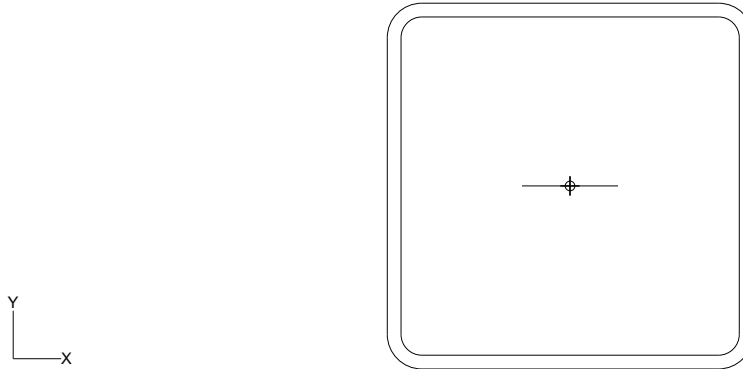
Allowable Deflection: $L / 240 = 4.5' * 12" / 240 = 0.225"$ OK

Rev. Date: 2/24/2023 1:17:02 PM

By: Sal

Printed: 2/13/2026 11:42:54 AM

Item 10: Platform Leg Seismic Load



Section Inputs

Material: A653 SS Grade 33

No cold work of forming strength increase.

No inelastic reserve strength increase.

Modulus of Elasticity, E 29500 ksi

Yield Strength, Fy 33 ksi

Tensile Strength, Fu 45 ksi

Min Elongation in 2 inches 20 %

Torsion Constant Override, J 0 in⁴Warping Constant Override, Cw 0 in⁶

Tube, Thickness 0.0566 in (54 mil)

Placement of Part from Origin:

X to center of gravity 0 in

Y to center of gravity 0 in

Outside dimensions, Closed shape

	Length (in)	Angle (deg)	Radius (in)	Web	k Coef.	Hole Size (in)	Distance (in)
1	1.5000	0.000	0.084900	Single	0.000	0.0000	0.7500
2	1.5000	90.000	0.084900	Single	0.000	0.0000	0.7500
3	1.5000	180.000	0.084900	Single	0.000	0.0000	0.7500
4	1.5000	-90.000	0.084900	Single	0.000	0.0000	0.7500

Full Section Properties

Area	0.31579 in ²	Wt.	0.0010737 k/ft	Flat	5.5793 in
Ix	0.10758 in ⁴	rx	0.58367 in	Ixy	0.00000 in ⁴
Sx(t)	0.14344 in ³	y(t)	0.75000 in	α	0.000 deg
Sx(b)	0.14344 in ³	y(b)	0.75000 in		
Zx	0.16880 in ³	Height	1.50000 in		
Iy	0.10758 in ⁴	ry	0.58367 in	x _o	0.00000 in
Sy(l)	0.14344 in ³	x(l)	0.75000 in	y _o	0.00000 in
Sy(r)	0.14344 in ³	x(r)	0.75000 in	jx	0.00000 in
Zy	0.16880 in ³	Width	1.50000 in	jy	0.00000 in

Section: 11 - Item 10 Platform Leg Tube 1.5x1.5-16 Gage.cfss
 Tube 1.5x1.5-16 Gage

Rev. Date: 2/24/2023 1:17:02 PM

By: Sal

Printed: 2/13/2026 11:42:54 AM

I_1	0.10758 in ⁴	r_1	0.58367 in	Cw	0.00002 in ⁶
I_2	0.10758 in ⁴	r_2	0.58367 in	J	0.17428 in ⁴
I_c	0.21516 in ⁴	r_c	0.82544 in		
I_o	0.21516 in ⁴	r_o	0.82544 in		

Fully Braced Strength - AISI S100-24, US, ASD

Material Type: A653 SS Grade 33, Fy=33 ksi

Axial		Positive Bending		Positive Bending	
Pao	5.7894 k	Maxo	2.8344 k-in	Mayo	2.8344 k-in
Ae	0.31579 in ²	Ixe	0.10758 in ⁴	Iye	0.10758 in ⁴
Ta	6.2401 k	Sxe(t)	0.14344 in ³	Sye(l)	0.14344 in ³
		Sxe(b)	0.14344 in ³	Sye(r)	0.14344 in ³
Shear		Negative Bending		Negative Bending	
Vay	1.6334 k	Maxo	2.8344 k-in	Mayo	2.8344 k-in
Vax	1.6334 k	Ixe	0.10758 in ⁴	Iye	0.10758 in ⁴
		Sxe(t)	0.14344 in ³	Sye(l)	0.14344 in ³
Torsion		Sxe(b)	0.14344 in ³	Sye(r)	0.14344 in ³
Ba	0.028691 k-in ²				

Member Check - AISI S100-24, US, ASD

Material Type: A653 SS Grade 33, Fy=33 ksi

Design Parameters:

Lx	3.2500 ft	Ly	3.2500 ft	Lt	0.0000 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000
Cbx	1.0000	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in
Braced Flange:	None	kφ	0 k		
Red. Factor, R:	0	Lm	3.2500 ft		

Loads:	P (k)	Mx (k-in)	Vy (k)	My (k-in)	Vx (k)
Entered	0.0675	2.6618	0.0683	0.0000	0.0000
Applied	0.0675	2.6758	0.0683	0.0000	0.0000
Strength	4.6843	2.8344	1.6334	2.8344	1.6334

Interaction Equations

Eq. H1.2-1	(P, Mx, My)	$0.014 + 0.944 + 0.000 = 0.958 \leq 1.0$
Eq. H2-1	(Mx, Vy)	$\text{Sqrt}(0.891 + 0.002) = 0.945 \leq 1.0$
Eq. H2-1	(My, Vx)	$\text{Sqrt}(0.000 + 0.000) = 0.000 \leq 1.0$

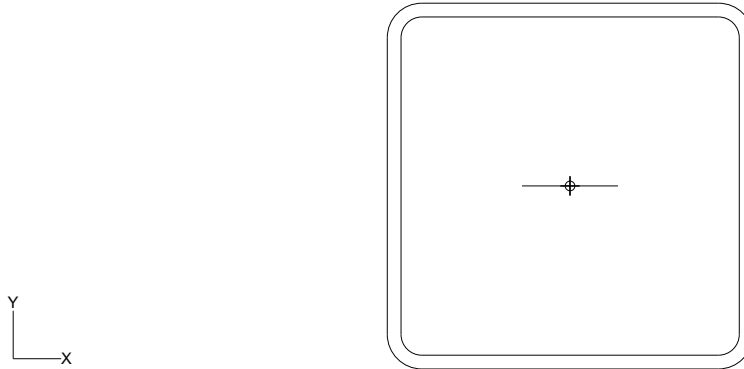
Section: 12 - Item 10 Platform Leg Tube 1.5x1.5-16 Gage - D + L.cfss
 Tube 1.5x1.5-16 Gage

Rev. Date: 2/24/2023 1:17:02 PM

By: Sal

Printed: 2/13/2026 11:49:18 AM

Item 10: Platform Leg D + L



Section Inputs

Material: A653 SS Grade 33

No cold work of forming strength increase.

No inelastic reserve strength increase.

Modulus of Elasticity, E 29500 ksi

Yield Strength, Fy 33 ksi

Tensile Strength, Fu 45 ksi

Min Elongation in 2 inches 20 %

Torsion Constant Override, J 0 in⁴

Warping Constant Override, Cw 0 in⁶

Tube, Thickness 0.0566 in (54 mil)

Placement of Part from Origin:

X to center of gravity 0 in

Y to center of gravity 0 in

Outside dimensions, Closed shape

	Length (in)	Angle (deg)	Radius (in)	Web	k Coef.	Hole Size (in)	Distance (in)
1	1.5000	0.000	0.084900	Single	0.000	0.0000	0.7500
2	1.5000	90.000	0.084900	Single	0.000	0.0000	0.7500
3	1.5000	180.000	0.084900	Single	0.000	0.0000	0.7500
4	1.5000	-90.000	0.084900	Single	0.000	0.0000	0.7500

Full Section Properties

Area	0.31579 in ²	Wt.	0.0010737 k/ft	Flat	5.5793 in
Ix	0.10758 in ⁴	rx	0.58367 in	Ixy	0.00000 in ⁴
Sx(t)	0.14344 in ³	y(t)	0.75000 in	α	0.000 deg
Sx(b)	0.14344 in ³	y(b)	0.75000 in		
Zx	0.16880 in ³	Height	1.50000 in		
Iy	0.10758 in ⁴	ry	0.58367 in	x _o	0.00000 in
Sy(l)	0.14344 in ³	x(l)	0.75000 in	y _o	0.00000 in
Sy(r)	0.14344 in ³	x(r)	0.75000 in	jx	0.00000 in
Zy	0.16880 in ³	Width	1.50000 in	jy	0.00000 in

Section: 12 - Item 10 Platform Leg Tube 1.5x1.5-16 Gage - D + L.cfss
Tube 1.5x1.5-16 Gage

Rev. Date: 2/24/2023 1:17:02 PM

By: Sal

Printed: 2/13/2026 11:49:18 AM

I_1	0.10758 in ⁴	r_1	0.58367 in	Cw	0.00002 in ⁶
I_2	0.10758 in ⁴	r_2	0.58367 in	J	0.17428 in ⁴
I_c	0.21516 in ⁴	r_c	0.82544 in		
I_o	0.21516 in ⁴	r_o	0.82544 in		

Fully Braced Strength - AISI S100-24, US, ASD

Material Type: A653 SS Grade 33, Fy=33 ksi

Axial		Positive Bending		Positive Bending	
Pao	5.7894 k	Maxo	2.8344 k-in	Mayo	2.8344 k-in
Ae	0.31579 in ²	Ixe	0.10758 in ⁴	Iye	0.10758 in ⁴
Ta	6.2401 k	Sxe(t)	0.14344 in ³	Sye(l)	0.14344 in ³
		Sxe(b)	0.14344 in ³	Sye(r)	0.14344 in ³

Shear

Vay		Negative Bending		Negative Bending	
Vay	1.6334 k	Maxo	2.8344 k-in	Mayo	2.8344 k-in
Vax	1.6334 k	Ixe	0.10758 in ⁴	Iye	0.10758 in ⁴
		Sxe(t)	0.14344 in ³	Sye(l)	0.14344 in ³
		Sxe(b)	0.14344 in ³	Sye(r)	0.14344 in ³

Member Check - AISI S100-24, US, ASD

Material Type: A653 SS Grade 33, Fy=33 ksi

Design Parameters:

Lx	3.2500 ft	Ly	3.2500 ft	Lt	0.0000 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000
Cbx	1.0000	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in
Braced Flange:	None	kφ	0 k		
Red. Factor, R:	0	Lm	3.2500 ft		

Loads:	P (k)	Mx (k-in)	Vy (k)	My (k-in)	Vx (k)
Entered	1.4175	0.0000	0.0000	0.0000	0.0000
Applied	1.4175	0.0000	0.0000	0.0000	0.0000
Strength	4.6843	2.8344	1.6334	2.8344	1.6334

Interaction Equations

Eq. H1.2-1	(P, Mx, My)	$0.303 + 0.000 + 0.000 = 0.303 \leq 1.0$
Eq. H2-1	(Mx, Vy)	$\text{Sqrt}(0.000 + 0.000) = 0.000 \leq 1.0$
Eq. H2-1	(My, Vx)	$\text{Sqrt}(0.000 + 0.000) = 0.000 \leq 1.0$

Rev. Date: 2/20/2023 9:36:29 AM
By: Sal
Printed: 2/13/2026 11:56:47 AM

Item 2: Main Frame Side Rails
Trib Width = 2.25'



Section Inputs

Material: A653 SS Grade 33
Apply cold work of forming strength increase.
No inelastic reserve strength increase.
Modulus of Elasticity, E 29500 ksi
Yield Strength, Fy 33 ksi
Tensile Strength, Fu 45 ksi
Min Elongation in 2 inches 20 %
Torsion Constant Override, J 0 in⁴
Warping Constant Override, Cw 0 in⁶

Part 1, Thickness 0.0566 in (54 mil)
Placement of Part from Origin:
X to center of gravity 0 in
Y to center of gravity 0 in
Outside dimensions, Open shape

	Length (in)	Angle (deg)	Radius (in)	Web	k Coef.	Hole Size (in)	Distance (in)
1	0.6250	0.000	0.084900	None	0.000	0.0000	0.3125
2	4.0000	90.000	0.084900	None	0.000	0.0000	2.0000
3	0.3564	180.000	0.084900	None	0.000	0.0000	0.0891
4	1.0000	-90.000	0.084900	None	0.000	0.0000	0.5000
5	1.1920	180.000	0.084900	None	0.000	0.0000	0.5960

Full Section Properties

Area	0.38220 in ²	Wt.	0.0012995 k/ft	Flat	6.7527 in
Ix	0.6153 in ⁴	rx	1.2688 in	Ixy	-0.0427 in ⁴
Sx(t)	0.35742 in ³	y(t)	1.7215 in	α	4.282 deg
Sx(b)	0.27005 in ³	y(b)	2.2785 in		
Zx	0.40722 in ³	Height	4.0000 in		
Iy	0.0486 in ⁴	ry	0.3565 in	x _o	0.4042 in
Sy(l)	0.03915 in ³	x(l)	1.2408 in	y _o	1.0135 in
Sy(r)	0.19350 in ³	x(r)	0.2510 in	jx	-0.7803 in
Zy	0.08639 in ³	Width	1.4918 in	jy	-1.3515 in

Rev. Date: 2/20/2023 9:36:29 AM
 By: Sal
 Printed: 2/13/2026 11:56:47 AM

I_1	0.6185 in ⁴	r_1	1.2721 in	Cw	0.035342 in ⁶
I_2	0.0454 in ⁴	r_2	0.3446 in	J	0.00040813 in ⁴
I_c	0.6639 in ⁴	r_c	1.3179 in		
I_o	1.1189 in ⁴	r_o	1.7110 in		

Fully Braced Strength - AISI S100-24, US, ASD

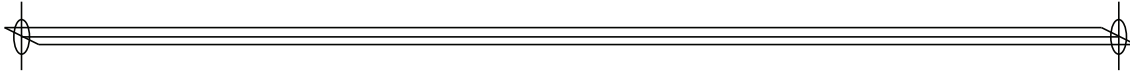
Material Type: A653 SS Grade 33, Fy=33 ksi

Axial		Positive Bending		Positive Bending	
Pao	4.3648 k	Maxo	5.5971 k-in	Mayo	0.7735 k-in
Ae	0.26453 in ²	Ixe	0.61530 in ⁴	Iye	0.04857 in ⁴
Ta	8.0210 k	Sxe(t)	0.35742 in ³	Sye(l)	0.03915 in ³
		Sxe(b)	0.27005 in ³	Sye(r)	0.19350 in ³
Shear		Negative Bending		Negative Bending	
Vay	0.0000 k	Maxo	6.1813 k-in	Mayo	0.6400 k-in
Vax	0.0000 k	Ixe	0.61530 in ⁴	Iye	0.03583 in ⁴
Torsion		Sxe(t)	0.35742 in ³	Sye(l)	0.03239 in ³
Ba	0.45052 k-in ²	Sxe(b)	0.27005 in ³	Sye(r)	0.16117 in ³

Section contains no web elements for vertical shear.
 Section contains no web elements for horizontal shear.
 Edge stiffener D/w (1.6625) exceeds 0.8.

Rev. Date: 2/13/2026 11:54:34 AM

Printed: 2/13/2026 11:56:49 AM



Analysis Inputs

General

Member Orientation: Horizontal
 Calculate global buckling using specification equations
 Do not include torsion in member checks

Members

Section File				Revision Date and Time			
1 13 - 16 ga Side Frame - 6 ft Span.cfss				2/20/2023 9:36:29 AM			
Material	Area (in ²)	Length (ft)	Weight (k)				
1 A653 SS Grade 33	0.38220	6.0000	0.0077969				
Total		6.0000	0.0077969				
Start Loc. (ft)	End Loc. (ft)	Braced Flange	R	kφ (k)	Lm (ft)	ex (in)	ey (in)
1 0.0000	6.0000	None	0.0000	0.0000	20.0000	0.000	0.000

Supports

Type	Location (ft)	Bearing (in)	Fastened	K
1 Y	0.0000	2.00	No	1.0000
2 XT	0.0000	2.00	No	0.0000
3 Y	6.0000	2.00	No	1.0000
4 XT	6.0000	2.00	No	1.0000

Loading: Dead Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude	
1 Distributed	90.000	0.0000	6.0000	-0.01125	-0.01125	k/ft

Loading: Live Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude	
1 Distributed	90.000	0.0000	6.0000	-0.22500	-0.22500	k/ft

Analysis: Frame Side Rail Analysis.cfsa
6 ft Span Simple Beam

Rev. Date: 2/13/2026 11:54:34 AM

Printed: 2/13/2026 11:56:49 AM

Load Combination: D

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000

Load Combination: D+L

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Live Load	1.000
4 Product Load	1.000

Load Combination: D+0.75(L+Lr)

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Live Load	0.750
4 Product Load	0.750
5 Roof Live Load	0.750

Load Combination: 0.6D+0.6W

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	0.600
2 Dead Load	0.600
3 Wind Load	0.600

Load Combination: D+0.7E

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Earthquake Load	0.700

Load Combination: D+0.525E+0.75L+0.1S

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Earthquake Load	0.525
4 Live Load	0.750
5 Product Load	0.750
6 Snow Load	0.100

Rev. Date: 2/13/2026 11:54:34 AM

Printed: 2/13/2026 11:56:49 AM

Load Combination: 0.6D+0.7E
 Specification: AISI S100-24, US, ASD
 Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	0.600
2 Dead Load	0.600
3 Earthquake Load	0.700

Member Check - AISI S100-24, US, ASD

Load Combination: D+L

Design Parameters at 3.0000 ft:

Lx	6.0000 ft	Ly	6.0000 ft	Lt	6.0000 ft
Kx	1.0000	Ky	0.0000	Kt	0.0000

Section: 13 - 16 ga Side Frame - 6 ft Span.cfss

Material Type: A653 SS Grade 33, Fy=33 ksi

Cbx	1.0000	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in
Braced Flange: None		kφ	0 k		
Red. Factor, R: 0		Lm	20.0000 ft		

Loads:	P (k)	Mx (k-in)	Vy (k)	My (k-in)	Vx (k)
Total	0.0000	12.828	0.0000	0.000	0.0000
Applied	0.0000	12.828	0.0000	0.000	0.0000
Strength	3.9226	5.597	0.0000	0.774	0.0000

Interaction Equations

Eq. H1.2-1	(P, Mx, My)	$0.000 + 2.292 + 0.000 = 2.292$	> 1.0
Eq. H2-1	(Mx, Vy)	$\text{Sqrt}(5.253 + 9.999) = 9.999$	> 1.0
Eq. H2-1	(My, Vx)	$\text{Sqrt}(0.000 + 9.999) = 9.999$	> 1.0

Side Rails Proven
By Testing

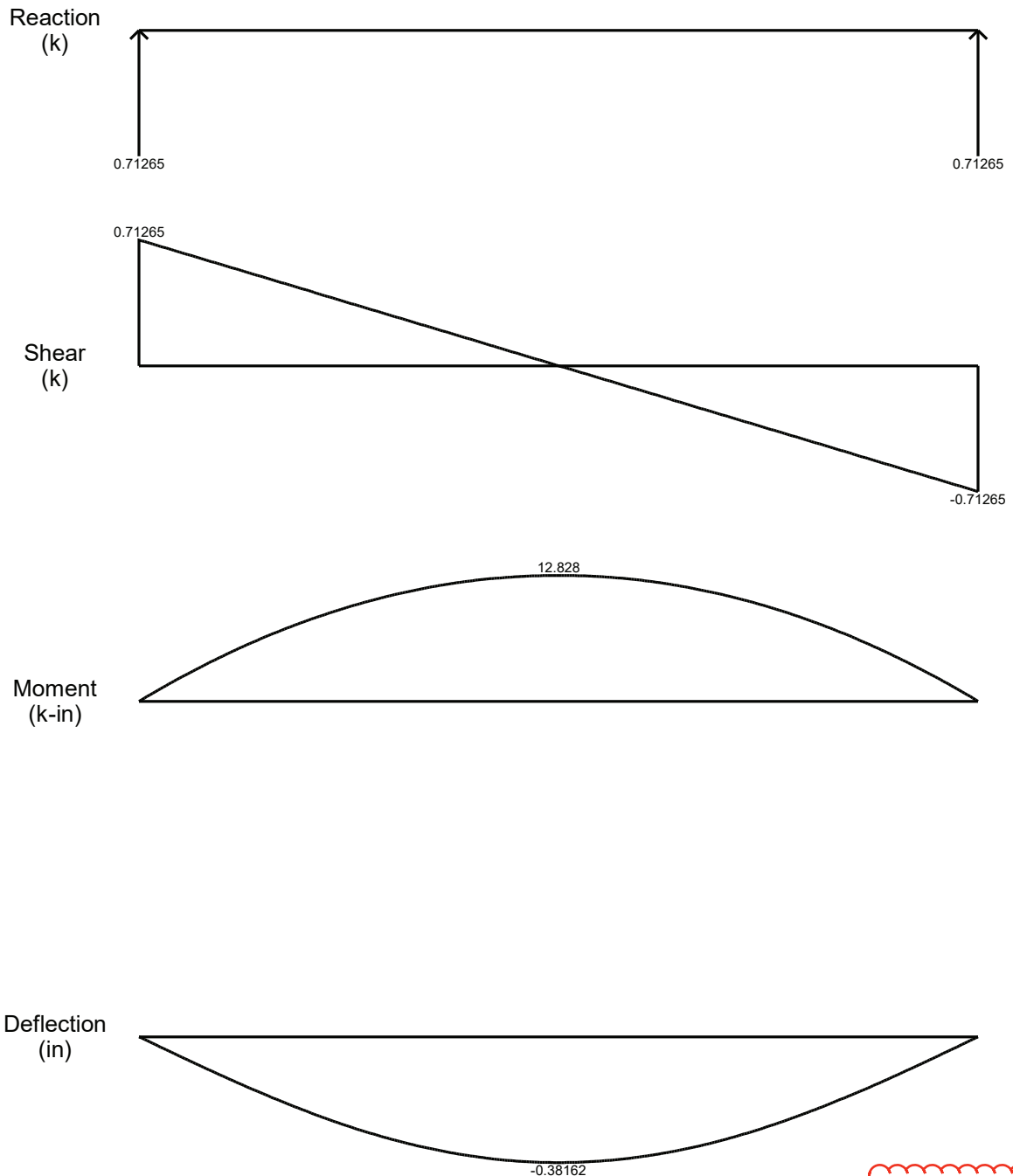
Section contains no web elements for vertical shear.
 Section contains no web elements for horizontal shear.
 Edge stiffener D/w (1.6625) exceeds 0.8.
 Calculation of Mndx used αs=1 from DSM inputs.

Rev. Date: 2/13/2026 11:54:34 AM

Item 2: Main Frame Side Rails

Printed: 2/13/2026 11:56:09 AM

Load Combination: D+L, Y Direction



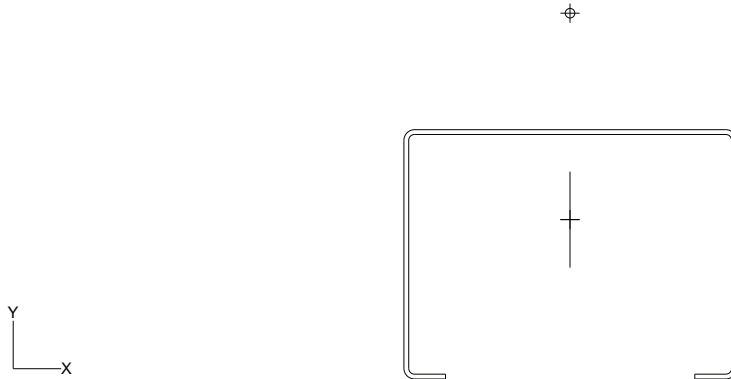
Allowable Deflection: $L / 240 = 6' * 12" / 240 = 0.3"$

Side Rails Proven
By Testing

Section: 14 - Cross-bracing Channel 16 ga x 4 x 3.cfs
Channel 4x2.75-16 Gage

Rev. Date: 2/21/2023 7:52:57 AM
By: Sal
Printed: 2/13/2026 12:02:34 PM

Item 2: Cross-Bracing Channel
Trib Width = 2'-0"
Span 4'-6"



Section Inputs

Material: A653 SS Grade 33
Apply cold work of forming strength increase.
No inelastic reserve strength increase.
Modulus of Elasticity, E 29500 ksi
Yield Strength, Fy 33 ksi
Tensile Strength, Fu 45 ksi
Min Elongation in 2 inches 20 %
Torsion Constant Override, J 0 in⁴
Warping Constant Override, Cw 0 in⁶

Channel, Thickness 0.0566 in (54 mil)

Placement of Part from Origin:

X to center of gravity 0 in

Y to center of gravity 0 in

Outside dimensions, Open shape

	Length (in)	Angle (deg)	Radius (in)	Web	k Coef.	Hole Size (in)	Distance (in)
1	0.5000	180.000	0.069000	Single	0.000	0.0000	0.2500
2	3.0000	90.000	0.069000	Single	0.000	0.0000	1.5000
3	4.0000	0.000	0.069000	Cee	0.000	0.0000	2.0000
4	3.0000	-90.000	0.069000	Single	0.000	0.0000	1.5000
5	0.5000	180.000	0.069000	None	0.000	0.0000	0.2500

Full Section Properties

Area	0.60033 in ²	Wt.	0.0020411 k/ft	Flat	10.607 in
Ix	0.7149 in ⁴	rx	1.0913 in	Ixy	0.0000 in ⁴
Sx(t)	0.65969 in ³	y(t)	1.0837 in	α	-90.000 deg
Sx(b)	0.37309 in ³	y(b)	1.9163 in		
Zx	0.57456 in ³	Height	3.0000 in		
Iy	1.7094 in ⁴	ry	1.6874 in	x _o	0.0000 in
Sy(l)	0.85471 in ³	x(l)	2.0000 in	y _o	2.4879 in
Sy(r)	0.85471 in ³	x(r)	2.0000 in	jx	0.0000 in
Zy	0.95095 in ³	Width	4.0000 in	jy	-3.1305 in

Section: 14 - Cross-bracing Channel 16 ga x 4 x 3.cfss
Channel 4x2.75-16 Gage

Rev. Date: 2/21/2023 7:52:57 AM

By: Sal

Printed: 2/13/2026 12:02:34 PM

I_1	1.7094 in ⁴	r_1	1.6874 in	Cw	2.3251 in ⁶
I_2	0.7149 in ⁴	r_2	1.0913 in	J	0.0006411 in ⁴
I_c	2.4243 in ⁴	r_c	2.0096 in		
I_o	6.1402 in ⁴	r_o	3.1981 in		

Fully Braced Strength - AISI S100-24, US, ASD

Material Type: A653 SS Grade 33, Fy=33 ksi

Axial		Positive Bending		Positive Bending	
Pao	7.586 k	Maxo	7.192 k-in	Mayo	13.151 k-in
Ae	0.41380 in ²	Ixe	0.6738 in ⁴	Iye	1.4709 in ⁴
Ta	12.310 k	Sxe(t)	0.58665 in ³	Sye(l)	0.82182 in ³
		Sxe(b)	0.36396 in ³	Sye(r)	0.66550 in ³
Shear		Negative Bending		Negative Bending	
Vay	3.689 k	Maxo	8.770 k-in	Mayo	13.151 k-in
Vax	2.491 k	Ixe	0.7149 in ⁴	Iye	1.4709 in ⁴
Torsion		Sxe(t)	0.65969 in ³	Sye(l)	0.66550 in ³
Ba	9.1251 k-in ²	Sxe(b)	0.37309 in ³	Sye(r)	0.82182 in ³

Rev. Date: 2/13/2026 12:00:50 PM

Printed: 2/13/2026 12:02:35 PM



Analysis Inputs

General

Member Orientation: Horizontal
 Calculate global buckling using specification equations
 Do not include torsion in member checks

Members

Section File Revision Date and Time
 1 14 - Cross-bracing Channel 16 ga x 4 x 3.cfss2/21/2023 7:52:57 AM

Material	Area (in ²)	Length (ft)	Weight (k)
1 A653 SS Grade 33	0.60033	4.5000	0.0091851
Total		4.5000	0.0091851

Start Loc. (ft)	End Loc. (ft)	Braced Flange	R	kφ (k)	Lm (ft)	ex (in)	ey (in)
1 0.0000	4.5000	None	0.0000	0.0000	4.5000	0.000	0.000

Supports

Type	Location (ft)	Bearing (in)	Fastened	K
1 XYT	0.0000	2.00	No	1.0000
2 XYT	4.5000	2.00	No	1.0000

Loading: Dead Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude
1 Distributed	90.000	0.0000	4.5000	-0.01000	-0.01000 k/ft

Loading: Live Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude
1 Distributed	90.000	0.0000	4.5000	-0.20000	-0.20000 k/ft

Analysis: Cross-Bracing Analysis.cfsa
4.5 ft Span Simple Beam

Rev. Date: 2/13/2026 12:00:50 PM

Printed: 2/13/2026 12:02:35 PM

Load Combination: D

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000

Load Combination: D+L

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Live Load	1.000
4 Product Load	1.000

Load Combination: D+0.75(L+Lr)

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Live Load	0.750
4 Product Load	0.750
5 Roof Live Load	0.750

Load Combination: 0.6D+0.6W

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	0.600
2 Dead Load	0.600
3 Wind Load	0.600

Load Combination: D+0.7E

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Earthquake Load	0.700

Load Combination: D+0.525E+0.75L+0.1S

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Earthquake Load	0.525
4 Live Load	0.750
5 Product Load	0.750
6 Snow Load	0.100

Analysis: Cross-Bracing Analysis.cfsa
4.5 ft Span Simple Beam

Rev. Date: 2/13/2026 12:00:50 PM

Printed: 2/13/2026 12:02:35 PM

Load Combination: 0.6D+0.7E

Specification: AISI S100-24, US, ASD

Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	0.600
2 Dead Load	0.600
3 Earthquake Load	0.700

Member Check - AISI S100-24, US, ASD

Load Combination: D+L

Design Parameters at 2.2500 ft:

Lx	4.5000 ft	Ly	4.5000 ft	Lt	4.5000 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000

Section: 14 - Cross-bracing Channel 16 ga x 4 x 3.cfss

Material Type: A653 SS Grade 33, Fy=33 ksi

Cbx	1.1364	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in
Braced Flange: None	kφ	0 k			
Red. Factor, R: 0	Lm	4.5000 ft			

Loads:	P (k)	Mx (k-in)	Vy (k)	My (k-in)	Vx (k)
Total	0.0000	6.441	0.0000	0.000	0.0000
Applied	0.0000	6.441	0.0000	0.000	0.0000
Strength	5.9323	7.192	3.6893	13.055	2.4912

Interaction Equations

Eq. H1.2-1	(P, Mx, My)	$0.000 + 0.896 + 0.000 = 0.896 \leq 1.0$
Eq. H2-1	(Mx, Vy)	$\text{Sqrt}(0.802 + 0.000) = 0.896 \leq 1.0$
Eq. H2-1	(My, Vx)	$\text{Sqrt}(0.000 + 0.000) = 0.000 \leq 1.0$

Calculation of Mndy used αs=1 from DSM inputs.

Web Crippling Check - AISI S100-24, US, ASD

Load Combination: D+L

Parameters at 0.0000 ft:

Total Load: 0.47709 k on bottom flange

Total Moment: 0.0000 k-in

Bearing: 2.0000 in

Flange fastened to bearing surface: No

Distance from edge of bearing to edge of opposite load: 4.5000 ft

Section: 14 - Cross-bracing Channel 16 ga x 4 x 3.cfss

Material Type: A653 SS Grade 33, Fy=33 ksi

Applied Load: 0.47709 k on bottom flange

Applied Moment: 0.0000 k-in

Distance from edge of bearing to end of member: 0.0000 ft

Rev. Date: 2/13/2026 12:00:50 PM

Printed: 2/13/2026 12:02:35 PM

Part	Elem	Calculation Type	Pa (k)	Pay (k)	Notes
1	2	Single, UU-EOF	0.47378	0.47378	
1	4	Single, UU-EOF	0.47378	0.47378	
		Web Crippling Strength		0.94756	

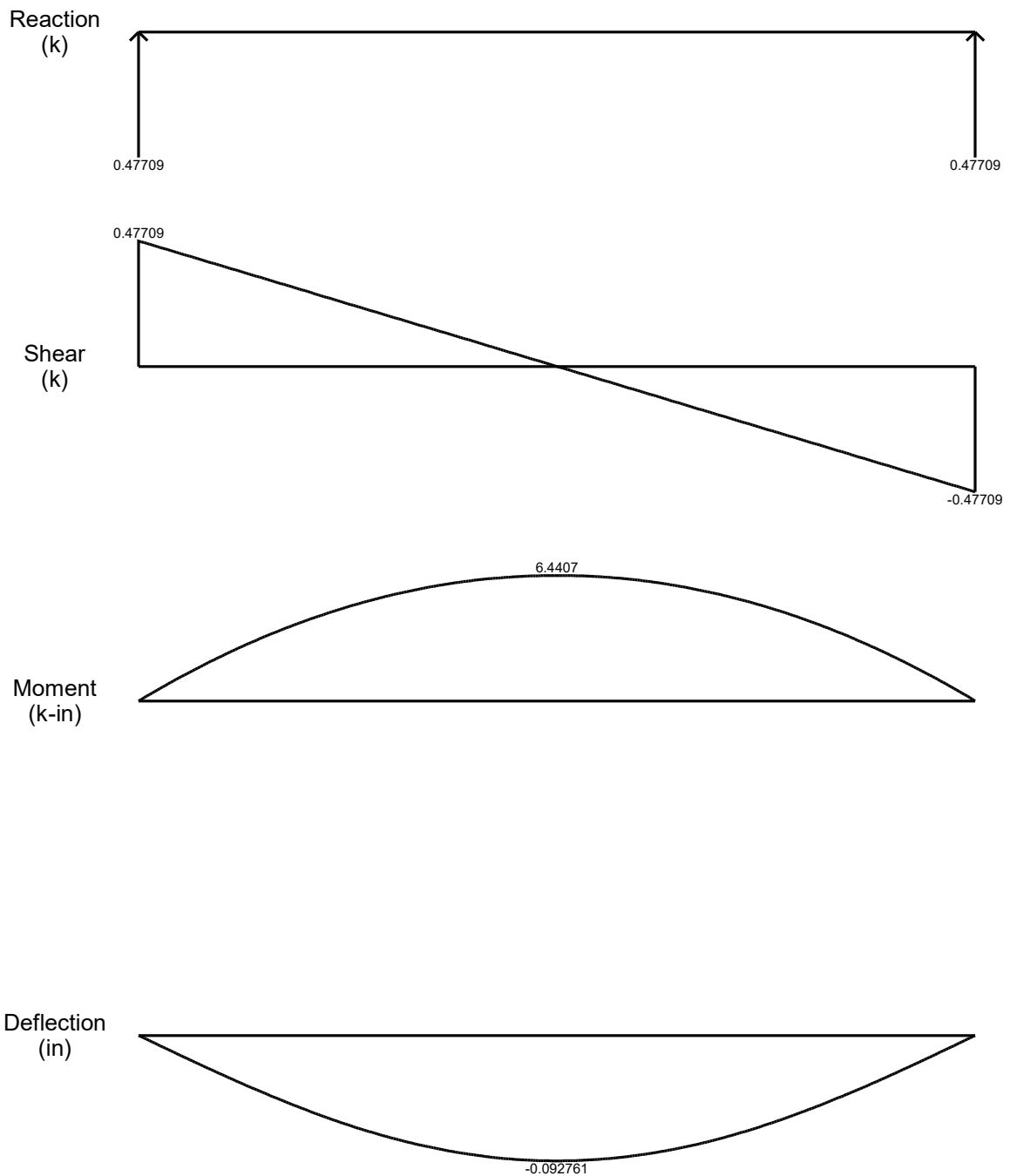
Web Crippling Check: 0.47709 k <= 0.94756 k
Moment Check: 0.0000 k-in <= 7.1919 k-in
Interaction Equations
Eq. H3-1a (P, M) $0.255 + 0.000 = 0.255 <= 0.782$

Rev. Date: 2/13/2026 12:00:50 PM

Item 2: Cross-Bracing Channel

Printed: 2/13/2026 12:02:02 PM

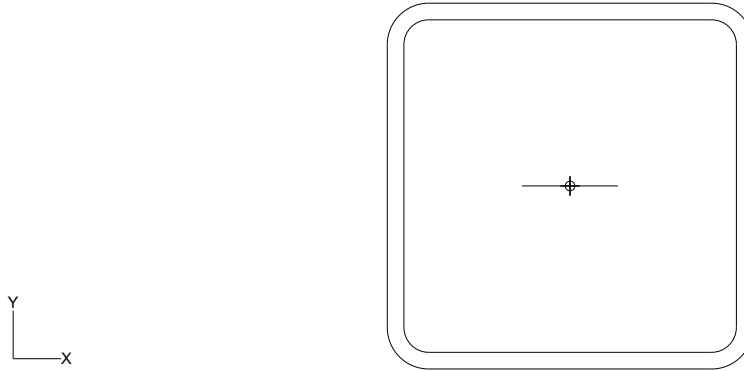
Load Combination: D+L, Y Direction



Allowable Deflection: $L / 240 = 4.5' * 12" / 240 = 0.225"$ OK

Rev. Date: 2/20/2023 6:23:44 PM
By: Sal
Printed: 2/13/2026 12:41:49 PM

Item 24: 6 ft Hand Rails Top Rails



Section Inputs

Material: A653 SS Grade 33
No cold work of forming strength increase.
No inelastic reserve strength increase.
Modulus of Elasticity, E 29500 ksi
Yield Strength, Fy 33 ksi
Tensile Strength, Fu 45 ksi
Min Elongation in 2 inches 20 %
Torsion Constant Override, J 0 in⁴
Warping Constant Override, Cw 0 in⁶

Tube, Thickness 0.0566 in (54 mil)

Placement of Part from Origin:

X to center of gravity 0 in

Y to center of gravity 0 in

Outside dimensions, Closed shape

	Length (in)	Angle (deg)	Radius (in)	Web	k Coef.	Hole Size (in)	Distance (in)
1	1.2500	0.000	0.084900	Single	0.000	0.0000	0.6250
2	1.2500	90.000	0.084900	Single	0.000	0.0000	0.6250
3	1.2500	180.000	0.084900	Single	0.000	0.0000	0.6250
4	1.2500	-90.000	0.084900	Single	0.000	0.0000	0.6250

Full Section Properties

Area	0.25919 in ²	Wt.	0.00088123 k/ft	Flat	4.5793 in
Ix	0.06008 in ⁴	rx	0.48147 in	Ixy	0.00000 in ⁴
Sx(t)	0.09613 in ³	y(t)	0.62500 in	α	0.000 deg
Sx(b)	0.09613 in ³	y(b)	0.62500 in		
Zx	0.11421 in ³	Height	1.25000 in		
Iy	0.06008 in ⁴	ry	0.48147 in	x _o	0.00000 in
Sy(l)	0.09613 in ³	x(l)	0.62500 in	y _o	0.00000 in
Sy(r)	0.09613 in ³	x(r)	0.62500 in	jx	0.00000 in
Zy	0.11421 in ³	Width	1.25000 in	jy	0.00000 in

Section: 15 - Hand Rails Top Rails Section 1 6'.cfss
 Tube 1.25x1.25-16 Gage

Rev. Date: 2/20/2023 6:23:44 PM

By: Sal

Printed: 2/13/2026 12:41:49 PM

I_1	0.06008 in ⁴	r_1	0.48147 in	Cw	0.000009 in ⁶
I_2	0.06008 in ⁴	r_2	0.48147 in	J	0.098740 in ⁴
I_c	0.12017 in ⁴	r_c	0.68090 in		
I_o	0.12017 in ⁴	r_o	0.68090 in		

Fully Braced Strength - AISI S100-24, US, ASD

Material Type: A653 SS Grade 33, Fy=33 ksi

Axial		Positive Bending		Positive Bending	
Pao	4.7517 k	Maxo	1.8996 k-in	Mayo	1.8996 k-in
Ae	0.25919 in ²	Ixe	0.060083 in ⁴	Iye	0.060083 in ⁴
Ta	5.1216 k	Sxe(t)	0.096133 in ³	Sye(l)	0.096133 in ³
		Sxe(b)	0.096133 in ³	Sye(r)	0.096133 in ³
Shear		Negative Bending		Negative Bending	
Vay	1.2978 k	Maxo	1.8996 k-in	Mayo	1.8996 k-in
Vax	1.2978 k	Ixe	0.060083 in ⁴	Iye	0.060083 in ⁴
Torsion		Sxe(t)	0.096133 in ³	Sye(l)	0.096133 in ³
Ba	0.018425 k-in ²	Sxe(b)	0.096133 in ³	Sye(r)	0.096133 in ³

Rev. Date: 2/13/2026 12:40:49 PM

Printed: 2/13/2026 12:41:50 PM



Analysis Inputs

General

Member Orientation: Horizontal
 Calculate global buckling using specification equations
 Do not include torsion in member checks

Members

Section File Revision Date and Time
 1 15 - Hand Rails Top Rails Section 1 6'.cfss2/20/2023 6:23:44 PM

Material	Area (in ²)	Length (ft)	Weight (k)
1 A653 SS Grade 33	0.25919	6.0000	0.0052874
Total		6.0000	0.0052874

	Start Loc. (ft)	End Loc. (ft)	Braced Flange	R	k ϕ (k)	Lm (ft)	ex (in)	ey (in)
1	0.0000	6.0000	None	0.0000	0.0000	6.0000	0.000	0.000

Supports

Type	Location (ft)	Bearing (in)	Fastened	K
1 XYT	0.0000	2.00	No	1.0000
2 XYT	6.0000	2.00	No	1.0000

Loading: Dead Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude	
1 Distributed	90.000	0.0000	6.0000	-0.002500	-0.002500	k/ft

Loading: Live Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude	
1 Distributed	90.000	0.0000	6.0000	-0.050000	-0.050000	k/ft

Rev. Date: 2/13/2026 12:40:49 PM

Printed: 2/13/2026 12:41:50 PM

Load Combination: D
Specification: AISI S100-24, US, ASD
Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000

Load Combination: D+L
Specification: AISI S100-24, US, ASD
Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Live Load	1.000
4 Product Load	1.000

Load Combination: D+0.75(L+Lr)
Specification: AISI S100-24, US, ASD
Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Live Load	0.750
4 Product Load	0.750
5 Roof Live Load	0.750

Load Combination: 0.6D+0.6W
Specification: AISI S100-24, US, ASD
Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	0.600
2 Dead Load	0.600
3 Wind Load	0.600

Load Combination: D+0.7E
Specification: AISI S100-24, US, ASD
Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Earthquake Load	0.700

Load Combination: D+0.525E+0.75L+0.1S
Specification: AISI S100-24, US, ASD
Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Earthquake Load	0.525
4 Live Load	0.750
5 Product Load	0.750
6 Snow Load	0.100

Rev. Date: 2/13/2026 12:40:49 PM

Printed: 2/13/2026 12:41:50 PM

Load Combination: 0.6D+0.7E
 Specification: AISI S100-24, US, ASD
 Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	0.600
2 Dead Load	0.600
3 Earthquake Load	0.700

Member Check - AISI S100-24, US, ASD

Load Combination: D+L

Design Parameters at 3.0000 ft:

Lx	6.0000 ft	Ly	6.0000 ft	Lt	6.0000 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000

Section: 15 - Hand Rails Top Rails Section 1 6'.cfss

Material Type: A653 SS Grade 33, Fy=33 ksi

Cbx	1.1364	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in
Braced Flange: None		kφ	0 k		
Red. Factor, R: 0		Lm	6.0000 ft		

Loads:	P (k)	Mx (k-in)	Vy (k)	My (k-in)	Vx (k)
Total	0.0000	2.8826	0.0000	0.0000	0.0000
Applied	0.0000	2.8826	0.0000	0.0000	0.0000
Strength	1.6441	1.8996	1.2978	1.8996	1.2978

Interaction Equations

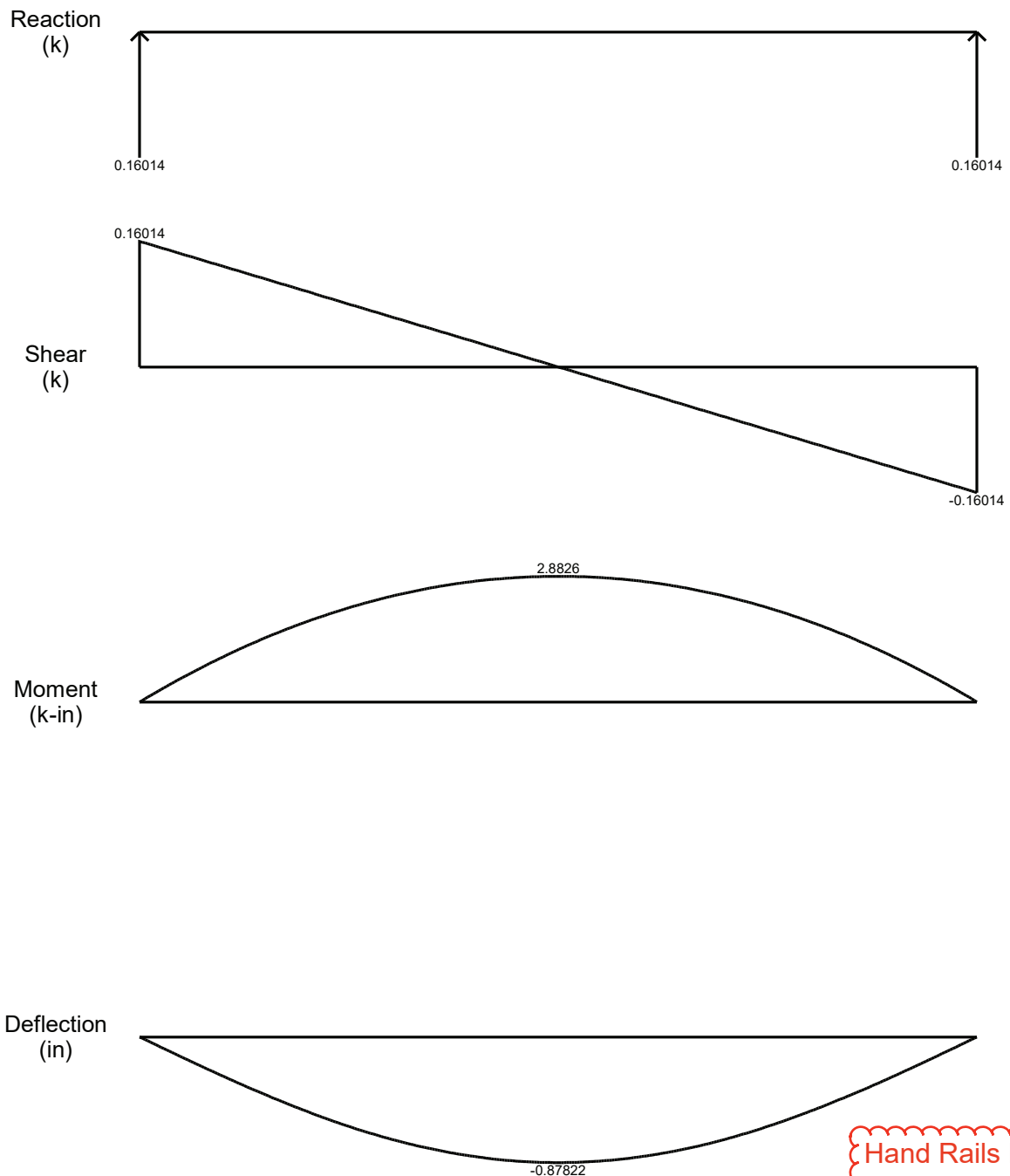
Eq. H1.2-1	(P, Mx, My)	$0.000 + 1.517 + 0.000 = 1.517 > 1.0$
Eq. H2-1	(Mx, Vy)	$\text{Sqrt}(2.303 + 0.000) = 1.517 > 1.0$
Eq. H2-1	(My, Vx)	$\text{Sqrt}(0.000 + 0.000) = 0.000 \leq 1.0$

Hand Rails Proven
 By Testing

Rev. Date: 2/13/2026 12:40:49 PM

Item 24: 6 ft Hand Rails Top Rails

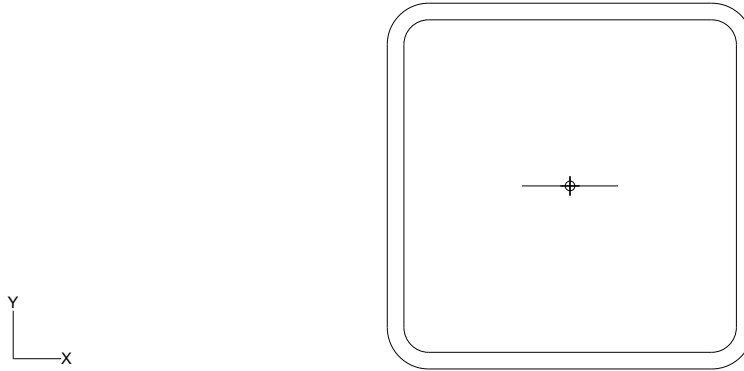
Printed: 2/13/2026 12:41:24 PM

Load Combination: D+L, Y Direction

Hand Rails Proven
By Testing

Rev. Date: 2/18/2023 6:48:30 AM
 By: Sal
 Printed: 2/13/2026 12:37:08 PM

Item 17 and 24: 5 ft Hand Rails Top Rails



Section Inputs

Material: A653 SS Grade 33
 No cold work of forming strength increase.
 No inelastic reserve strength increase.
 Modulus of Elasticity, E 29500 ksi
 Yield Strength, Fy 33 ksi
 Tensile Strength, Fu 45 ksi
 Min Elongation in 2 inches 20 %
 Torsion Constant Override, J 0 in⁴
 Warping Constant Override, Cw 0 in⁶

Tube, Thickness 0.0566 in (54 mil)

Placement of Part from Origin:

X to center of gravity 0 in

Y to center of gravity 0 in

Outside dimensions, Closed shape

	Length (in)	Angle (deg)	Radius (in)	Web	k Coef.	Hole Size (in)	Distance (in)
1	1.2500	0.000	0.084900	Single	0.000	0.0000	0.6250
2	1.2500	90.000	0.084900	Single	0.000	0.0000	0.6250
3	1.2500	180.000	0.084900	Single	0.000	0.0000	0.6250
4	1.2500	-90.000	0.084900	Single	0.000	0.0000	0.6250

Full Section Properties

Area	0.25919 in ²	Wt.	0.00088123 k/ft	Flat	4.5793 in
Ix	0.06008 in ⁴	rx	0.48147 in	Ixy	0.00000 in ⁴
Sx(t)	0.09613 in ³	y(t)	0.62500 in	α	0.000 deg
Sx(b)	0.09613 in ³	y(b)	0.62500 in		
Zx	0.11421 in ³	Height	1.25000 in		
Iy	0.06008 in ⁴	ry	0.48147 in	x _o	0.00000 in
Sy(l)	0.09613 in ³	x(l)	0.62500 in	y _o	0.00000 in
Sy(r)	0.09613 in ³	x(r)	0.62500 in	jx	0.00000 in
Zy	0.11421 in ³	Width	1.25000 in	jy	0.00000 in

Section: 16 - Square Handrail Posts Section 3.cfss
 Tube 1.25x1.25-16 Gage

Rev. Date: 2/18/2023 6:48:30 AM

By: Sal

Printed: 2/13/2026 12:37:08 PM

I_1	0.06008 in ⁴	r_1	0.48147 in	Cw	0.000009 in ⁶
I_2	0.06008 in ⁴	r_2	0.48147 in	J	0.098740 in ⁴
I_c	0.12017 in ⁴	r_c	0.68090 in		
I_o	0.12017 in ⁴	r_o	0.68090 in		

Fully Braced Strength - AISI S100-24, US, ASD

Material Type: A653 SS Grade 33, Fy=33 ksi

Axial		Positive Bending		Positive Bending	
Pao	4.7517 k	Maxo	1.8996 k-in	Mayo	1.8996 k-in
Ae	0.25919 in ²	Ixe	0.060083 in ⁴	Iye	0.060083 in ⁴
Ta	5.1216 k	Sxe(t)	0.096133 in ³	Sye(l)	0.096133 in ³
		Sxe(b)	0.096133 in ³	Sye(r)	0.096133 in ³
Shear		Negative Bending		Negative Bending	
Vay	1.2978 k	Maxo	1.8996 k-in	Mayo	1.8996 k-in
Vax	1.2978 k	Ixe	0.060083 in ⁴	Iye	0.060083 in ⁴
Torsion		Sxe(t)	0.096133 in ³	Sye(l)	0.096133 in ³
Ba	0.018425 k-in ²	Sxe(b)	0.096133 in ³	Sye(r)	0.096133 in ³

Rev. Date: 2/13/2026 12:35:55 PM

Printed: 2/13/2026 12:37:10 PM



Analysis Inputs

General

Member Orientation: Horizontal
 Calculate global buckling using specification equations
 Do not include torsion in member checks

Members

Section File				Revision Date and Time				
1	16 - Square Handrail Posts			Section 3.cfss	2/18/2023 6:48:30 AM			
Material				Area	Length	Weight		
				(in²)	(ft)	(k)		
1	A653 SS Grade 33			0.25919	15.000	0.013218		
Total					15.000	0.013218		
	Start Loc.	End Loc.	Braced	R	kφ	Lm	ex	ey
	(ft)	(ft)	Flange		(k)	(ft)	(in)	(in)
1	0.000	15.000	None	0.0000	0.0000	15.000	0.000	0.000

Supports

Type	Location (ft)	Bearing (in)	Fastened	K
1 XYT	0.000	2.00	No	1.0000
2 XYT	5.000	2.00	No	1.0000
3 XYT	10.000	2.00	No	1.0000
4 XYT	15.000	2.00	No	1.0000

Loading: Dead Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude
1 Distributed	90.000	0.000	15.000	-0.002500	-0.002500 k/ft

Loading: Live Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude
1 Distributed	90.000	0.000	15.000	-0.050000	-0.050000 k/ft

Rev. Date: 2/13/2026 12:35:55 PM

Printed: 2/13/2026 12:37:10 PM

Load Combination: D
Specification: AISI S100-24, US, ASD
Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000

Load Combination: D+L
Specification: AISI S100-24, US, ASD
Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Live Load	1.000
4 Product Load	1.000

Load Combination: D+0.75(L+Lr)
Specification: AISI S100-24, US, ASD
Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Live Load	0.750
4 Product Load	0.750
5 Roof Live Load	0.750

Load Combination: 0.6D+0.6W
Specification: AISI S100-24, US, ASD
Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	0.600
2 Dead Load	0.600
3 Wind Load	0.600

Load Combination: D+0.7E
Specification: AISI S100-24, US, ASD
Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Earthquake Load	0.700

Load Combination: D+0.525E+0.75L+0.1S
Specification: AISI S100-24, US, ASD
Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	1.000
2 Dead Load	1.000
3 Earthquake Load	0.525
4 Live Load	0.750
5 Product Load	0.750
6 Snow Load	0.100

Rev. Date: 2/13/2026 12:35:55 PM

Printed: 2/13/2026 12:37:10 PM

Load Combination: 0.6D+0.7E
Specification: AISI S100-24, US, ASD
Inflection Point Bracing: No

Loading	Factor
1 Beam Self Weight	0.600
2 Dead Load	0.600
3 Earthquake Load	0.700

Member Check - AISI S100-24, US, ASD

Load Combination: D+L

Design Parameters at 5.0000 ft, Left side:

Lx	5.0000 ft	Ly	5.0000 ft	Lt	5.0000 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000

Section: 16 - Square Handrail Posts Section 3.cfss

Material Type: A653 SS Grade 33, Fy=33 ksi

Cbx	1.5385	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in
Braced Flange:	None	kφ	0 k		
Red. Factor, R:	0	Lm	15.0000 ft		

Loads:	P (k)	Mx (k-in)	Vy (k)	My (k-in)	Vx (k)
Total	0.0000	-1.6014	-0.1601	0.0000	0.0000
Applied	0.0000	-1.6014	-0.1601	0.0000	0.0000
Strength	2.2746	1.8996	1.2978	1.8996	1.2978

Interaction Equations

Eq. H1.2-1	(P, Mx, My)	$0.000 + 0.843 + 0.000 = 0.843 \leq 1.0$
Eq. H2-1	(Mx, Vy)	$\text{Sqrt}(0.711 + 0.015) = 0.852 \leq 1.0$
Eq. H2-1	(My, Vx)	$\text{Sqrt}(0.000 + 0.000) = 0.000 \leq 1.0$

Web Crippling Check - AISI S100-24, US, ASD

Load Combination: D+L

Parameters at 5.000 ft:

Total Load: 0.29360 k on bottom flange

Total Moment: -1.6014 k-in

Bearing: 2.0000 in

Flange fastened to bearing surface: No

Distance from edge of bearing to edge of opposite load: 15.000 ft

Section: 16 - Square Handrail Posts Section 3.cfss

Material Type: A653 SS Grade 33, Fy=33 ksi

Applied Load: 0.2936 k on bottom flange

Applied Moment: -1.6014 k-in

Distance from edge of bearing to end of member: 4.9167 ft

Rev. Date: 2/13/2026 12:35:55 PM

Printed: 2/13/2026 12:37:10 PM

Part	Elem	Calculation Type	Pa (k)	Pay (k)	Notes
1	2	Single, US-IOF	0.8670	0.8670	N/h>2
1	4	Single, US-IOF	0.8670	0.8670	N/h>2
Web Crippling Strength				1.7340	

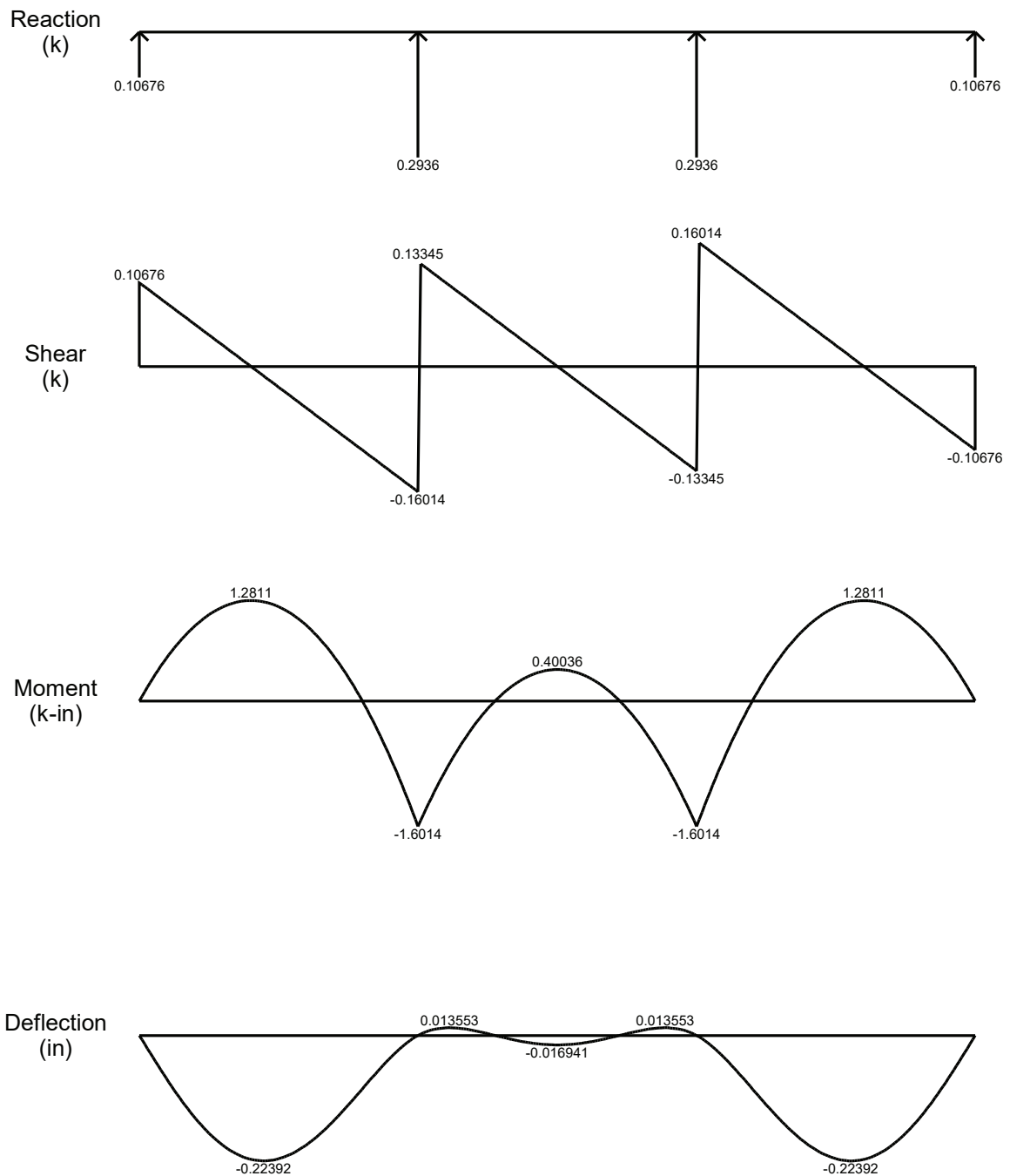
Web Crippling Check: 0.2936 k <= 1.7340 k
 Moment Check: 1.6014 k-in <= 1.8996 k-in
 Interaction Equations
 Eq. H3-1a (P, M) 0.077 + 0.505 = 0.582 <= 0.665

Rev. Date: 2/13/2026 12:35:55 PM

Item 17 and 24: 5 ft Hand Rails Top Rails

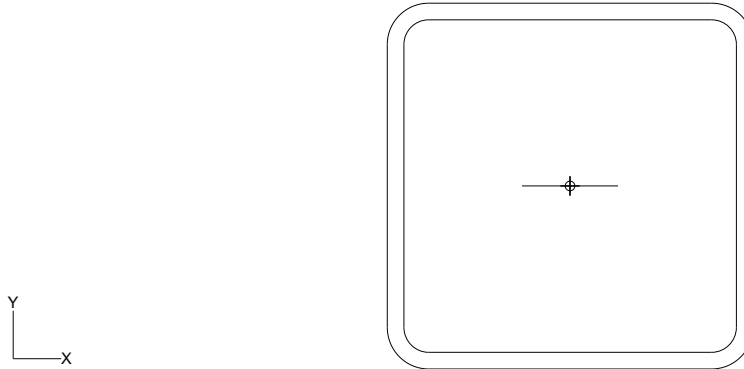
Printed: 2/13/2026 12:37:27 PM

Load Combination: D+L, Y Direction



Handrail Allowable Deflection $h/12 = 60" / 12 = 5.0"$ per ASTM E985

Rev. Date: 2/20/2023 6:23:44 PM
By: Sal
Printed: 2/13/2026 12:48:55 PM



Section Inputs

Material: A653 SS Grade 33
No cold work of forming strength increase.
No inelastic reserve strength increase.
Modulus of Elasticity, E 29500 ksi
Yield Strength, Fy 33 ksi
Tensile Strength, Fu 45 ksi
Min Elongation in 2 inches 20 %
Torsion Constant Override, J 0 in⁴
Warping Constant Override, Cw 0 in⁶

Tube, Thickness 0.0566 in (54 mil)

Placement of Part from Origin:

X to center of gravity 0 in

Y to center of gravity 0 in

Outside dimensions, Closed shape

	Length (in)	Angle (deg)	Radius (in)	Web	k Coef.	Hole Size (in)	Distance (in)
1	1.2500	0.000	0.084900	Single	0.000	0.0000	0.6250
2	1.2500	90.000	0.084900	Single	0.000	0.0000	0.6250
3	1.2500	180.000	0.084900	Single	0.000	0.0000	0.6250
4	1.2500	-90.000	0.084900	Single	0.000	0.0000	0.6250

Full Section Properties

Area	0.25919 in ²	Wt.	0.00088123 k/ft	Flat	4.5793 in
Ix	0.06008 in ⁴	rx	0.48147 in	Ixy	0.00000 in ⁴
Sx(t)	0.09613 in ³	y(t)	0.62500 in	α	0.000 deg
Sx(b)	0.09613 in ³	y(b)	0.62500 in		
Zx	0.11421 in ³	Height	1.25000 in		
Iy	0.06008 in ⁴	ry	0.48147 in	x _o	0.00000 in
Sy(l)	0.09613 in ³	x(l)	0.62500 in	y _o	0.00000 in
Sy(r)	0.09613 in ³	x(r)	0.62500 in	jx	0.00000 in
Zy	0.11421 in ³	Width	1.25000 in	jy	0.00000 in

Rev. Date: 2/20/2023 6:23:44 PM
By: Sal
Printed: 2/13/2026 12:48:55 PM

I ₁	0.06008 in ⁴	r ₁	0.48147 in	Cw	0.000009 in ⁶
I ₂	0.06008 in ⁴	r ₂	0.48147 in	J	0.098740 in ⁴
I _c	0.12017 in ⁴	r _c	0.68090 in		
I _o	0.12017 in ⁴	r _o	0.68090 in		

Fully Braced Strength - AISI S100-24, US, ASD

Material Type: A653 SS Grade 33, Fy=33 ksi

Axial		Positive Bending		Positive Bending	
Pao	4.7517 k	Maxo	1.8996 k-in	Mayo	1.8996 k-in
Ae	0.25919 in ²	Ixe	0.060083 in ⁴	Iye	0.060083 in ⁴
Ta	5.1216 k	Sxe(t)	0.096133 in ³	Sye(l)	0.096133 in ³
		Sxe(b)	0.096133 in ³	Sye(r)	0.096133 in ³
Shear		Negative Bending		Negative Bending	
Vay	1.2978 k	Maxo	1.8996 k-in	Mayo	1.8996 k-in
Vax	1.2978 k	Ixe	0.060083 in ⁴	Iye	0.060083 in ⁴
Torsion		Sxe(t)	0.096133 in ³	Sye(l)	0.096133 in ³
Ba	0.018425 k-in ²	Sxe(b)	0.096133 in ³	Sye(r)	0.096133 in ³

Square Handrail Posts

Handrail Post Stress : $M = 3.5' * 12" * 0.2 \text{ kips} = 8.4 \text{ in} - \text{kips}$

$f_b = M / S = 0.82 * 8.4 \text{ in} - \text{kips} / 0.096133 \text{ in}^3 = 72 \text{ ksi}$

$F_b = 0.66 * 50 \text{ ksi} = 33 \text{ ksi}$ Say OK Based on Testing

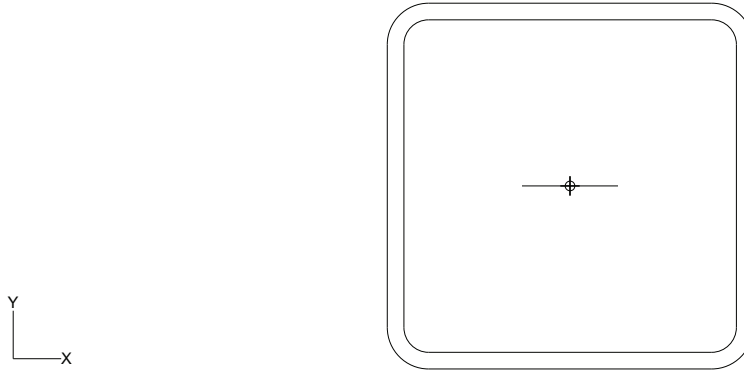
Handrail Deflection :

Deflection : $d = p * L^3 / (3 * E * I)$

Deflection : $d = 0.82 * 200 \text{ lbs} * (42")^3 / (3 * 29,000,000 \text{ psi} * 0.060083 \text{ in}^4) = 2.32" \text{ OK}$

Handrail Allowable Deflection $h/12 = 42" / 12 = 3.5" \text{ per ASTM E985}$

Rev. Date: 2/20/2023 6:23:44 PM
By: Sal
Printed: 2/13/2026 12:50:51 PM



Section Inputs

Material: A653 SS Grade 33
No cold work of forming strength increase.
No inelastic reserve strength increase.
Modulus of Elasticity, E 29500 ksi
Yield Strength, Fy 33 ksi
Tensile Strength, Fu 45 ksi
Min Elongation in 2 inches 20 %
Torsion Constant Override, J 0 in⁴
Warping Constant Override, Cw 0 in⁶

Tube, Thickness 0.0566 in (54 mil)

Placement of Part from Origin:

X to center of gravity 0 in

Y to center of gravity 0 in

Outside dimensions, Closed shape

	Length (in)	Angle (deg)	Radius (in)	Web	k Coef.	Hole Size (in)	Distance (in)
1	1.2500	0.000	0.084900	Single	0.000	0.0000	0.6250
2	1.2500	90.000	0.084900	Single	0.000	0.0000	0.6250
3	1.2500	180.000	0.084900	Single	0.000	0.0000	0.6250
4	1.2500	-90.000	0.084900	Single	0.000	0.0000	0.6250

Full Section Properties

Area	0.25919 in ²	Wt.	0.00088123 k/ft	Flat	4.5793 in
Ix	0.06008 in ⁴	rx	0.48147 in	Ixy	0.00000 in ⁴
Sx(t)	0.09613 in ³	y(t)	0.62500 in	α	0.000 deg
Sx(b)	0.09613 in ³	y(b)	0.62500 in		
Zx	0.11421 in ³	Height	1.25000 in		
Iy	0.06008 in ⁴	ry	0.48147 in	x _o	0.00000 in
Sy(l)	0.09613 in ³	x(l)	0.62500 in	y _o	0.00000 in
Sy(r)	0.09613 in ³	x(r)	0.62500 in	jx	0.00000 in
Zy	0.11421 in ³	Width	1.25000 in	jy	0.00000 in

Rev. Date: 2/20/2023 6:23:44 PM
By: Sal
Printed: 2/13/2026 12:50:51 PM

I ₁	0.06008 in ⁴	r ₁	0.48147 in	Cw	0.000009 in ⁶
I ₂	0.06008 in ⁴	r ₂	0.48147 in	J	0.098740 in ⁴
I _c	0.12017 in ⁴	r _c	0.68090 in		
I _o	0.12017 in ⁴	r _o	0.68090 in		

Fully Braced Strength - AISI S100-24, US, ASD

Material Type: A653 SS Grade 33, Fy=33 ksi

Axial		Positive Bending		Positive Bending	
Pao	4.7517 k	Maxo	1.8996 k-in	Mayo	1.8996 k-in
Ae	0.25919 in ²	Ixe	0.060083 in ⁴	Iye	0.060083 in ⁴
Ta	5.1216 k	Sxe(t)	0.096133 in ³	Sye(l)	0.096133 in ³
		Sxe(b)	0.096133 in ³	Sye(r)	0.096133 in ³
Shear		Negative Bending		Negative Bending	
Vay	1.2978 k	Maxo	1.8996 k-in	Mayo	1.8996 k-in
Vax	1.2978 k	Ixe	0.060083 in ⁴	Iye	0.060083 in ⁴
Torsion		Sxe(t)	0.096133 in ³	Sye(l)	0.096133 in ³
Ba	0.018425 k-in ²	Sxe(b)	0.096133 in ³	Sye(r)	0.096133 in ³

Member Check - AISI S100-24, US, ASD

Material Type: A653 SS Grade 33, Fy=33 ksi

Design Parameters:

Lx	2.3330 ft	Ly	2.3330 ft	Lt	0.0000 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000
Cbx	1.0000	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in
Braced Flange: None		kφ	0 k		
Red. Factor, R: 0		Lm	2.3330 ft		

Loads:	P	Mx	Vy	My	Vx
	(k)	(k-in)	(k)	(k-in)	(k)
Entered	0.7500	1.3720	0.0000	0.0000	0.0000
Applied	0.7500	1.4500	0.0000	0.0000	0.0000
Strength	4.0476	1.8996	1.2978	1.8996	1.2978

Interaction Equations

Eq. H1.2-1	(P, Mx, My)	0.185 + 0.763 + 0.000 = 0.949 <= 1.0
Eq. H2-1	(Mx, Vy)	Sqrt(0.583 + 0.000) = 0.763 <= 1.0
Eq. H2-1	(My, Vx)	Sqrt(0.000 + 0.000) = 0.000 <= 1.0

SPECIFICATIONS

Table 1: Footing Pad Allowable Loads

Pad Identification	Nominal Pad Diameter (in.)	Pad Capacity ¹ 1000 psf soil (lbf)	Pad Capacity ¹ 1500 psf soil (lbf)	Pad Capacity ¹ 3000 psf soil (lbf)
Model #10	10	545	810 ²	1622 ²
Model #16	16		2100 ²	4200 ²

¹ Pad capacity is limited by the lesser of the following criteria; the peak load divided by a safety factor of 3, the soil capacity, load at 3/4-in. deflection

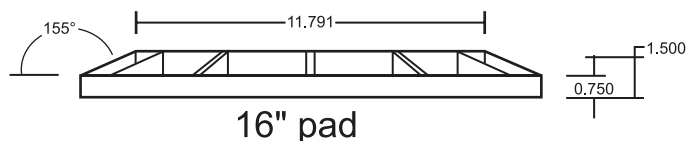
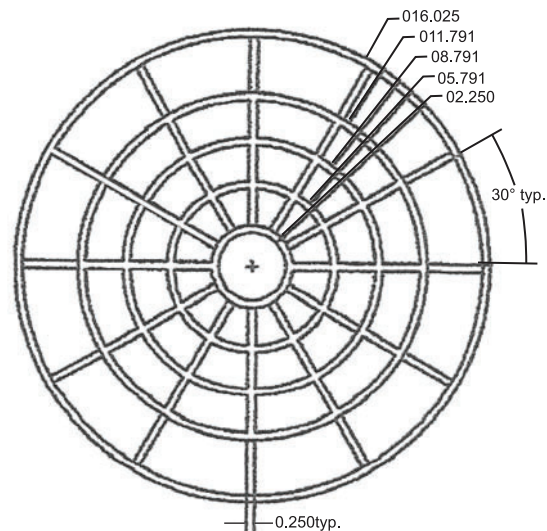
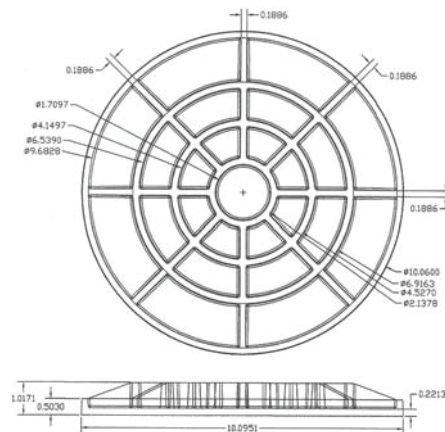
² Pad capacity is limited to soil capacity

Characteristics

Density 1.13g/cm
 Stiffness 535.054 psi
 Izod Impact 0.95 ft. -lb./in.
 Gardner Impact 164 in.-lb.

Benefits:

- UV Stable
- Easy Installation
- Saves time & labor
- Strong and durable
- Eliminate deflection
- Made from 100% recycled materials
- Resists most herbicides and pesticides
- Replaces concrete
- Light weight saves on shipping & handling



For		Date	2/17/2026
At		By	Granata
Description		Checked	
		Page	

ACI 318-19 Section 22.6.5.2

Concrete Punching Shear :

ACI 318-14 Section 22.6.5.2

ACI 318-05 Section 11.12.4.8

Input :

fc' =	3,000	psi
Dead Load =	5	psf
Live Load =	100	psf
Trib : W =	2.2500	ft
Trib : L =	3.00	ft
Ftg Thick: d =	4.00	in
Plate : w =	4.00	in
Con. Wt: w _c =	150	pcf

$$\begin{aligned}
 \text{Trib Area : } A &= W * L = 6.75 \text{ sq. ft} \\
 \text{Dead Load : } D &= A * DL / 1000 = 0.03 \text{ kips} \\
 \text{Live Load : } L &= A * LL / 1000 = 0.68 \text{ kips} \\
 \text{Siesmic Sds} &= 2.460 \\
 \text{Siesmic Vert. Load : } E &= (0.25 * L + D) * 0.2 * Sds = 0.10 \text{ kips} \\
 \text{Total Load : } P &= D + L + 0.7 E = 0.78 \text{ kips} \\
 \text{Total Load : } Pu &= 1.2 * D + 1.6 * L + 1.0 * E = 1.22013 \text{ kips}
 \end{aligned}$$

$$\text{Critical Section : } b_o = 4 * (w + (2 * d / 2)) = 32.0 \text{ in}$$

$$\text{Slab Capacity: } V = \Phi V_n = 0.60 * (4 * \text{sqrt}(fc') * b_o * d) / 1000 = 16.8 \text{ kips} \quad \text{OK}$$

Soil Stress :

ACI 318-19 Section 22.8.3.2

$$\text{Fdn Area : } A_f = (w + (2 * d))^2 = 1.0000 \text{ ft}^2 = 144 \text{ in}^2$$

$$\text{Soil Stress} = P / A_f = 778 \text{ psf} \quad \text{ASD}$$

$$\text{Allowable Soil Stress} = 2600 \text{ psf}$$

Plate Thickness:

$$\begin{aligned}
 \text{Plate Stress : } S &= P / w^2 = 0.05 \text{ ksi} \\
 M &= S * w * ((w - 1.25)/2) = 0.27 \text{ in-kips} \\
 b &= w = 4.00 \text{ in} \\
 \text{Plate Thick: } t &= \text{sqrt}((6 * M) / (b * 0.75 * 36 \text{ ksi})) = 0.122 \text{ in}
 \end{aligned}$$

Use (1) 10 ga Minimum Plate Thickness

(1) 10 ga = 0.1242" Plate Thickness

0.98173 Stress

Concrete One-Way Shear :

ACI 318-19 Section 9.6.3.1

Input :

fc' =	3,000	psi
Dead Load =	5	psf
Live Load =	100	psf
Length (L) =	6.0	ft
Ftg Thick: d =	4.00	in
Con. Wt: w _c =	150	pcf

Assume simply supported slab & 12" width of slab

$$\begin{aligned}
 \text{Controlling Load Combination (w)} &= 1.2 * D + 1.6 * L = 0.17 \text{ klf} \\
 \text{Maximum Shear (Vu)} &= wL/2 = 0.50 \text{ k} \\
 \text{Estimate d} &= 4" - 0.75 - 0.5(.5) = 3.00 \text{ in} \\
 \text{Beam width (bw)} &= 12.00 \text{ in} \\
 \text{Resistance Factor (}\Phi\text{)} &= 0.6 \\
 \text{Nominal Shear Capacity (Vn)} &= \Lambda * \sqrt{fc'} * bw * d = 1.97 \text{ k} \\
 \text{Design Shear Capacity (}\Phi V_n\text{)} &= 1.18 \text{ k}
 \end{aligned}$$

$$\text{Verify Capacity: } Vu < \Phi V_n = 0.50 \text{ k} < 1.18 \text{ k} \quad \text{OK}$$