WELCOME RAMP, INC.

STRUCTURAL ANALYSIS

STANDARD DECK, RAMPS & STAIRS

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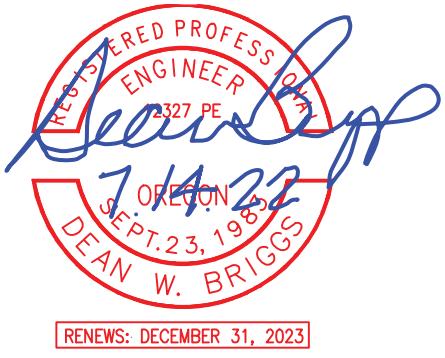

WELCOME RAMP, INC.

STRUCTURAL ANALYSIS

Ramp System Design Criteria and Analysis

1) Reference Design Criteria:
   a) International Building Code, 2018 Edition, ASCE 7-16, & OSSC-2019

2) Site Specific Criteria:
   a) Building Occupancy Classifications: II
   b) Vertical Loading: 100 psf for Landings, 300 lbs. concentrated loads for steps
   c) Horizontal Loading:
      i) Wind Loads: 135 mph(ultimate), Exposure B, Kz=0.85, Kzt=1.0; Design Wind Pressure = 30 psf (At less than 15 feet above grade, IBC 2018, 1609.6.2) w/ 5' effective width = 30 lbs/leg
      ii) Seismic Loads: Sds = 1.50, S1=0.50, I=1.0, R=3.25, Ωo=2, Cd=3.25, Cs=0.462, w/62.5#DL/leg*0.462*2 = 58#/leg
      iii) Pedestrian Traffic Load: 5' effective*100psf*1/12*1.5 = 63#/leg
   d) Soil Bearing: 1,500 psf, unless verified by Geotechnical Report or Building Official

3) Material Specifications:
   a) Aluminum:
      i) Handrail ASTM 6063-T5, 16 ksi, minimum yield strength
      ii) Structural ASTM 6061-T5, 35 ksi, minimum yield strength
   b) Density 170 lbs. per cubic foot

4) Connectors:
   a) Bolts Grade 5 zinc-coated (Design), ASTM A-325 may be substituted.
   b) Screws #10x1.25" zinc plated Self-Tapping Screw (STS)
   c) Welding Per AWS D1.2 and size as shown on the drawings
   d) Sleeves Length of snug-fitting sleeves designed resist moment and shear of sleeved connection.

5) Design Basis:
   a) Each side of the assembly is a framed made rigid by either welding or assembling parts together in sleeves to resist movement. Base connections are a pinned condition.
   b) Each frame is connected together with landing or ramp frames and planking to distribute dead and live loads to the frames. Railing is added to the frame assembly.
   c) Landing Platforms are attached to buildings with Lag-bolts or SDS Screws.
   d) Basic Dead Load is 5 psf for frame, ramp & landing surfaces. 2 psf is added for railing.
   e) A 300 lb. lateral load is used in the design to simulate seismic, wind and pedestrian lateral loading for each frame (2 frames per unit, 600# per assembly). This results in an effective Design Cs for a 30-foot ramp and 5x10 platform of 0.5 and a design wind load of 30 psf without consideration for stress duration. Seismic and wind loads do not govern lateral loading for standard configurations. Standard platform lateral loading will be resisted by connections of platform to building. (3) SDS25300 (OR 3/8" Ø x 3" lag-bolts= 900# for each 5' platform section. Lateral loads of ramps and stair assemblies attached to the platforms will be resisted by the platforms.
   f) Anchorage for Asphalt and Concrete Substrate: Where requested by the Owner, anchorage of ramps and stairs to asphalt and concrete substrates will be done with drilled anchors. Asphalt substrate conditions will use (1) 'Bolt-Hold' SP-10 at each bottom bearing plate of last section of ramp and bottom of stair. Anchorage for concrete substrate is 'Simpson' Titen HD ¼" Ø x 3".

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Ramp System Design

Member Data

Member Label	I Joint	J Joint	Rotate (degrees)	Shape / Section Set	Material Set	Phys Memb	TOM	End Releases I-End AVM	End Releases J-End AVM	End Offsets I-End (in)	End Offsets J-End (in)	Inactive Code	Length (ft)
M1	N1	N10		SEC1	AL	Y		PIN					4.768
M2	N10	N11		SEC1	AL	Y			PIN				4.768
M3	N11	N9		SEC1	AL	Y							4.768
M4	N9	N6		SEC1	AL	Y			PIN				5.012
M5	N6	N8		SEC2	AL	Y							5
M6	N7	N8		SEC3	AL	Y							1.599
M7	N5	N6		SEC3	AL	Y							1.599
M8	N4	N9		SEC3	AL	Y							1.25
M9	N3	N11		SEC3	AL	Y							.833
M10	N2	N10		SEC3	AL	Y							.417

Sections

Section Label	Database Shape	Material Label	Area (in)^2	SA (0,180)	SA (90,270)	I (90,270) (in^4)	I (0,180) (in^4)	T/C Only
SEC1	Welcome Ramp	AL	1.438	1.2	1.2	.421	2.02	
SEC2	Welcome Deck	AL	1.438	1.2	1.2	.421	1.378	
SEC3	TU2X2X2	AL	.897	1.2	1.2	.513	.513	

Basic Load Case Data

BLC No.	Basic Load Case Description	Category Code	Category Description	Gravity X	Gravity Y	Load Type Totals Joint	Load Type Totals Point	Load Type Totals Direct Dist.
1	w1 - Dead Load	DL	Dead Load		-1			5
2	w2 -Pedestrian Load	LLS	Live Load Special (public as..			1		5

Member Direct Distributed Loads, Category : DL, BLC 1 : w1 - Dead Load

Member Label	Direction	Start Magnitude (k/ft, F)	End Magnitude (k/ft, F)	Start Location (ft or %)	End Location (ft or %)
M1	Y	-.014	-.014	0	0
M2	Y	-.014	-.014	0	0
M3	Y	-.014	-.014	0	0
M4	Y	-.014	-.014	0	0
M5	Y	-.018	-.018	0	0

Member Direct Distributed Loads, Category : LLS, BLC 2 : w2 -Pedestrian Load

Member Label	Direction	Start Magnitude (k/ft, F)	End Magnitude (k/ft, F)	Start Location (ft or %)	End Location (ft or %)
M1	Y	-.2	-.2	0	0
M2	Y	-.2	-.2	0	0
M3	Y	-.2	-.2	0	0
M4	Y	-.2	-.2	0	0
M5	Y	-.25	-.25	0	0

Load Combinations

Num	Description	Env	WS	PD	SRSS	CD	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	DL + Ped. Load	y				1	1	1	2	1				
2	Ped. Load Only	y				1	2	1						

Load Combinations (continued)

Num	Description	Env	WS	PD	SRSS	CD	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
3						1								
4						1								
5						1								

Envelope Member Stresses

Member Label	Section		Axial (ksi)	Lc	Shear (ksi)	Lc	Bending top (ksi)	Lc	Bending bot (ksi)	Lc
M1	1	max	.023	1	.319	1	0	1	0	1
		min	.022	2	.299	2	0	1	0	1
	2	max	.003	1	.036	1	4.933	1	-2.906	2
		min	.003	2	.034	2	4.625	2	-3.1	1
	3	max	-.017	2	-.23	2	2.009	1	-1.197	2
		min	-.018	1	-.247	1	1.906	2	-1.262	1
	4	max	-.036	2	-.494	2	-8.157	2	5.513	1
		min	-.039	1	-.53	1	-8.774	1	5.125	2
M2	1	max	.059	2	.531	1	-8.355	2	5.589	1
		min	.053	1	.497	2	-8.895	1	5.25	2
	2	max	.04	2	.248	1	1.928	1	-1.114	2
		min	.032	1	.232	2	1.773	2	-1.211	1
	3	max	.02	2	-.032	2	4.893	1	-2.864	2
		min	.011	1	-.035	1	4.558	2	-3.074	1
	4	max	.001	2	-.296	2	0	1	0	1
		min	-.009	1	-.318	1	0	1	0	1
M3	1	max	.2	1	.359	1	-2.64	2	1.752	1
		min	.199	2	.337	2	-2.789	1	1.659	2
	2	max	.18	2	.077	1	3.268	1	-1.91	2
		min	.18	1	.072	2	3.039	2	-2.053	1
	3	max	.16	2	-.192	2	1.467	1	-.864	2
		min	.159	1	-.206	1	1.375	2	-.922	1
	4	max	.141	2	-.456	2	-7.633	2	5.147	1
		min	.138	1	-.489	1	-8.192	1	4.796	2
M4	1	max	.029	1	.55	1	-8.455	2	5.68	1
		min	.026	2	.514	2	-9.04	1	5.313	2
	2	max	.012	1	.252	1	2.667	1	-1.564	2
		min	.01	2	.236	2	2.489	2	-1.676	1
	3	max	-.006	1	-.043	2	5.681	1	-3.334	2
		min	-.006	2	-.046	1	5.307	2	-3.569	1
	4	max	-.022	2	-.321	2	0	1	0	1
		min	-.023	1	-.343	1	0	1	0	1
M5	1	max	.152	1	.56	1	-5.456	2	6.538	1
		min	.141	2	.523	2	-5.832	1	6.116	2
	2	max	.152	1	.188	1	6.427	1	-6.715	2
		min	.141	2	.175	2	5.99	2	-7.205	1
	3	max	.152	1	-.173	2	6.464	1	-6.765	2
		min	.141	2	-.185	1	6.035	2	-7.246	1
	4	max	.152	1	-.52	2	-5.322	2	6.414	1
		min	.141	2	-.558	1	-5.721	1	5.966	2
M6	1	max	.745	1	.523	1	0	1	0	1
		min	.695	2	.487	2	0	1	0	1
	2	max	.745	1	.523	1	2.717	1	-2.527	2

Envelope Member Stresses, (continued)

Member Label	Section		Axial (ksi)	Lc	Shear (ksi)	Lc	Bending top (ksi)	Lc	Bending bot (ksi)	Lc
		min	.695	2	.487	2	2.527	2	-2.717	1
	3	max	.745	1	.523	1	5.435	1	-5.055	2
		min	.695	2	.487	2	5.055	2	-5.435	1
	4	max	.745	1	.523	1	8.152	1	-7.582	2
		min	.695	2	.487	2	7.582	2	-8.152	1
M7	1	max	1.208	1	-.499	2	0	1	0	1
		min	1.129	2	-.533	1	0	1	0	1
	2	max	1.208	1	-.499	2	-2.591	2	2.77	1
		min	1.129	2	-.533	1	-2.77	1	2.591	2
	3	max	1.208	1	-.499	2	-5.182	2	5.54	1
		min	1.129	2	-.533	1	-5.54	1	5.182	2
	4	max	1.208	1	-.499	2	-7.774	2	8.31	1
		min	1.129	2	-.533	1	-8.31	1	7.774	2
M8	1	max	1.367	1	-.108	2	0	1	0	1
		min	1.275	2	-.112	1	0	1	0	1
	2	max	1.367	1	-.108	2	-.44	2	.454	1
		min	1.275	2	-.112	1	-.454	1	.44	2
	3	max	1.367	1	-.108	2	-.879	2	.907	1
		min	1.275	2	-.112	1	-.907	1	.879	2
	4	max	1.367	1	-.108	2	-1.319	2	1.361	1
		min	1.275	2	-.112	1	-1.361	1	1.319	2
M9	1	max	.93	1	-.521	2	0	1	0	1
		min	.87	2	-.55	1	0	1	0	1
	2	max	.93	1	-.521	2	-1.411	2	1.49	1
		min	.87	2	-.55	1	-1.49	1	1.411	2
	3	max	.93	1	-.521	2	-2.822	2	2.98	1
		min	.87	2	-.55	1	-2.98	1	2.822	2
	4	max	.93	1	-.521	2	-4.233	2	4.471	1
		min	.87	2	-.55	1	-4.471	1	4.233	2
M10	1	max	1.424	1	-.048	1	0	1	0	1
		min	1.332	2	-.078	2	0	1	0	1
	2	max	1.424	1	-.048	1	-.065	1	.106	2
		min	1.332	2	-.078	2	-.106	2	.065	1
	3	max	1.424	1	-.048	1	-.129	1	.212	2
		min	1.332	2	-.078	2	-.212	2	.129	1
	4	max	1.424	1	-.048	1	-.194	1	.318	2
		min	1.332	2	-.078	2	-.318	2	.194	1

Envelope Member Section Forces

Member Label	Section		Axial (k)	Lc	Shear (k)	Lc	Moment (k)	Lc
M1	1	max	.034	1	.382	1	0	1
		min	.031	2	.358	2	0	1
	2	max	.004	1	.043	1	-.317	2
		min	.004	2	.041	2	-.338	1
	3	max	-.024	2	-.276	2	-.131	2
		min	-.026	1	-.296	1	-.138	1
	4	max	-.052	2	-.592	2	.601	1
		min	-.056	1	-.634	1	.559	2
M2	1	max	.085	2	.636	1	.61	1
		min	.076	1	.595	2	.573	2
	2	max	.057	2	.297	1	-.122	2

Envelope Member Section Forces, (continued)

Member Label	Section		Axial (k)	Lc	Shear (k)	Lc	Moment (k)	Lc
		min	.046	1	.278	2	-.132	1
	3	max	.029	2	-.038	2	-.312	2
		min	.016	1	-.042	1	-.335	1
	4	max	.002	2	-.355	2	0	1
		min	-.013	1	-.38	1	0	1
M3	1	max	.288	1	.431	1	.191	1
		min	.286	2	.403	2	.181	2
	2	max	.258	2	.092	1	-.208	2
		min	.258	1	.087	2	-.224	1
	3	max	.231	2	-.23	2	-.094	2
		min	.229	1	-.247	1	-.101	1
	4	max	.203	2	-.547	2	.561	1
		min	.199	1	-.586	1	.523	2
M4	1	max	.042	1	.659	1	.62	1
		min	.038	2	.616	2	.58	2
	2	max	.017	1	.302	1	-.171	2
		min	.015	2	.282	2	-.183	1
	3	max	-.008	1	-.051	2	-.364	2
		min	-.009	2	-.055	1	-.389	1
	4	max	-.032	2	-.384	2	0	1
		min	-.033	1	-.411	1	0	1
M5	1	max	.218	1	.671	1	.355	1
		min	.203	2	.627	2	.332	2
	2	max	.218	1	.225	1	-.365	2
		min	.203	2	.21	2	-.391	1
	3	max	.218	1	-.207	2	-.368	2
		min	.203	2	-.222	1	-.394	1
	4	max	.218	1	-.623	2	.348	1
		min	.203	2	-.669	1	.324	2
M6	1	max	.669	1	.218	1	0	1
		min	.623	2	.203	2	0	1
	2	max	.669	1	.218	1	-.108	2
		min	.623	2	.203	2	-.116	1
	3	max	.669	1	.218	1	-.216	2
		min	.623	2	.203	2	-.232	1
	4	max	.669	1	.218	1	-.324	2
		min	.623	2	.203	2	-.348	1
M7	1	max	1.084	1	-.208	2	0	1
		min	1.012	2	-.222	1	0	1
	2	max	1.084	1	-.208	2	.118	1
		min	1.012	2	-.222	1	.111	2
	3	max	1.084	1	-.208	2	.237	1
		min	1.012	2	-.222	1	.222	2
	4	max	1.084	1	-.208	2	.355	1
		min	1.012	2	-.222	1	.332	2
M8	1	max	1.226	1	-.045	2	0	1
		min	1.144	2	-.047	1	0	1
	2	max	1.226	1	-.045	2	.019	1
		min	1.144	2	-.047	1	.019	2
	3	max	1.226	1	-.045	2	.039	1
		min	1.144	2	-.047	1	.038	2
	4	max	1.226	1	-.045	2	.058	1
		min	1.144	2	-.047	1	.056	2

Envelope Member Section Forces, (continued)

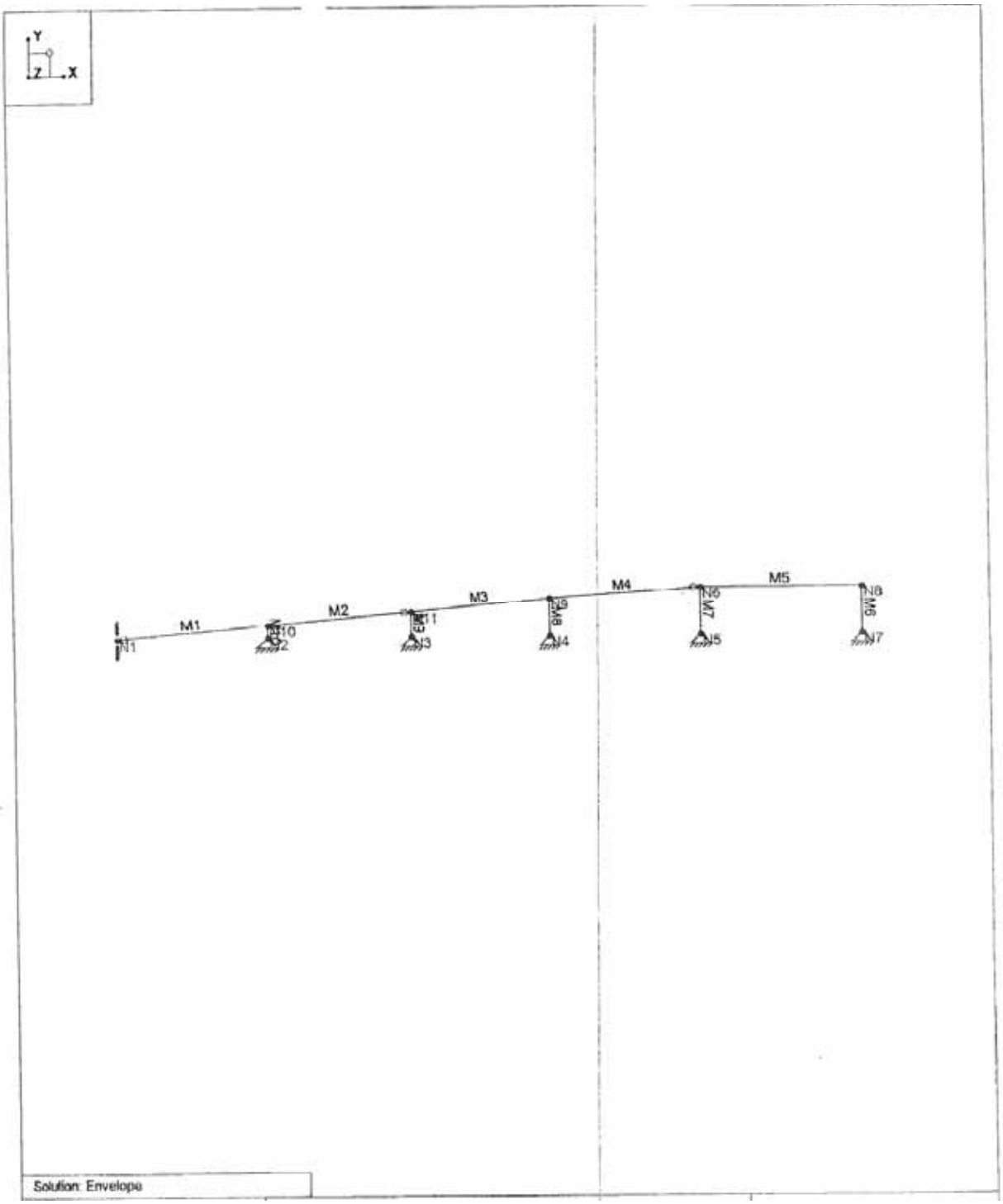
Member Label	Section		Axial (k)	Lc	Shear (k)	Lc	Moment (k)	Lc
M9	1	max	.834	1	-.217	2	0	1
		min	.78	2	-.229	1	0	1
	2	max	.834	1	-.217	2	.064	1
		min	.78	2	-.229	1	.06	2
	3	max	.834	1	-.217	2	.127	1
		min	.78	2	-.229	1	.121	2
	4	max	.834	1	-.217	2	.191	1
		min	.78	2	-.229	1	.181	2
M10	1	max	1.277	1	-.02	1	0	1
		min	1.195	2	-.033	2	0	1
	2	max	1.277	1	-.02	1	.005	2
		min	1.195	2	-.033	2	.003	1
	3	max	1.277	1	-.02	1	.009	2
		min	1.195	2	-.033	2	.006	1
	4	max	1.277	1	-.02	1	.014	2
		min	1.195	2	-.033	2	.008	1

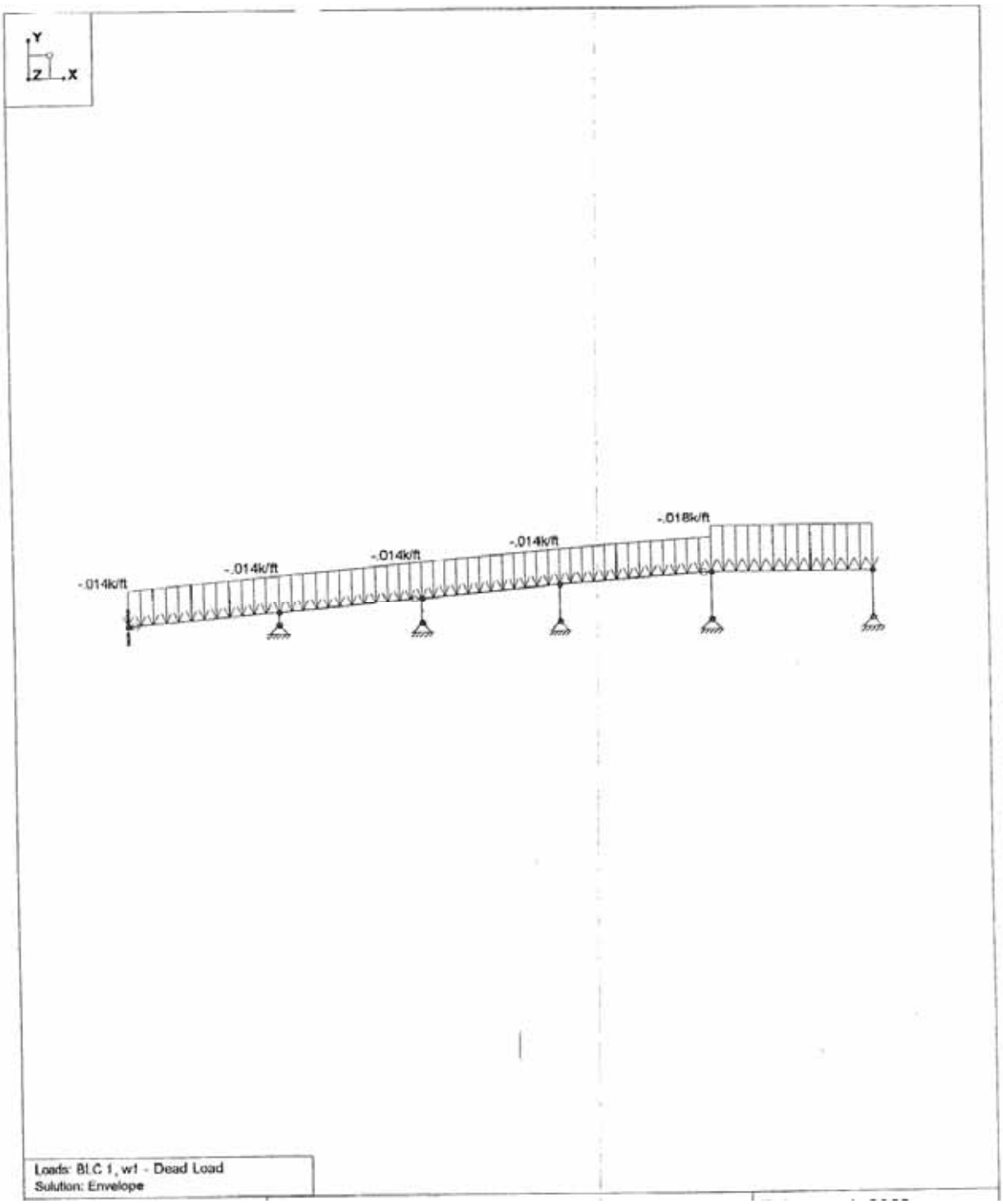
Envelope Member Deflections

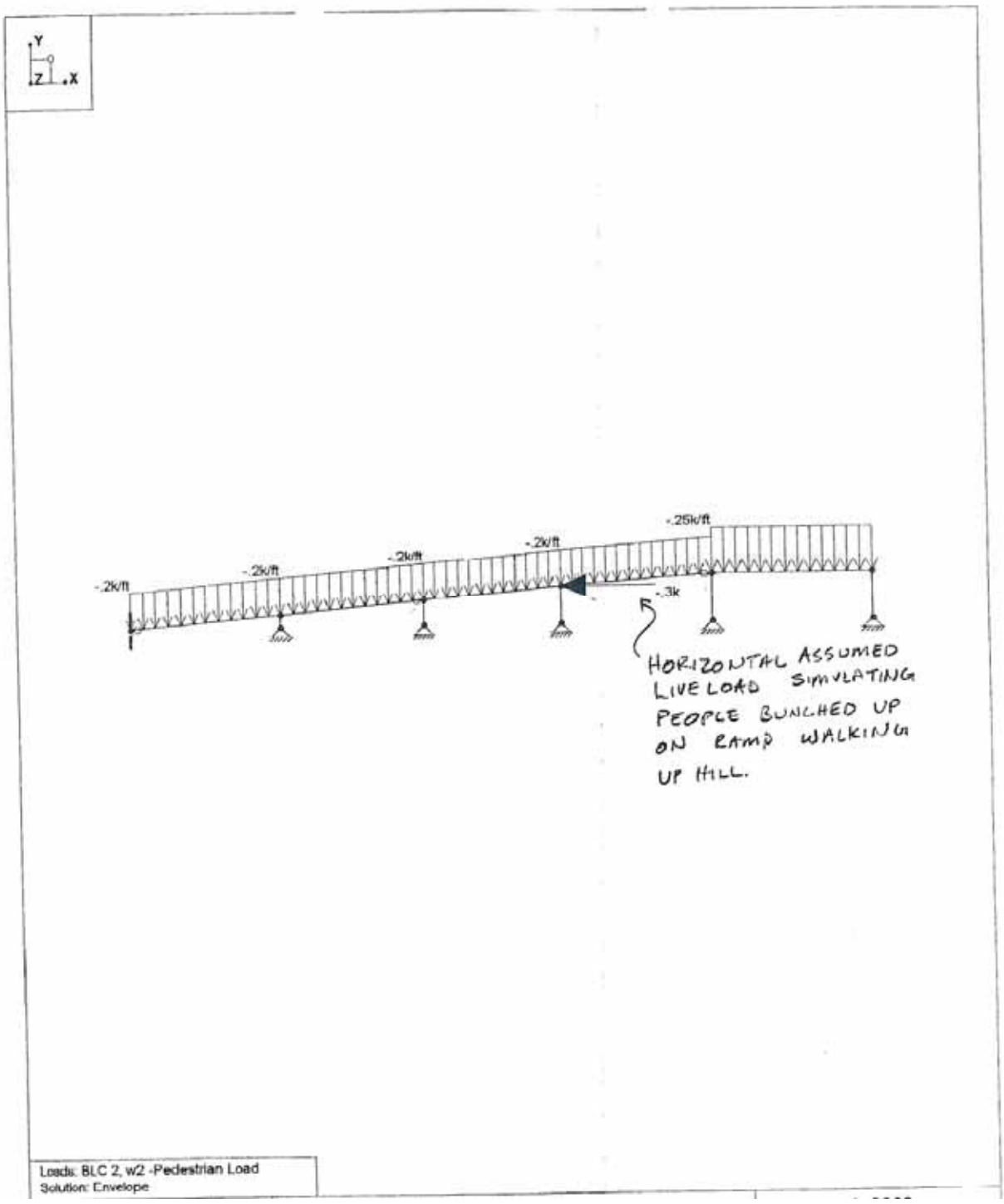
Member Label	Section		x-Translate (in)	Lc	y-Translate (in)	Lc	(n) L/y Ratio	Lc
M1	1	max	0	1	0	2	NC	
		min	0	2	0	1	NC	
	2	max	0	1	-.046	2	1243.875	2
		min	0	2	-.049	1	1169.664	1
	3	max	0	1	-.033	2	1756.299	2
		min	0	2	-.035	1	1659.338	1
	4	max	0	1	0	2	NC	
		min	0	2	0	1	NC	
M2	1	max	0	1	0	2	NC	
		min	0	2	0	1	NC	
	2	max	0	1	-.032	2	1848.986	2
		min	0	2	-.034	1	1708.638	1
	3	max	0	1	-.045	2	1260.237	2
		min	0	2	-.049	1	1189.011	1
	4	max	0	1	0	2	NC	
		min	0	2	0	1	NC	
M3	1	max	0	1	0	2	NC	
		min	0	2	0	1	NC	
	2	max	0	1	-.029	2	2063.401	2
		min	-.001	2	-.031	1	1919.616	1
	3	max	-.001	1	-.021	2	2931.998	2
		min	-.002	2	-.022	1	2735.504	1
	4	max	-.002	1	-.002	2	NC	
		min	-.002	2	-.002	1	NC	
M4	1	max	-.002	1	-.002	2	NC	
		min	-.002	2	-.002	1	NC	
	2	max	-.002	1	-.047	2	1336.222	2
		min	-.002	2	-.05	1	1247.236	1
	3	max	-.002	1	-.062	2	996.057	2
		min	-.002	2	-.067	1	930.197	1
	4	max	-.002	1	-.002	2	NC	
		min	-.002	2	-.002	1	NC	

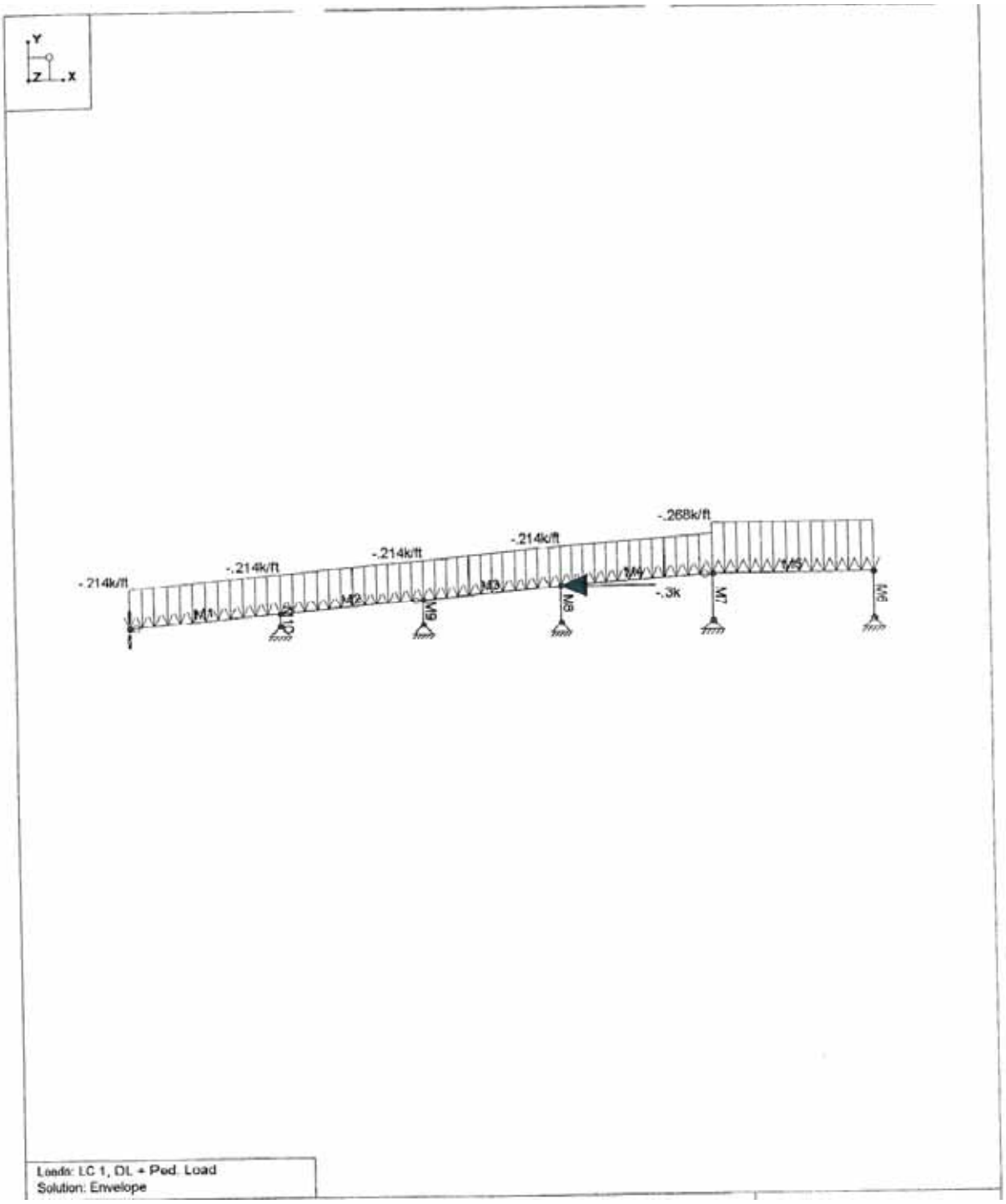
Envelope Member Deflections, (continued)

Member Label	Section		x-Translate (in)	Lc	y-Translate (in)	Lc	(n) L/y Ratio	Lc
M5	1	max	-.001	1	-.002	2	NC	
		min	-.002	2	-.002	1	NC	
	2	max	-.002	1	-.109	2	559.623	2
		min	-.002	2	-.117	1	521.856	1
	3	max	-.002	1	-.109	2	557.976	2
		min	-.002	2	-.117	1	520.674	1
	4	max	-.002	1	-.001	2	NC	
		min	-.003	2	-.001	1	NC	
M6	1	max	0	1	0	1	NC	
		min	0	1	0	1	NC	
	2	max	0	2	-.013	2	1392.207	2
		min	0	1	-.014	1	1294.941	1
	3	max	0	2	-.016	2	1113.766	2
		min	0	1	-.017	1	1035.953	1
	4	max	-.001	2	.003	2	NC	
		min	-.001	1	.002	1	NC	
M7	1	max	0	1	0	1	NC	
		min	0	1	0	1	NC	
	2	max	0	2	.016	1	1270.353	1
		min	0	1	.015	2	1357.948	2
	3	max	-.001	2	.02	1	1016.282	1
		min	-.002	1	.019	2	1086.359	2
	4	max	-.002	2	.002	2	NC	
		min	-.002	1	.001	1	NC	
M8	1	max	0	1	0	1	NC	
		min	0	1	0	1	NC	
	2	max	0	2	.002	2	NC	
		min	0	1	.002	1	9920.451	1
	3	max	-.001	2	.003	2	8189.633	2
		min	-.001	1	.003	1	7936.361	1
	4	max	-.002	2	.002	2	NC	
		min	-.002	1	.001	1	NC	
M9	1	max	0	1	0	1	NC	
		min	0	1	0	1	NC	
	2	max	0	2	.002	1	4529.485	1
		min	0	1	.002	2	4784.344	2
	3	max	0	2	.003	2	3827.475	2
		min	0	1	.003	1	3623.588	1
	4	max	0	2	0	2	NC	
		min	0	1	0	1	NC	
M10	1	max	0	1	0	1	NC	
		min	0	1	0	1	NC	
	2	max	0	2	0	2	NC	
		min	0	1	0	1	NC	
	3	max	0	2	0	2	NC	
		min	0	1	0	1	NC	
	4	max	0	2	0	2	NC	
		min	0	1	0	1	NC	


Y
Z
X
M1
M2
M3
M4
M5
M6
M7
M8
M9
N1
N2
N3
N4
N5
N6
N7
N8
N9
N10
N11
Solution: Envelope


Y
Z
X
-.014k/ft
-.014k/ft
-.014k/ft
-.014k/ft
-.018k/ft
Loads: BLC 1, w1 - Dead Load
Solution: Envelope

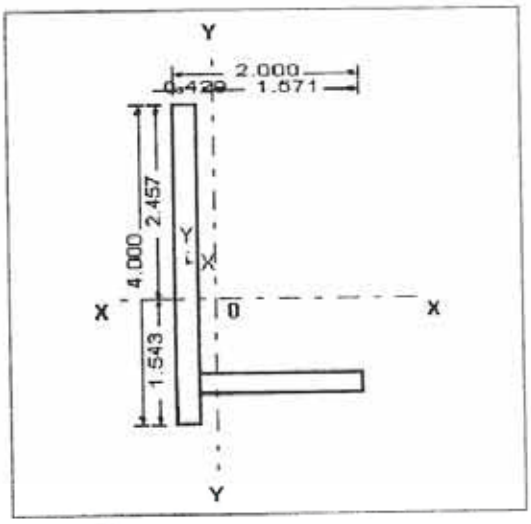

Y
Z
X
-.25k/ft
-.2k/ft
-.2k/ft
-.2k/ft
-.2k/ft
-.2k/ft
-.3k
HORIZONTAL ASSUMED LIVE LOAD SIMULATING PEOPLE BUNCHED UP ON RAMP WALKING UP HILL.
Loads: BLC 2, w2 -Pedestrian Load
Solution: Envelope


Y
Z
X
-.214k/ft
-.214k/ft
-.214k/ft
-.214k/ft
-.268k/ft
-.3k
M1
M2
M3
M4
M5
M6
M7
M8
M9
Loads: LC 1, DL + Ped. Load
Solution: Envelope

Section:Welcome Ramp

Section Properties:

Number of Shapes	= 2	
Total Width	= 2.00	in
Total Height	= 4.00	in
Center, Xo	= 0.304	in
Center, Yo	= -0.457	in
X-bar (Right)	= 1.571	in
X-bar (Left)	= 0.429	in
Y-bar (Top)	= 2.457	in
Y-bar (Bot)	= 1.543	in
Equivalent Properties:		
Area, Ax	= 1.438	in^2
Inertia, Ixx	= 2.02	in^4
Inertia, Iyy	= 0.4212	in^4
Inertia, Ixy	= -0.4565	in^4
Torsional, J	= 0.0299	in^4
Modulus, Sx(Top)	= 0.8225	in^3
Modulus, Sx(Bot)	= 1.309	in^3
Modulus, Sy(Left)	= 0.981	in^3
Modulus, Sy(Right)	= 0.2682	in^3
Plastic Modulus, Zx	= 1.4921	in^3
Plastic Modulus, Zy	= 0.4852	in^3
Radius, rx	= 1.186	in
Radius, ry	= 0.541	in



Section Diagram

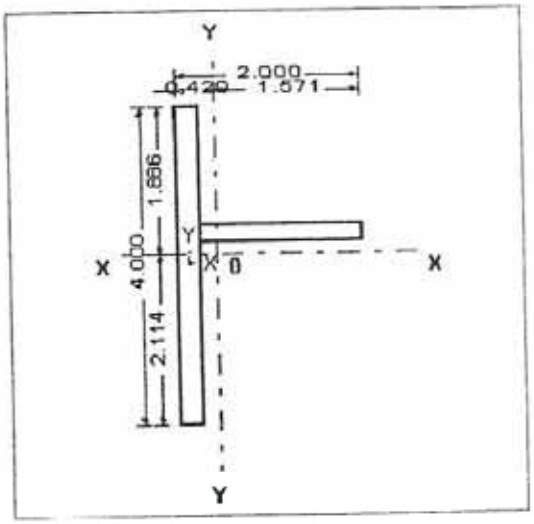
Summary of Section Properties

Sh. No.	Section	Width in	Height in	Xo in	Yo in	Ax in^2	Ixx in^4	Iyy in^4
1	Welcome Ramp	2.00	4.00	0.304	-0.457	1.438	2.02	0.4212

Section:Welcome Deck

Section Properties:

Number of Shapes	= 2	
Total Width	= 2.00	in
Total Height	= 4.00	in
Center, Xo	= 0.304	in
Center, Yo	= 0.114	in
X-bar (Right)	= 1.571	in
X-bar (Left)	= 0.429	in
Y-bar (Top)	= 1.886	in
Y-bar (Bot)	= 2.114	in
Equivalent Properties:		
Area, Ax	= 1.438	in^2
Inertia, Ixx	= 1.378	in^4
Inertia, Iyy	= 0.4212	in^4
Inertia, Ixy	= 0.1141	in^4
Torsional, J	= 0.0299	in^4
Modulus, Sx(Top)	= 0.7309	in^3
Modulus, Sx(Bot)	= 0.652	in^3
Modulus, Sy(Left)	= 0.981	in^3
Modulus, Sy(Right)	= 0.2682	in^3
Plastic Modulus, Zx	= 1.0532	in^3
Plastic Modulus, Zy	= 0.4852	in^3
Radius, rx	= 0.9792	in
Radius, ry	= 0.5413	in



Section Diagram

Summary of Section Properties

Sh. No.	Section	Width in	Height in	Xo in	Yo in	Ax in^2	Ixx in^4	Iyy in^4
1	Welcome Deck	2.00	4.00	0.304	0.114	1.438	1.378	0.4212

Member Stress Results

Access the **Member Section Stresses** spreadsheet by selecting the **Results** menu and then selecting **Members ▸ Stresses.**

These are the member stresses calculated along each active member. The number of sections for which stresses are reported is controlled by the **Number Of Sections** specified on the Global window. The actual number of segments is this **Number Of Sections** minus 1. The incremental length of each segment is the same. For example, if you specify 5 sections, the member is divided into 4 equal pieces, and the stresses are reported for each piece.

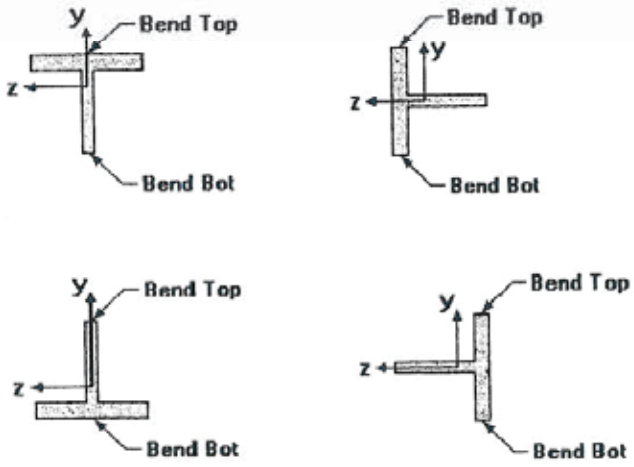
There will be four stress values listed for each section location along the member taking into account any member offsets. The units for the stresses are shown at the top of each column. As for the sign convention, the signs of these results correspond to the signs of the forces. These line up as positive or negative according to the member local axis directions.

The axial stress is the ratio P/A, where P is the section axial force. A positive stress is compressive, since the sign of the stress follows the sign of the force.

The shear stress is calculated as V/S.A., where S.A. is the effective shear area. For members not defined with a section set a value of 1.2 is used for the shear area coefficient S.A.

The bending stresses are calculated using the familiar equation M * c / I, where "M" is the bending moment, "c" is the distance from the neutral axis to the extreme fiber and "I" is the moment of inertia. The stress for the section's extreme edge is listed with respect to the positive and negative directions of the local y and z axes. A positive stress is compressive and a negative stress is tensile.

Some shapes are not symmetrical about both local axes. For example Tee and Channel shapes. Thus the stress at the positive and negative edges may not be the same. The locations for the calculated stresses are illustrated in this diagram:



So, the y-top location is the extreme fiber of the shape in the positive local y direction, y-bot is the extreme fiber in the negative local y direction, etc. The y-top,bot stresses are calculated using Mz.

For enveloped results the maximum and minimum value at each location is listed. The load combination producing the maximum or minimum is also listed, in the "lc" column. To include a particular Load Combination in the envelope analysis, open the **Load Combinations** spreadsheet and check the box in the "Env" column.

Note

- A special case is bending stress calculations for single angles. The bending stresses for single angles are reported for bending about the principal axes.
- To view the results for a particular member, use the Find option. To view the maximums and minimums, use the Sort option.

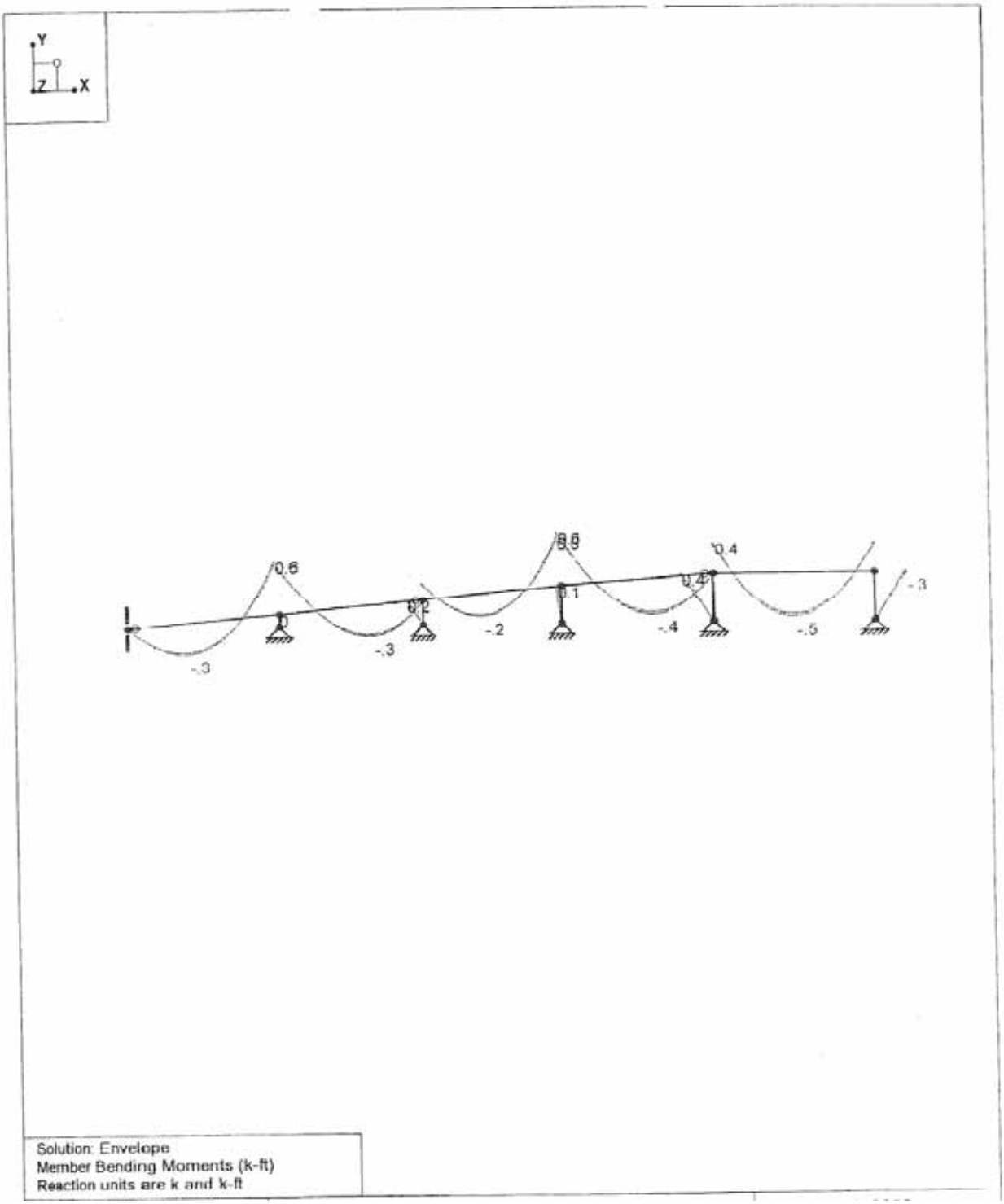

Y
Z
X
0.6
-.3
-.3
-.2
0.1
-.4
0.4
-.5
-.3
Solution: Envelope
Member Bending Moments (k-ft)
Reaction units are k and k-ft

TABLE 20-II-A—MINIMUM MECHANICAL PROPERTIES FOR ALUMINUM ALLOYS—(Continued)
Values Are Given in Units of ksi (1,000 lb/in²)

ALLOY AND TEMPER	PRODUCT[1]	THICKNESS RANGE[1] (inch)	TENSION F_{tu}[2] ksi	TENSION F_{ty}[2] ksi	COMPRESSION F_{cy} ksi	SHEAR F_{su} ksi	SHEAR F_{sy} ksi	BEARING F_{bru} ksi	BEARING F_{bry} ksi	COMPRESSIVE MODULUS OF ELASTICITY[3] E ksi
		× 25.4 for mm	× 6.89 for MPa							
5086-H111	Extrusions	up to 0.500	36	21	18	21	12	70	36	10,400
-H111	Extrusions	0.501 and over	36	21	18	21	12	70	34	10,400
-H112	Plate	0.250-0.499	36	18	17	22	10	72	31	10,400
-H112	Plate	0.500-1.000	35	16	16	21	9	70	28	10,400
-H112	Plate	1.001-2.000	35	14	15	21	8	70	28	10,400
-H112	Plate	2.001-3.000	34	14	15	21	8	68	28	10,400
-H32	Sheet and plate	All	40	28	26	24	16	78	48	10,400
-H34	Drawn tube.	All	44	34	32	26	20	84	58	10,400
5154-H38	Sheet	0.006-0.128	45	35	33	24	20	81	56	10,300
5454-H111	Extrusions	up to 0.500	33	19	16	20	11	64	32	10,400
H111	Extrusions	0.501 and over	33	19	16	19	11	64	30	10,400
-H112	Extrusions	up to 5.000	31	12	13	19	7	62	24	10,400
-H32	Sheet and plate	0.020-2.000	36	26	24	21	15	70	44	10,400
H34	Sheet and plate	0.020-1.000	39	29	27	23	17	74	49	10,400
5456-H111	Extrusions	up to 0.500	42	26	22	25	15	82	44	10,400
-H111	Extrusions	0.501 and over	42	26	22	24	15	82	42	10,400
-H112	Extrusions	up to 5.000	41	19	20	24	11	82	38	10,400
-H321	Sheet and plate	0.188-1.250	46	33	27	27	19	87	56	10,400
-H321	Plate	1.251-1.500	44	31	25	25	18	84	53	10,400
-H321	Plate	1.501-3.000	41	29	25	25	17	82	49	10,400
-H323	Sheet	0.051-0.249	48	36	34	28	21	94	61	10,400
-H343	Sheet	0.051-0.249	53	41	39	31	24	101	70	10,400
6005-T5	Extrusions	up to 0.500	38	35	35	24	20	80	56	10,100
6061-T6, -T651	Sheet and plate	0.010-4.000	42	35	35	27	20	88	58	10,100
-T6, -T6510[4]	Extrusions	up to 3.000	38	35	35	24	20	80	56	10,100
-T6, -T651	Rolled rod and bar	up to 8.000	42	35	35	27	20	88	56	10,100
-T6	Drawn tube	0.025-0.500	42	35	35	27	20	88	56	10,100
-T6	Pipe	up to 0.999	42	35	35	27	20	88	56	10,100
-T6	Pipe	over 0.999	38	35	35	24	20	80	56	10,100

MAIN RAILS

HAND RAILS

6063-T5	Extrusions	up to 0.500	22	16	16	13	9	46	26	10,100
-T5	Extrusions	over 0.500	21	15	15	12	8.5	44	24	10,100
-T6	Extrusions	All	30	25	25	19	14	63	40	10,100
	Pipe									
6351-T5	Extrusions	up to 1.00	38	35	35	24	20	80	56	10,100

[1]Values also apply to -T6511 temper.
[2]F_{tu} and F_{ty} are minimum specified values (except for Alclad 3004-H14, -H16 and F_{ty} for Alclad 3003-H18). Other strength properties are corresponding minimum expected values.
[3]For deflection calculations an average modulus of elasticity is used; numerically this is 100 ksi (689 MPa) lower than the values in this column.

TABLE 20-II-B—MINIMUM MECHANICAL PROPERTIES FOR WELDED ALUMINUM ALLOYS[1]
(Gas Tungsten Arc or Gas Metal Arc Welding with No Postweld Heat Treatment)

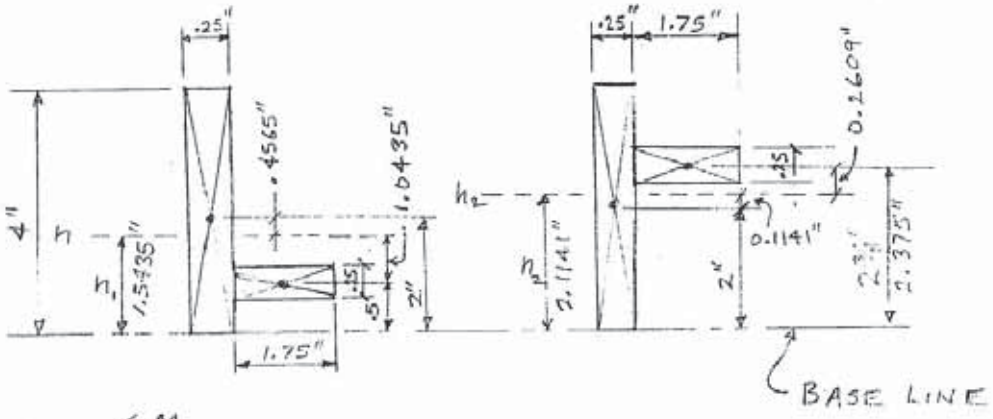
ALLOY AND TEMPER	PRODUCT AND THICKNESS RANGE (inch)	TENSION F_{tu}[2] ksi	TENSION F_{ty}[2] ksi	COMPRESSION F_{cy}[3] ksi	SHEAR F_{su} ksi	SHEAR F_{sy} ksi	BEARING F_{bru} ksi	BEARING F_{bry} ksi
	× 25.4 for mm	× 6.89 for MPa						
1100-H12, -H14	All	11	4.5	4.5	8	2.5	23	8
3003-H12, -H14, -H16, -H18	All	14	7	7	10	4	30	12
Alclad 3003-H12, -H14, -H16, -H18	All	13	6	6	10	3.5	30	11
3004-H32, -H34, -H36	All	22	11	11	14	6.5	46	20
Alclad 3004-H32, -H34, -H14, -H16	All	21	11	11	13	6.5	44	19
3005-H25	Sheet 0.013-0.050	17	9	9	12	5	36	15
5005-H12, -H14, -H32, -H34	All	14	7	7	9	4	28	10

F_{byw} = bearing yield strength within 1.0 inch (25.4 mm) of a weld, ksi (MPa).
F_c = allowable compressive stress, ksi (MPa).
F_{cy} = compressive yield strength, ksi (MPa).
F_{cyw} = compressive yield strength across a butt weld (0.2 percent offset in 10-inch (254 mm) gage length), ksi (MPa).
F_{ec} = $\pi^2 E/[n_a(l/r)^2]$, where l/r is slenderness ratio for member considered as a column tending to fail in the plane of the applied bending moments, ksi (MPa).
F_n = allowable stress for cross section 1.0 inch (25.4 mm) or more from weld, ksi (MPa).
F_{pw} = allowable stress on cross section, part of whose area lies within 1.0 (25.4 mm) inch of a weld, ksi (MPa).
F_s = allowable shear stress for members subjected only to torsion or shear, ksi (MPa).
F_{su} = shear ultimate strength, ksi (MPa).
F_{suw} = shear ultimate strength within 1.0 inch (25.4 mm) of a weld, ksi (MPa).
F_{sy} = shear yield strength, ksi (MPa).
F_{syw} = shear yield strength within 1.0 inch (25.4 mm) of a weld, ksi (MPa).
F_{tu} = tensile ultimate strength, ksi (MPa).
F_{tuw} = tensile ultimate strength across a butt weld, ksi (MPa).
F_{ty} = tensile yield strength, ksi (MPa).
F_{tyw} = tensile yield strength across a butt weld [0.2 percent offset in 10-inch (254 mm) gage length], ksi (MPa).
F_y = either F_b or F_{cy}, whichever is smaller, ksi (MPa).
f = calculated stress, ksi (MPa).
f_a = average compressive stress on cross section of member produced by axial compressive load, ksi (MPa).
f_b = maximum bending stress (compressive) caused by transverse loads or end moments, ksi (MPa).
f_s = shear stress caused by torsion or transverse shear, ksi (MPa).
G = modulus of elasticity in shear, ksi (MPa).
g = spacing of rivet or bolt holes perpendicular to direction of load, inches (mm).
h = clear height of shear web, inches (mm).
I = moment of inertia, inches^4 (mm^4).
I_s = moment of inertia of horizontal stiffener, inches^4 (mm^4).
I_t = moment of inertia of transverse stiffener to resist shear buckling, inches^4 (mm^4).
I_x = moment of inertia of a beam about axis perpendicular to web, inches^4 (mm^4).
I_y = moment of inertia of a beam about axis parallel to web, inches^4 (mm^4).
I_{yc} = moment of inertia of compression element about axis parallel to vertical web, inches^4 (mm^4).
J = torsion constant, inches^4 (mm^4).
k_1 = coefficient for determining slenderness limit S_2 for sections for which the allowable compressive stress is based on crippling strength.
k_2 = coefficient for determining allowable compressive stress in sections with slenderness ratio above S_2 for which the allowable compressive stress is based on crippling strength.
k_c = coefficient for compression members.
k_t = coefficient for tension members.
L = length of compression member between points of lateral support, or twice the length of a cantilever column (except where analysis shows that a shorter length can be used), inches (mm).

L_b = length of beam between points at which the compression flange is sup al movement, or length of cantilever beam from free end to point at sion flange is supported against lateral movement, inches (mm).
L_h = total length of portion of column lying within 1.0 inch (25.4 mm) o welds at ends of columns that are supported at both ends), inches (m
L_w = increased length to be substituted in column formula to determine a welded column, inches (mm).
l/r = slenderness ratio for columns.
M = bending moment, inch-kips (kN·m).
M_c = bending moment at center of span resulting from applied bendin (kN·m).
M_m = maximum bending moment in span resulting from applied bendin (kN·m).
M_1, M_2 = bending moments at two ends of a beam, inch-kips (kN·m).
N = length of bearing at reaction or concentrated load, inches (mm).
n_a = factor of safety on appearance of buckling.
n_u = factor of safety on ultimate strength.
n_y = factor of safety on yield strength.
P = local load concentration on bearing stiffener, kips (kN).
P_c = allowable reaction or concentrated load per web, kips (kN).
P_t = allowable tensile load per fastener, sheet to purlin or girt, kips (kN).
R = outside radius of round tube or maximum outside radius for an oval t
R_b = radius of curvature of tubular members, inches (mm).
R_r = transition radius, the radius of an attachment of the weld detail.
r = least radius of gyration of a column, inches (mm).
r_c = radius of gyration of lip or bulb about face of flange from which lip proj
r_y = radius of gyration of a beam (about axis parallel to web), inches (mm). (I unsymmetrical about the horizontal axis, r_y should be calculated as th were the same as the compression flange.)
S_c = section modulus of a beam, compression side, inches^3 (mm^3).
SR = stress ratio, the ratio of minimum stress to maximum stress.
S_t = section modulus of a beam, tension side, inches^3 (mm^3).
S_1, S_2 = slenderness limits.
s = spacing of transverse stiffeners (clear distance between stiffeners for stif of a pair of members, one on each side of the web, center-to-center distan eners consisting of a member on one side of the web only), inches (mm or bolt holes parallel to direction of load, inches (mm).
t = thickness of flange, plate, web or tube, inches (mm). (For tapered flange thickness.)
V = shear force on web at stiffener location, kips (kN).
α = a factor equal to unity for a stiffener consisting of equal members or both and equal to 3.5 for a stiffener consisting of a member on one side only
θ = angle between plane of web and plane of bearing surface ($\theta \leq 90$) deg

2001.4 Identification. Aluminum for structural elements shall at all times be seg wise handled in the fabricator's plant so that the separate alloys and tempers are p

(1.) CALC. I_{xx} FOR TWO AL. SECTIONS.



$$h = \frac{\Sigma M}{\Sigma A}$$

$$h_1 = \frac{(2")(.25)(4.0) + (.5)(.25)(1.75)}{(.25)(4.0) + (.25)(1.75)} = \frac{2.2188}{1.4375} = 1.5435"$$

$$h_2 = \frac{(2")(.25)(4.0) + (2.375)(.25)(1.75)}{(.25)(4.0) + (.25)(1.75)} = \frac{3.0391}{1.4375} = 2.1141"$$

$$I_1 = I + Ad^2 + I + Ad_h^2 = \frac{bd^3}{3} + bd(d_h^2) + \ldots$$

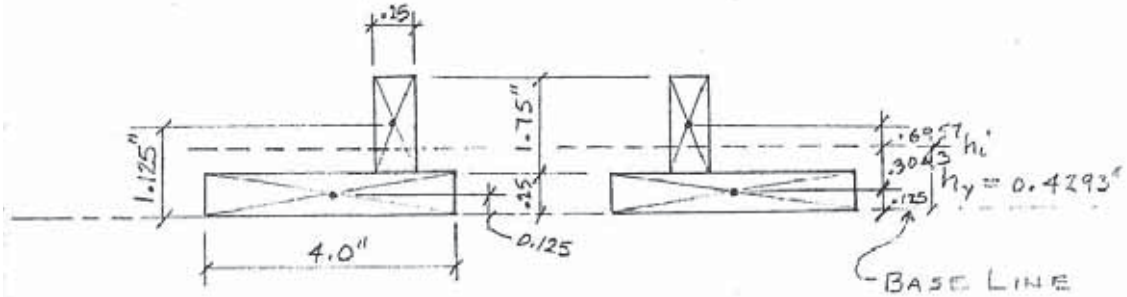
$$I_1 = \frac{.25(4)^3}{12} + .25(4)(.4565)^2 + \frac{1.75(.25)^3}{12} + 1.75(.25)(1.0435)^2$$

$$I_1 = 1.333 + 0.2084 + 0.0023 + 0.4764 = 2.0201 \text{ in}^4$$

$$I_2 = \frac{.25(4^3)}{12} + .25(4)(0.1141)^2 + \frac{1.75(.25)^3}{12} + 1.75(.25)(0.2609)^2$$

$$I_2 = 1.333 + 0.0130 + 0.0023 + 0.0298 = 1.3784 \text{ in}^4$$

(2.) CALC. I_{yy} FOR TWO AL. SECTIONS.



$$h = \frac{\Sigma M}{\Sigma A} \qquad I_1 = I_y$$

$$h_y = \frac{(0.125)(0.25)(4.0) + (1.125)(.25)(1.75)}{.25(4.0) + .25(1.75)} = 0.4293"$$

$$I_1 = I + Ad^2 + I + Ad^2 = \frac{bd^3}{3} + bd(d_h^2) + \ldots\ldots$$

$$I_1 = \frac{4.0(.25)^3}{12} + 4.0(.25)(0.3043)^2 + \frac{.25(1.75)^3}{12} + .25(1.75)(.6957)^2$$

$$I_1 = 0.0052 + 0.0926 + 0.1117 + 0.2117 = \underline{\underline{0.4212\ in^4}}$$

(3.) CALC. RAMP: (USING RISA-2D)

$A_{1\&2} = .25(4) + 1.75(.75) = 1.9375 in^2$

$I_1 = 2.0201 in^4$

$I_2 = 1.3754 in^4$

I_1 = RAMP

I_2 = PLATFORM

6061-T6 K_L, $F_y = 35^{KSI}$

DEAD LOAD = 7^{PSF}

LIVE LOAD = 100^{PSF}

PEDESTRIAN WALK = (UBC TABLE 16-A)

RAMP BEAM DL $= 7(\frac{4}{3}) = 14^{PLF}$

RAMP BEAM LL $= 100(\frac{4}{2}) = 200^{PLF}$

PLATFORM DL $= 7(\frac{5}{2}) = 17.5^{PLF}$

PLATFORM LL $= 100(\frac{5}{2}) = 250^{PLF}$

WELCOME RAMP, INC.

STRUCTURAL ANALYSIS

Adjustable Leg Design

PROJECT:	Lilac Meadows	**CODE:**	OSSC-2014 (IBC-2018)
ADDRESS:	7740 SE Powell, Portland, OR	**ESTIMATE#**	E20244
PROJECT #:	202009.06.1-2		
DATE:	12/8/2020		

Leg & Leg Sleeve Assembly Analysis (AA-ADM-2015)

Design Criteria Information

Design Code:	IBC2018				
Material	6061-T6, Ft=42 ksi, Fy=35 ksi, E=10000 ksi. G=3750 ksi				
Leg Sleeve Section:	HSS 1.75x1.75x0.125				
Leg Sleeve Section:	HSS 1.5x1.5x0.125		Controls		
Ax =	0.6875 in2		Fv=	12.7 ksi	
Sx =	0.2913 in3		Fb=	21.1 ksi	
Ix =	0.2184 in2		Fc=	21.1 ksi	
ry =	0.5636 in		Fbrg	30.2 ksi	

1. Max.Lateral Shear Capacity - Controlled by Leg

Vs =	0.125*1.5*2*Fv		4.76 k
Vbrg =	0.125*0.25*2*Fbrg		1.89 k
Minimum V =		Vm =	1.89

2. Max.Moment Capacity - Controlled by Leg

M =	0.2913*Fb	6.15 "k

3. Calculate Minimum Leg Pocket Depth to Equalize Minimum V vs M

dp (pocket depth) = M/Vm 3.26 inches minimum leg pocket depth.

4. Adjustable Leg Pin

Pin:	3/8"Ø Galv. Steel Bolt.				
Fy =	60 ksi				
Ax =	0.11 in2		Fv=	24 ksi	
Pin Load (double shear, Vp			Vp=	5.28 k	
Bearing on Leg Pb			Pb=	2.83 k	Governs

Std Leg WR-2018 Base Calculations

Dean Briggs, PE
Briggs Engineering, Inc.
5999 W State Street, Suite A
Garden City, Idaho 83703-5059
208.344.9700
dean@briggs-engineering.com

Project Title: WELCOME RAMP SYSTEMS, Inc.
Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard DecK, Ramp & Stair Design

Printed: 8 DEC 2020, 8:58AM
File: WR_OSSC-2019.ec6

General Section Property Calculator

DESCRIPTION: HSS 1.5x1.5x1/8

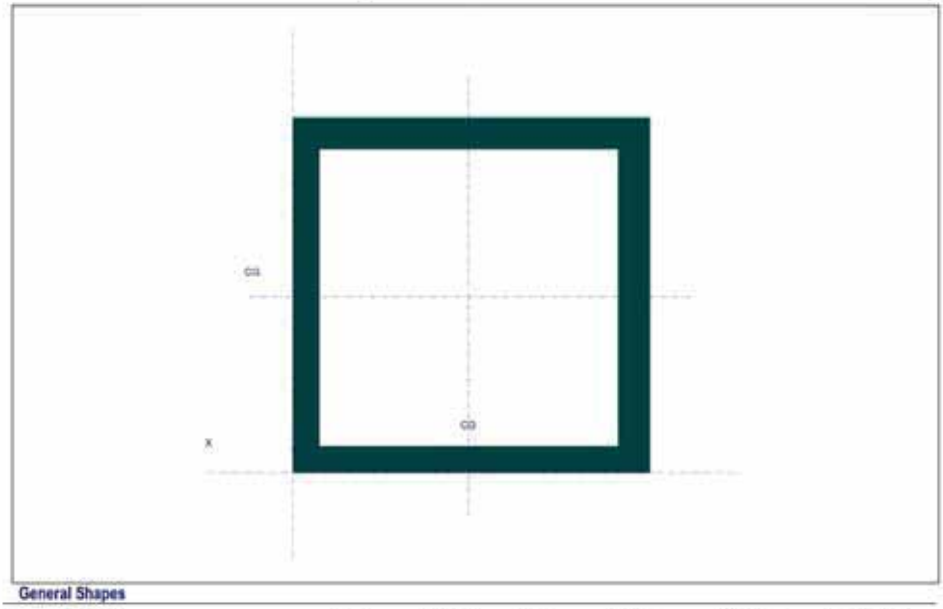
Final Section Properties

Total Area	:	0.6875 in^2	Ixx	:	0.2184 in^4	Sxx : - Y	: 0.2912 in^3
			Iyy	:	0.2184 in^4	Sxx : +Y	: 0.2912 in^3
Calculated final C.G. distance from Datum :						Syy : - X	: 0.2912 in^3
X cg Dist.	:	0.750 in	Zxx	:	0.3555 in^3	Syy : +X	: 0.2912 in^3
Y cg Dist.	:	0.750 in	Zyy	:	0.3555 in^3		
Edge Distances from CG. :						r xx	: 0.5636 in
+X	:	0.750 in	+Y	:	0.750 in	r yy	: 0.5636 in
-X	:	-0.750 in	-Y	:	-0.750 in		

Rotation of All Components @ Angle : 0.00 deg CCW

Minumim Section Properties

Rotation Angle (CCW)	0.0 deg CCW	I: Moment of Inertia	0.2184 in^4
r: Radius of Gyration	0.5636 in	S: Modulus	0.2912 in^3
		Z: Plastic Modulus	0.3555 in^3



General Shapes

Tube : #1 Xcg = 0.750 in Ycg = 0.750 in Rotation = 0 deg CCW

Total Height =	1.500in	Total Width =	1.500in	Left Thickness =	0.125in
Right Thickness =	0.125in	Bottom Thickness =	0.125in	Top Thickness =	0.125in

WELCOME RAMP, INC.

STRUCTURAL ANALYSIS

Alternate 7-foot Landing Design

- INCLUDED IS THE NEW DESIGN FOR A 7' SECTION PLATFORM.

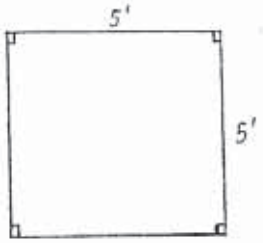
1) FOR A SINGLE POST AND DOUBLE ANGLE BEAM.
2) FOR A DOUBLE POST AND DOUBLE BEAM CONFIGURATION.

- THIS CHECKS ONLY WHAT HAS BEEN CHANGED FOR THE 7'-0" PLATFORM. ASSUMES TREADS ARE ADDED TO OR STAIRS TO SPAN 7'-0".

Summary

use current post IN center.
post will BE placed on a 16'x16' FOOTING.
New Double Angle For Beam section is a 4x2x3/16 Angle placed Back TO Back.

DESIGN OF 7' SECTION USING SINGLE POST IN CENTER OF NEW DOUBLE ANGLE BEAM.



Existing Design

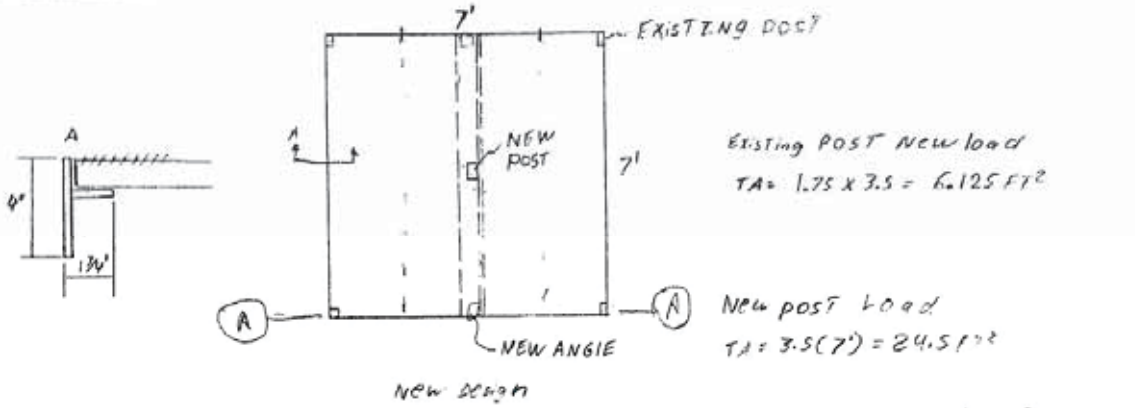
post Load Existing

TA= 2.5x2.5 = 6.25 FT²

100 psf LL

7psf DL

service Load per post= 669 lb



Existing POST New load

TA= 1.75 x 3.5 = 6.125 FT²

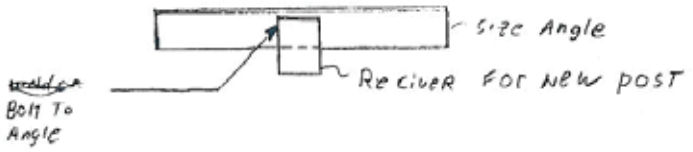
New post Load

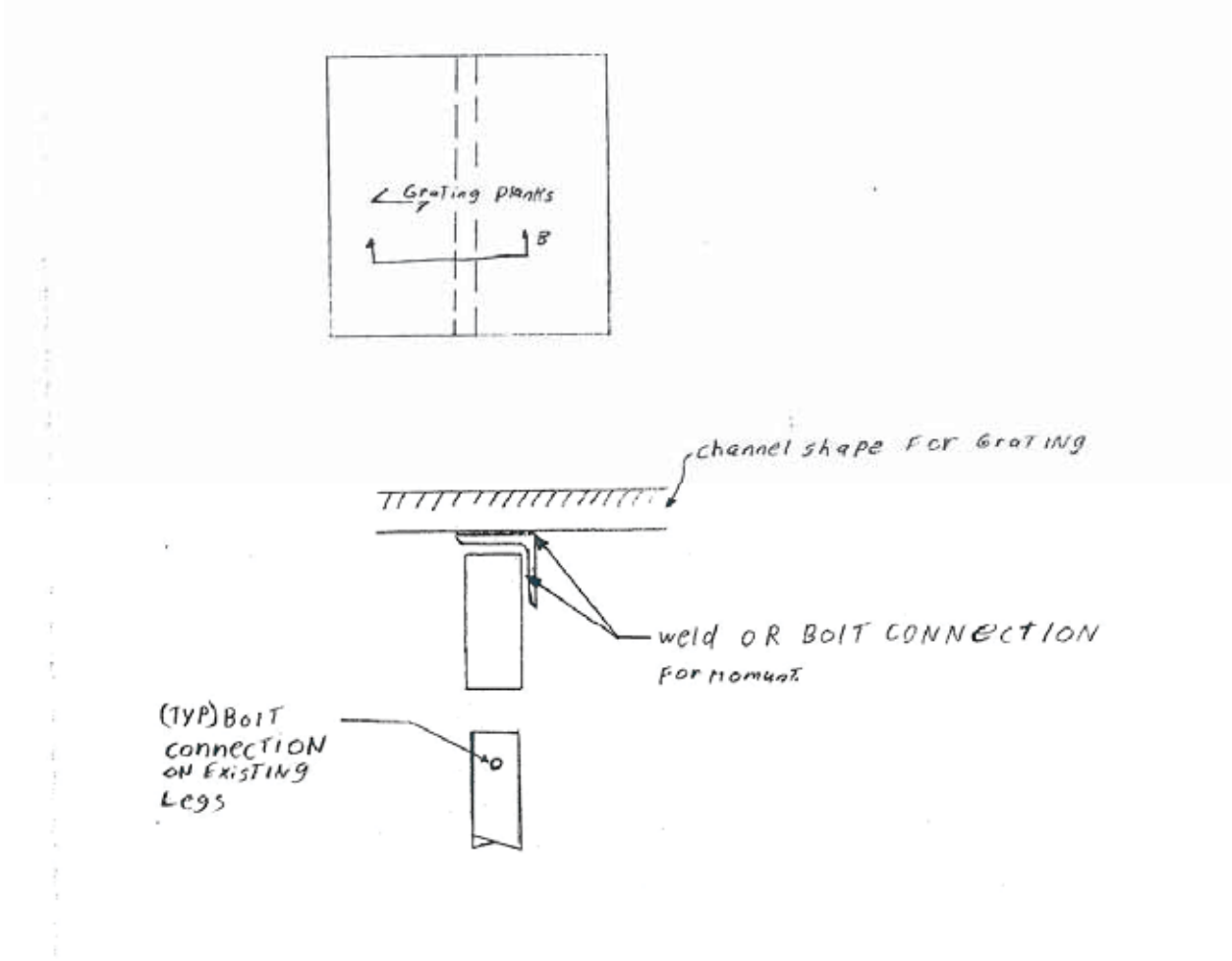
TA= 3.5(7') = 24.5 FT²

New Design

Service Load= 262216 400% increase

Not Including Angle mber wt.




Grating planks
A
B
channel shape for Grating
weld OR BOLT CONNECTION
for moment
(TYP) BOLT
connection
on EXISTING
Legs

Typical Post CalculATIONS.

TABLE 20-II-A Pg 2-296

PIPING = 6061 - T6 EXTRUSIONS

Tension F_{tu} = 38 ksi F_{ty} = 35 ksi

compression F_{cy} = 35 ksi

Shear = F_{su} = 24 ksi F_{sy} = 20 ksi

Bearing . F_{bu} = 80 ksi F_{by} = 56 ksi

E = 10,100 ksi

Square structural Tubing Pg III section A

Leg material = 1 ½" sq X .12" AL. Tubing   wT per FT = 2.252 lb/ft

ITEM I. BUCKLING LOAD

Fcr Buckling assuming 48" with NO Eccentricitie

$$F_{cr} = \frac{\pi^2 E}{(K\ell/r)^2} \qquad r = \sqrt{I/A} = \sqrt{\frac{.2118}{.6624}} = .5655 \qquad K = 1$$

$$= \frac{\pi^2 (10{,}100 \text{ ksi})}{\left(1 \cdot 48''/.5655\right)^2} = 13.84 \text{ kips} < 2622 \text{ lb (service load)}$$

ITEM 2. AXIAL LOAD

AXIAL BEARING $\quad P/A_g$ = service Load = $\frac{2622}{.6624}$ = 3958 psi

ITEM 3. BEARING. Allow comp = 35 ksi

Bolt Bearing - Alluminum will Fail Befor Bolt Bearing

Tube Thickness = .12 in   Bolt size = 3/8 = .375 F_{bu} = 80 ksi

F_b = (.375(.12))2 x 80 ksi = 7.2 Kips < 2.6 K

ITEM 4. AXIAL Load on Rod AT BASE

Area = $\pi (.375^2) = .4418\ in^2$

$$\text{Load} = \frac{2622\ lb}{.4418\ in^2} = 5934\ psi < F_{cy} = 35\ ksi \quad OK$$

ITEM 5. Base PLATE Bearing

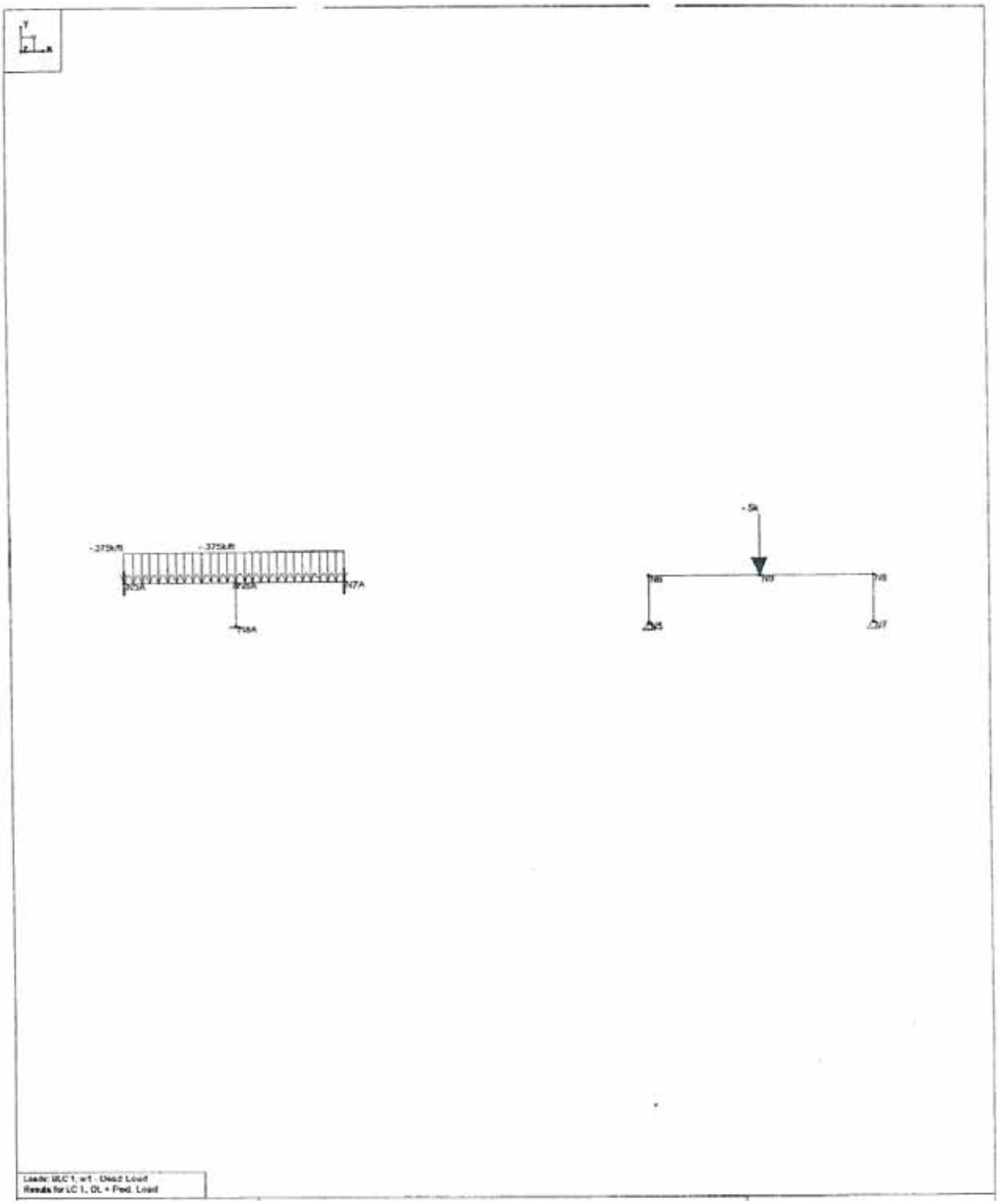
Base plate = 2'x2"

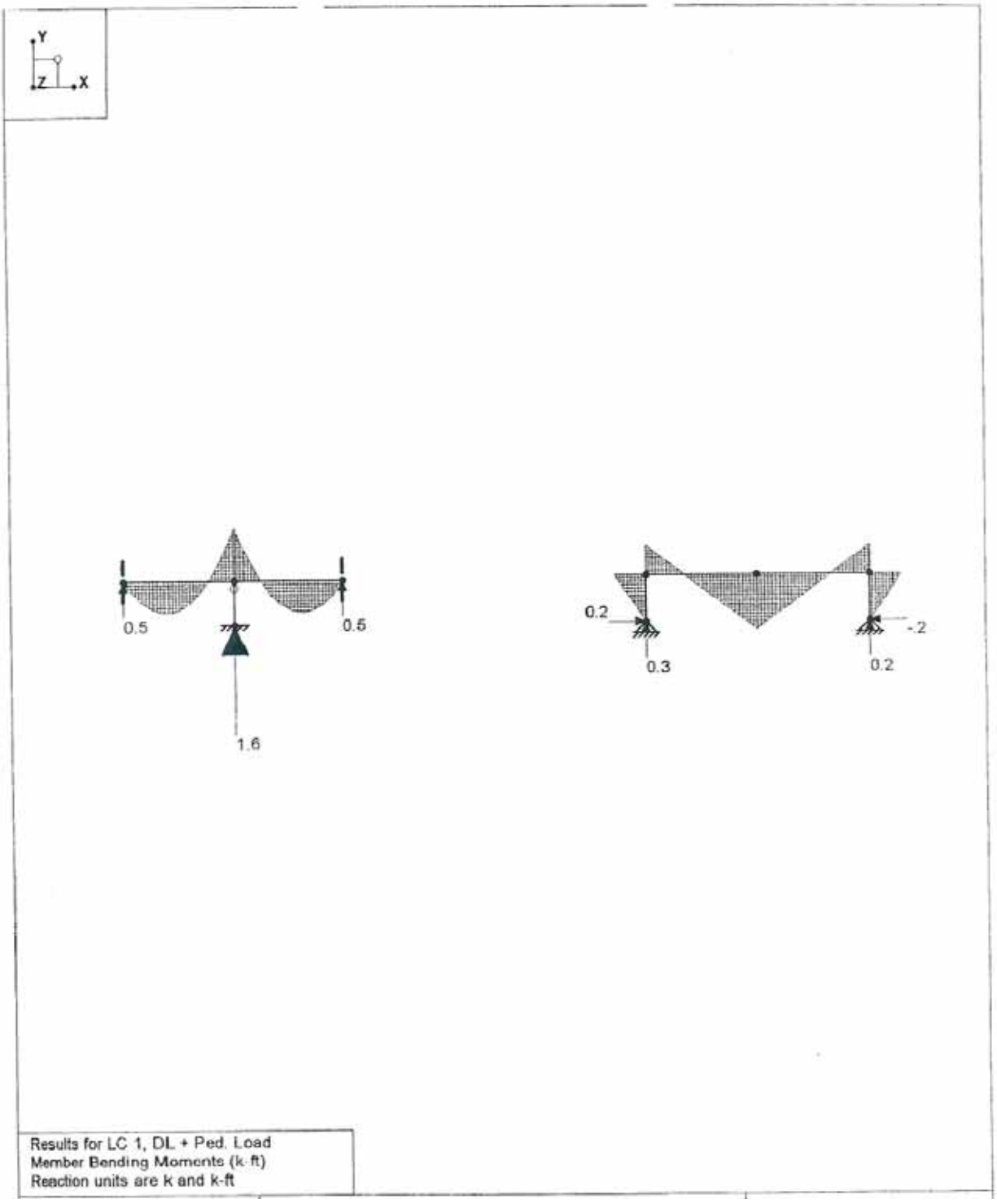
$$\frac{2622\ lb}{4\ in^2} = 655\ psi \quad \text{NOT OK}$$

allowable load = 4000 psf at FOOT or 27.7 psi

TRy a 16" Block = $1.78\ FT^2$

4000 psf $(1.78\ FT^2) = 7111\ lb > 2622\ lb$ OK! ←


-.375k/ft
-.375k/ft
N7A
N16A
-5k
N6
N7
N8
N5
N17
Loads: BLC 1, w1 : Dead Load
Results for LC 1, DL + Ped. Load


Y
Z
X
0.5
0.5
1.6
0.2
0.3
0.2
-.2
Results for LC 1, DL + Ped. Load
Member Bending Moments (k-ft)
Reaction units are k and k-ft

Member Data

Member Label	I Joint	J Joint	Rotate (degrees)	Shape / Section Set	Material Set	Phys Memb TOM	End Releases I-End AVM	End Releases J-End AVM	End Offsets I-End (in)	End Offsets J-End (in)	Inactive Code	Length (ft)
M1	N6	N9		SEC2	AL	Y						3.5
M2	N7	N8		SEC3	AL	Y						1.599
M3	N5	N6		SEC3	AL	Y						1.599
M4	N5A	N6A		SEC4	AL	Y						3.5
M5	N6A	N7A		SEC4	AL	Y						3.5
M6	N8A	N6A		SEC3	AL	Y		PIN				1.5
M7	N9	N8		SEC2	AL	Y						3.5

Sections

Section Label	Database Shape	Material Label	Area (in)^2	SA (0,180)	SA (90,270)	I (90,270) (in^4)	I (0,180) (in^4)	T/C Only
SEC1	Welcome Ramp	AL	1.438	1.2	1.2	.421	2.02	
SEC2	Welcome Deck	AL	1.438	1.2	1.2	.421	1.378	
SEC3	TU2X2X2	AL	.897	1.2	1.2	.513	.513	
SEC4	WT4X10.5	AL	3.08	1.2	1.2	4.89	3.9	

Member Deflections, By Combination

LC	Member Label	Section	x-Translation (in)	y-Translation (in)	(n) L/y Ratio
1	M1	1	0	0	NC
		2	0	-.086	3035.648
		3	0	-.174	1377.517
		4	0	-.214	NC
1	M2	1	0	0	NC
		2	0	-.013	1458.898
		3	0	-.016	1167.118
		4	0	0	NC
1	M3	1	0	0	NC
		2	0	.013	1458.898
		3	0	.016	1167.118
		4	0	0	NC
1	M4	1	0	0	NC
		2	0	-.015	3103.087
		3	0	-.012	4257.729
		4	0	.003	NC
1	M5	1	0	-.003	NC
		2	0	-.012	4257.729
		3	0	-.015	3103.087
		4	0	0	NC
1	M6	1	0	0	NC
		2	-.001	0	NC
		3	-.002	0	NC
		4	.003	0	NC
1	M7	1	0	-.214	NC
		2	0	-.174	1377.517
		3	0	-.086	3035.648
		4	0	0	NC

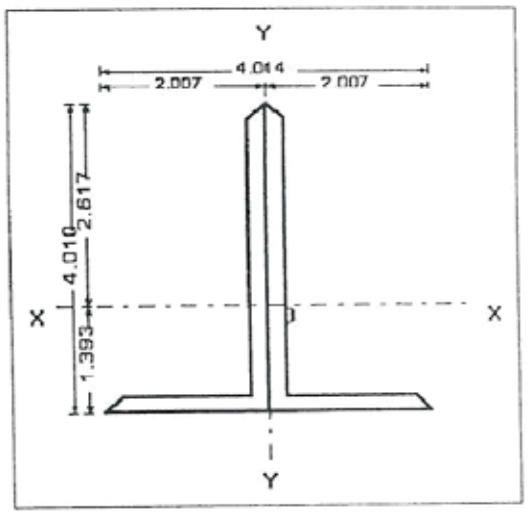
Member Stresses, By Combination

LC	Member Label	Section	Axial (ksi)	Shear (ksi)	Bending top (ksi)	Bending bot (ksi)
1	M1	1	.135	.21	-5.078	5.693
		2	.135	.21	-.271	.304
		3	.135	.21	4.536	-5.085
		4	.135	.21	9.343	-10.474
1	M2	1	.279	.464	0	0
		2	.279	.464	2.412	-2.412
		3	.279	.464	4.824	-4.824
		4	.279	.464	7.236	-7.236
1	M3	1	.279	-.464	0	0
		2	.279	-.464	-2.412	2.412
		3	.279	-.464	-4.824	4.824
		4	.279	-.464	-7.236	7.236
1	M4	1	0	.579	0	0
		2	0	.072	.838	-3.338
		3	0	-.435	.371	-1.479
		4	0	-.942	-1.401	5.577
1	M5	1	0	.942	-1.401	5.577
		2	0	.435	.371	-1.479
		3	0	-.072	.838	-3.338
		4	0	-.579	0	0
1	M6	1	1.812	0	0	0
		2	1.812	0	0	0
		3	1.812	0	0	0
		4	1.812	0	0	0
1	M7	1	.135	-.21	9.343	-10.474
		2	.135	-.21	4.536	-5.085
		3	.135	-.21	-.271	.304
		4	.135	-.21	-5.078	5.693

Section:RShape1

Section Properties:

Number of Shapes	= 2	
Total Width	= 4.014	in
Total Height	= 4.01	in
Center, Xo	= 14.995	in
Center, Yo	= -1.605	in
X-bar (Right)	=2.007in	
X-bar (Left)	=2.007in	
Y-bar (Top)	=2.617in	
Y-bar (Bot)	=1.393in	
Equivalent Properties:		
Area, Ax	= 2.24	in^2
Inertia, Ixx	= 3.607	in^4
Inertia, Iyy	= 0.9487	in^4
Inertia, Ixy	= 0.000	in^4
Torsional, J	= 0.0304	in^4
Modulus, Sx(Top)	= 1.378	in^3
Modulus, Sx(Bot)	= 2.589	in^3
Modulus, Sy(Left)	= 0.473	in^3
Modulus, Sy(Right)	= 0.473	in^3
Plastic Modulus, Zx	= 2.492	in^3
Plastic Modulus, Zy	= 16.794	in^3
Radius, rx	= 1.269	in
Radius, ry	= 0.651	in



Section Diagram

Basic Properties of Shapes in Section:

Sh. No.	Shape	Factor	Width in	Height in	Xo in	Yo in	Ax in^2	Ixx in^4	Iyy in^4
1	Unequal L	1	2.00	4.00	14.60	-1.60	1.12	1.004	0.30
2	Unequal L	1	2.00	4.00	15.39	-1.61	1.12	1.804	0.30

Additional Properties of Shapes in Section:

Sh. No.	Shape	J in^4	Sx in^3	Sy in^3	Zx in^3	Zy in^3	rx in	ry in
1	Unequal L	0.0152	0.6905	0.1859	1.246	0.533	1.269	0.517
2	Unequal L	0.0152	0.6905	0.1859	1.246	0.533	1.269	0.517

Summary of Properties

Sh. No.	Section	Width in	Height in	Xo in	Yo in	Ax in^2	Ixx in^4	Iyy in^4
1	RShape1	4.014	4.01	14.995	-1.605	2.24	3.607	0.949

Calculation Procedure

1) Closed Shapes:
The geometric properties for closed shapes are computed by using the Polygon method. All closed shapes are represented by closed polygons. Curvilinear and circular shapes or edges are represented by several straight line segments. The properties the overall shape are computed by geometric summation of the properties of a trapezoid defined by projection of two consecutive points of the cross-section on to the x and y axis.
2) Open Shapes:
The geometric properties for open (thin walled) shapes are computed by using the Polyline method. All open shapes are represented by polylines. Curvilinear and circular shapes or edges are represented by several straight line segments. The properties the overall shape are computed by geometric summation of the properties of a line defined by projection of two consecutive points of the cross-section on to the x and y axis
For details refer to the User's Manual

FOOTING SIZING CALCULATIONS

1) LOADING

Dead Load=	7	psf
Live Load =	100	psf
Total Load, RAMP_TL =	107	psf

2) FOOTING ON SOIL

Soil Allowable Bearing Pressure =	1500	psf
7' Platform Center Column, Area =	12.25	psf
Max Load =	1311	#
Min. Footing Area =	0.87	sf
Footing Pad w/ minimum Size =	11.22	inch

USE: 12-INCH, MIN. SQUARE PAD UNDER COLUMN ON SOIL

3) FOOTING ON PAVEMENT (Based on 8-inch Depth Pavement+Base)

Allowable Bearing Pressure =	8831	psf
7' Platform Center Column, Area =	12.25	psf
Max Load =	1311	#
Min. Footing Area =	0.15	sf
Footing Pad w/ minimum Size =	4.62	inch

USE: 5-INCH, MIN. SQUARE PAD UNDER COLUMN ON PAVEMENT

D. DEFLECTION CHECK FOR ALUMINUM TUBES

ALLOWABLE $\delta = \ell/240 = .175"$

Load = 107 (3.5) = 374.5 PLF

$$\delta = \frac{5 w \ell^4}{384 E I} = \frac{5 (374.5/12)(3.5' \times 12)^4}{384 (10{,}100 \times 1000)(2.074 \text{ in}^4)}$$

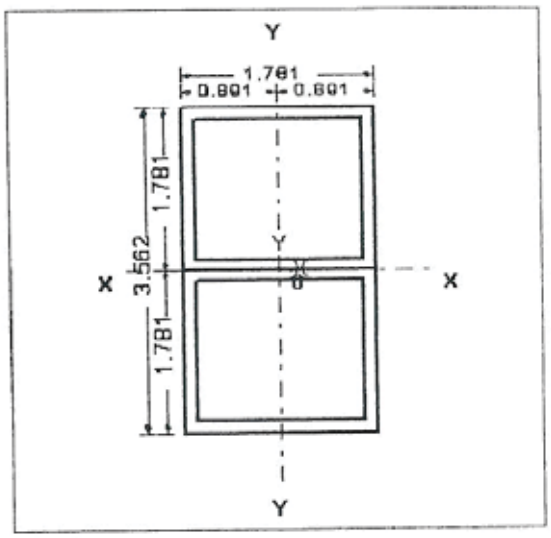
$= .064" < .175$ OK ←

USE 2 - 1.781" TUBES STACKED.

Section:Section1

Section Properties:

Number of Shapes	= 2	
Total Width	= 1.781	in
Total Height	= 3.562	in
Center, Xo	= 0.00	in
Center, Yo	= 0.00	in
X-bar (Right)	= 0.891	in
X-bar (Left)	= 0.891	in
Y-bar (Top)	= 1.781	in
Y-bar (Bot)	= 1.781	in
Equivalent Properties:		
Area, Ax	= 1.656	in^2
Inertia, Ixx	= 2.074	in^4
Inertia, Iyy	= 0.7612	in^4
Inertia, Ixy	= 0.000	in^4
Torsional, J	= 1.2688	in^4
Modulus, Sx(Top)	= 1.164	in^3
Modulus, Sx(Bot)	= 1.164	in^3
Modulus, Sy(Left)	= 0.855	in^3
Modulus, Sy(Right)	= 0.855	in^3
Plastic Modulus, Zx	= 1.568	in^3
Plastic Modulus, Zy	= 1.029	in^3
Radius, rx	= 1.119	in
Radius, ry	= 0.678	in



Section Diagram

Basic Properties of Shapes in Section: (Local Axis, for n=1)

Sh. No.	Shape	Modular Ratio(n)	Width in	Height in	Xo in	Yo in	Ax in^2	Ixx in^4	Iyy in^4
1	Tube	1.00	1.781	1.781	0.00	-0.891	0.828	0.3806	0.3806
2	Tube	1.00	1.781	1.781	0.00	0.89	0.828	0.3806	0.3806

Additional Properties of Shapes in Section: (Local Axis, for n=1)

Sh. No.	Shape	J in^4	Sx-Top in^3	Sy-Right in^3	Zx in^3	Zy in^3	rx in	ry in
1	Tube	0.6344	0.4274	0.4274	0.5144	0.5144	0.678	0.678
2	Tube	0.6344	0.4274	0.4274	0.5144	0.5144	0.678	0.678

Summary of Section Properties

Sh. No.	Section	Width in	Height in	Xo in	Yo in	Ax in^2	Ixx in^4	Iyy in^4
1	Section1	1.781	3.562	0.00	0.00	1.656	2.074	0.7612

Calculation Procedure

1) Closed Shapes:
   The geometric properties for closed shapes are computed by using the Polygon method. All closed shapes are represented by closed polygons. Curvilinear and circular shapes or edges are represented by several straight line segments. The properties of the overall shape are computed by geometric summation of the properties of a trapezoid defined by projection of two consecutive points of the cross-section on to the x and y axis.
2) Open Shapes:
   The geometric properties for open (thin walled) shapes are computed by using the Polyline method. All open shapes are represented by polylines. Curvilinear and circular shapes or edges are represented by several straight line segments. The properties of the overall shape are computed by geometric summation of the properties of a line defined by projection of two consecutive points of the cross-section on to the x and y axis
   For details refer to the User's Manual

WELCOME RAMP, INC.

STRUCTURAL ANALYSIS

Manufacturer Information - Planks

TRACTION TREAD LOAD TABLES

PLANKING

Plank Description
Plank: Traction Tread
Width: 12"
Guage: 13 GA

2" Channel Height

Se:	0.27	in^3
Mmax:	5335	lb-in

1 1/2" Channel Height

Se:	0.174	in^3
Mmax:	3438	lb-in

2" Channel Height

	2'-0	3'-0	4'-0	5'-0	6'-0	7'-0	8'-0	9'-0	10'-0
U	889	395	222	142	99	73	56	44	36
D	0.057	0.129	0.229	0.357	0.514	0.7	0.915	1.158	1.429
C	889	593	445	356	296	254	222	198	178
D	0.046	0.103	0.183	0.286	0.412	0.56	0.732	0.926	1.143

1 1/2" Channel Height

	2'-0	3'-0	4'-0	5'-0	6'-0	7'-0	8'-0	9'-0	10'-0
U	573	255	143	92	64	47	36	28	23
D	0.07	0.157	0.279	0.436	0.627	0.854	1.115	1.411	1.742
C	573	382	287	229	191	164	143	127	115
D	0.056	0.125	0.223	0.348	0.502	0.683	0.892	1.129	1.394

Notes:

@ 4'-8" U = 109 OK!

U = Uniform Load, psf
C = Concentrated Load, psf
D = Deflection, in.

1.) Allowable loads are based on the latest edition of AISI, 1986 Edition w/ 12/11/89 Addendum.
2.) This table is a theoretical calculation of the allowable loads and deflections for the specified spans. There are no test results to verify the actural load carrying capabilities. This table should be used as a reference only.
3.) Loads and deflections are based on side channel deflection only, and does not account for strut loading of the grating surface.

TRACTION TREAD LOAD TABLES

STAIRS

Plank Description
Plank: Traction Tread
Width: 12"
Guage: 11 GA

2" Channel Height
Se: 0.541 in^3
Mmax: 10690 lb-in

1.1/2" Channel Height
Se: 0.331 in^3
Mmax: 6541 lb-in

2" Channel Height

	2'-0	3'-0	4'-0	5'-0	6'-0	7'-0	8'-0	9'-0	10'-0
U	1782	792	445	285	198	145	111	88	71
D	0.028	0.064	0.113	0.177	0.254	0.346	0.452	0.572	0.706
C	1782	1188	891	713	594	509	445	396	356
D	0.023	0.051	0.09	0.141	0.203	0.277	0.362	0.458	0.565

1.1/2" Channel Height

	2'-0	3'-0	4'-0	5'-0	6'-0	7'-0	8'-0	9'-0	10'-0
U	1090	484	273	174	121	89	68	54	44
D	0.035	0.079	0.14	0.219	0.315	0.429	0.561	0.71	0.876
C	1090	727	545	436	363	311	273	242	218
D	0.028	0.063	0.112	0.175	0.252	0.343	0.449	0.568	0.701

Notes:

U = Uniform Load, psf
C = Concentrated Load, psf
D = Deflection, in.

1.) Allowable loads are based on the latest edition of AISI, 1986 Edition w/ 12/11/89 Addendum.
2.) This table is a theoretical calculation of the allowable loads and deflections for the specified spans. There are no test results to verify the actural load carrying capabilites. This table should be used as a reference only.
3.) Loads and deflections are based on side channel deflection only, and does not account for strut loading of the grating surface.

STRUCTURAL ANALYSIS

STAIRS, HANDRAIL, GUARDRAIL

BRIGGS ENGINEERING, Inc.
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SERVING THE WESTERN US

Project Title: ACCESS DECK, RAMPS & STAIRS - WELCOME F
Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:14AM

General Section Property Calculator

File = E:\0-MODULAR\0-STANDARDS\CALCULATIONS\ENERCALC Data Files\wr.ec6

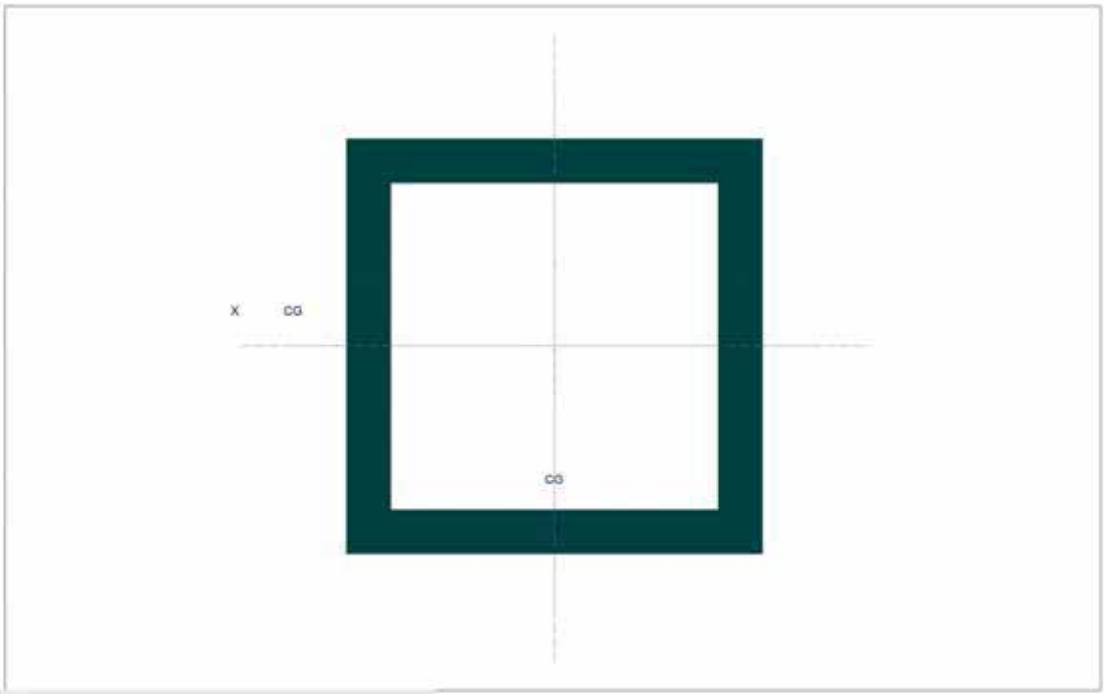
Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : HHS 1.5x1.5x0.156 Handrail Post Section

Final Section Properties

Total Area	in^2	Ixx	in^4	Sxx : - Y	in^3		
		Iyy	in^4	Sxx : +Y	in^3		
Calculated final C.G. distance from Datum :				Syy : - X	in^3		
X cg Dist	in	Zxx	in^3	Syy : +X	in^3		
Y cg Dist	in	Zyy	in^3				
Edge Distances from CG. :				r xx	in		
+X	in	+Y	in	r yy	in		
-X	in	-Y	in				

Rotation of All Components @ Angle : 0.00 deg CCW



General Shapes

Tube : #1 — Xcg = 0.000 in — Ycg = 0.000 in — Rotation = 0 deg CCW

Total Height =	1.500 in	Total Width =	1.500 in	Left Thickness =	0.156 in
Right Thickness =	0.156 in	Bottom Thickness =	0.156 in	Top Thickness =	0.156 in

BRIGGS ENGINEERING, Inc.
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SERVING THE WESTERN US

Project Title: ACCESS DECK, RAMPS & STAIRS - WELCOME F
Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:14AM

General Section Property Calculator

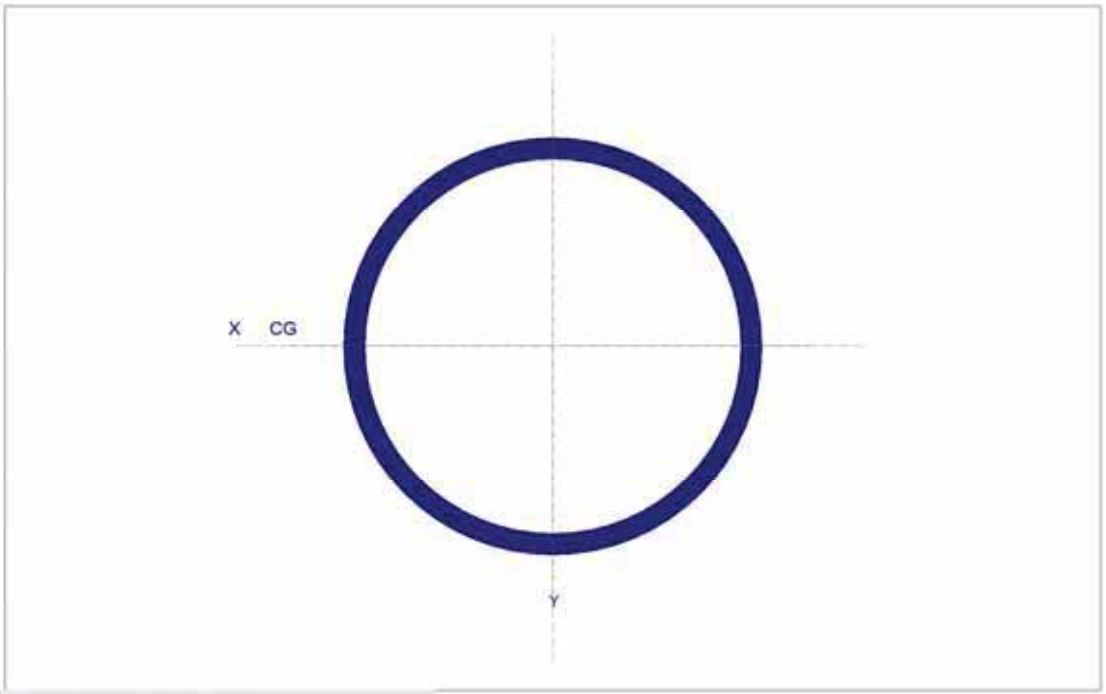
Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : 1-1/2" x 0.156 Handrail Section

Final Section Properties

Total Area	in^2	Ixx	in^4	Sxx : - Y	in^3		
		Iyy	in^4	Sxx : +Y	in^3		
Calculated final C.G. distance from Datum :				Syy : - X	in^3		
X cg Dist	in	Zxx	in^3	Syy : +X	in^3		
Y cg Dist	in	Zyy	in^3				
Edge Distances from CG. :				r xx	in		
+X	in	+Y	in	r yy	in		
-X	in	-Y	in				

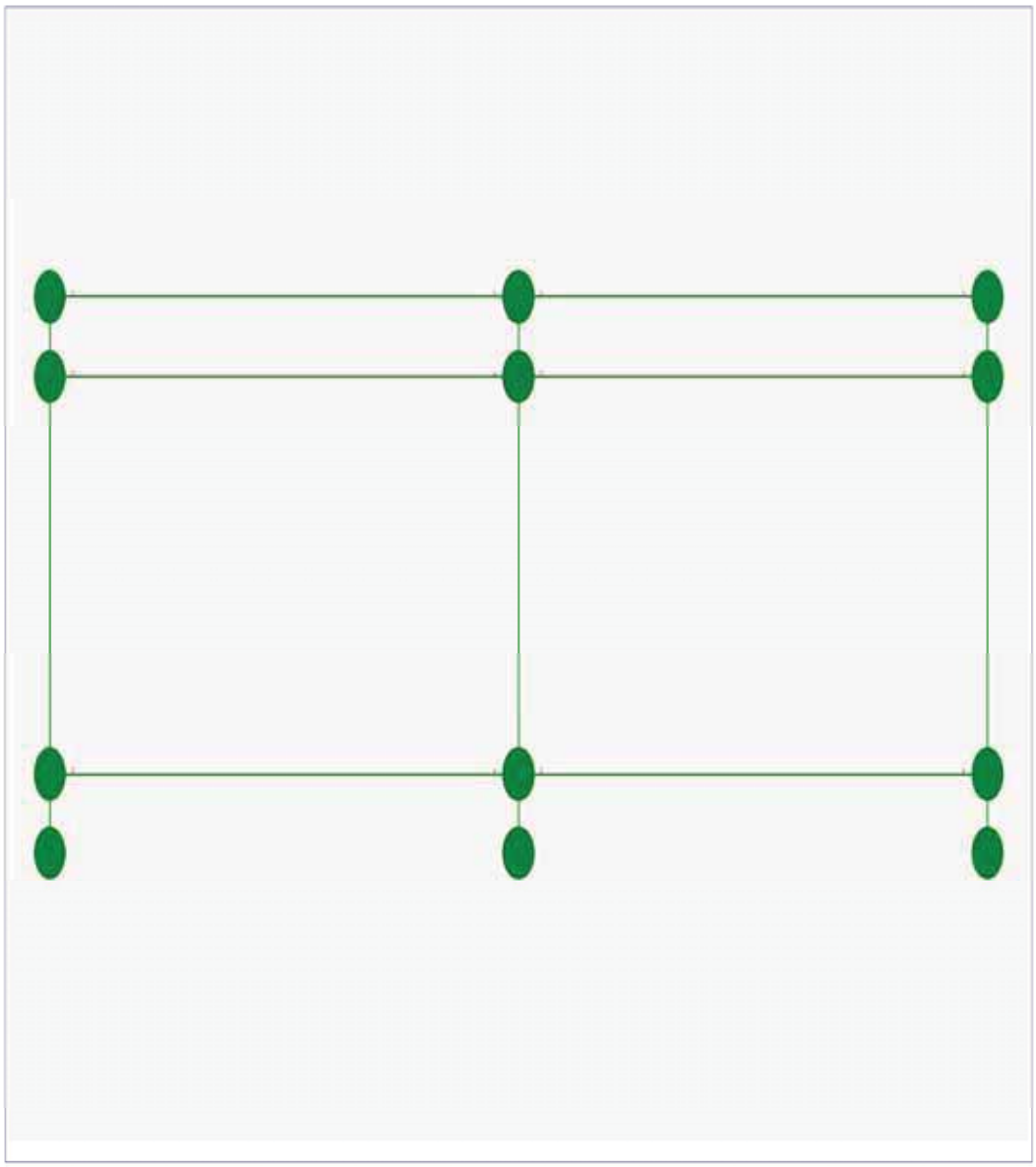
Rotation of All Components @ Angle : 0.00 deg CCW



Rectangular & Circular Shapes

Circular Shape : 1 — Radius = 1.500 in — Thickness 0.156 in

Area = 7.069 in^2 — Xcg = 0.000 in — Ycg = 0.000 in



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Project Title: ACCESS DECK, RAMPS & STAIRS - WELCOME F
Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design - OSSC-2019

Printed: 23 MAY 2020, 10:22AM

2-D Frame

Extreme Member Forces

Only Load Combinations giving maximum values are listed

Mmbr Label	Axial	Dist from "I" Joint	Moment	Dist from "I" Joint	Shear	Dist from "I" Joint
5-6	-0.009869 k	0.50 ft	0.0 k-ft	0.0 ft	0.0 k	0.0 ft
Max		*+0.660D*				
5-6	-0.4521 k	0.0 ft	0.0 k-ft	0.0 ft	0.0 k	0.0 ft
Min		*+1.20D+1.60L*				
6-10	0.1073 k	0.0 ft	0.1210 k-ft	4.920 ft	0.003006 k	0.0 ft
Max		*+1.20D+1.60L*		*+1.20D+1.60L*		*+1.40D*
6-10	0.000510 k	0.0 ft	-0.09319 k-ft	0.0 ft	-0.04593 k	4.920 ft
Min		*+0.660D*		*+1.20D+1.60L*		*+1.20D+1.60L*
6-7	-0.005695 k	2.50 ft	0.2183 k-ft	0.0 ft	0.1681 k	0.0 ft
Max		*+0.660D*		*+1.20D+1.60L*		*+1.20D+1.60L*
6-7	-0.4297 k	0.0 ft	-0.2018 k-ft	2.50 ft	0.05252 k	0.0 ft
Min		*+1.20D+1.60L*		*+1.20D+1.60L*		*+1.440D+0.50L*
7-11	0.2025 k	0.0 ft	0.1030 k-ft	4.920 ft	0.002850 k	0.0 ft
Max		*+1.20D+1.60L*		*+1.20D+1.60L*		*+1.40D*
7-11	0.002252 k	0.0 ft	-0.09688 k-ft	0.0 ft	-0.04301 k	4.920 ft
Min		*+0.660D*		*+1.20D+1.60L*		*+1.20D+1.60L*
7-8	-0.002740 k	0.50 ft	-0.002079 k-ft	0.0 ft	0.1427 k	0.0 ft
Max		*+0.660D*		*+1.440D+0.50L*		*+1.20D+1.60L*
7-8	-0.4238 k	0.0 ft	-0.07802 k-ft	0.50 ft	0.04460 k	0.0 ft
Min		*+1.20D+1.60L*		*+1.20D+1.60L*		*+1.20D+0.50L*
8-12	-0.002761 k	0.0 ft	0.1993 k-ft	4.920 ft	0.1865 k	0.0 ft
Max		*+0.660D*		*+1.20D+1.60L*		*+1.20D+1.60L*
8-12	-0.3098 k	0.0 ft	-0.1994 k-ft	2.008 ft	-0.1383 k	4.920 ft
Min		*+1.20D+1.60L*		*+1.20D+1.60L*		*+1.20D+1.60L*
9-10	-0.005383 k	0.50 ft	0.0 k-ft	0.0 ft	0.0 k	0.0 ft
Max		*+0.660D*				
9-10	-0.2307 k	0.0 ft	0.0 k-ft	0.0 ft	0.0 k	0.0 ft
Min		*+1.20D+1.60L*				

Member Stress Checks ...

Stress Checks per AISC 360-16 & NDS 2018

Member Label	Section Label	Material	Max. Axial + Bending Stress Ratios				Max. Shear Stress Ratios			
			Load Combination	Ratio	Status	Dist (ft)	Load Combination	Ratio	Status	Dist (ft)
1-2	Guard Rail	Steel	+1.20D+1.60L	0.461	PASS	0.50	+1.20D+1.60L	0.158	PASS	0.00
10-11	Guard Rail	Steel	+1.20D+1.60L	0.433	PASS	2.50	+1.20D+1.60L	0.053	PASS	0.00
11-12	Guard Rail	Steel	+1.20D+1.60L	0.577	PASS	0.50	+1.20D+1.60L	0.153	PASS	0.00
2-3	Guard Rail	Steel	+1.20D+1.60L	0.289	PASS	2.50	+1.20D+1.60L	0.022	PASS	0.00
2-6	Guard Rail	Steel	+1.20D+1.60L	0.525	PASS	0.00	+1.20D+1.60L	0.031	PASS	4.92
3-4	Guard Rail	Steel	+1.20D+1.60L	0.188	PASS	0.50	+1.20D+1.60L	0.065	PASS	0.00
3-7	Guard Rail	Steel	+1.20D+1.60L	0.300	PASS	4.92	+1.20D+1.60L	0.021	PASS	4.92
4-8	Guard Rail	Steel	+1.20D+1.60L	0.759	PASS	4.92	+1.20D+1.60L	0.117	PASS	4.92
5-6	Guard Rail	Steel	+1.20D+1.60L	0.046	PASS	0.00	N/A	0.000	PASS	0.00
6-10	Guard Rail	Steel	+1.20D+1.60L	0.358	PASS	4.92	+1.20D+1.60L	0.023	PASS	4.92
6-7	Guard Rail	Steel	+1.20D+1.60L	0.651	PASS	0.00	+1.20D+1.60L	0.083	PASS	0.00
7-11	Guard Rail	Steel	+1.20D+1.60L	0.316	PASS	4.92	+1.20D+1.60L	0.021	PASS	4.92
7-8	Guard Rail	Steel	+1.20D+1.60L	0.245	PASS	0.50	+1.20D+1.60L	0.070	PASS	0.00
8-12	Guard Rail	Steel	+1.20D+1.60L	0.604	PASS	2.01	+1.20D+1.60L	0.092	PASS	0.00
9-10	Guard Rail	Steel	+1.20D+1.60L	0.023	PASS	0.00	N/A	0.000	PASS	0.00

Extreme Member End Forces

Only Load Combinations giving maximum values are listed

Member Label	Member "I" End Forces Axial k	Shear k	Moment k-ft	Member "J" End Forces Axial k	Shear k	Moment k-ft
6-7 Max	0.4297 +1.20D+1.60L	0.1681 +1.20D+1.60L	0.2183 +1.20D+1.60L	-0.005695 +0.660D	0.0 +0.660D	0.2018 +1.20D+1.60L
6-7 Min	0.007034 +0.660D	0.0 +0.660D	0.0 +0.660D	-0.4273 +1.20D+1.60L	-0.1681 +1.20D+1.60L	0.0 +0.660D
7-11 Max	-0.002252 +0.660D	0.002850 +1.40D	0.002378 +1.40D	0.2025 +1.20D+1.60L	0.04301 +1.20D+1.60L	-0.000994 +0.660D
7-11 Min	-0.2025 +1.20D+1.60L	-0.03822 +1.20D+1.60L	-0.09688 +1.20D+1.60L	0.002252 +0.660D	0.001292 +0.660D	-0.1030 +1.20D+1.60L
7-8 Max	0.4238 +1.20D+1.60L	0.1427 +1.20D+1.60L	0.0 +1.20D	-0.002740 +0.660D	0.0 +0.660D	0.07802 +1.20D+1.60L
7-8 Min	0.003008 +0.660D	0.0 +0.660D	-0.006654 +1.20D+1.60L	-0.4233 +1.20D+1.60L	-0.1427 +1.20D+1.60L	0.0 +0.660D
8-12 Max	0.3098 +1.20D+1.60L	0.1865 +1.20D+1.60L	0.1704 +1.20D+1.60L	-0.002761 +0.660D	0.1383 +1.20D+1.60L	-0.000907 +0.660D
8-12 Min	0.002761 +0.660D	0.001370 +0.660D	0.001165 +0.660D	-0.3098 +1.20D+1.60L	0.001265 +0.660D	-0.1993 +1.20D+1.60L
9-10 Max	0.2307 +1.20D+1.60L	0.0 +1.20D+0.50L	0.0 +1.440D+0.80L	-0.005383 +0.660D	0.0 +0.660D	0.0 +1.20D+1.60L
9-10 Min	0.005651 +0.660D	0.0 +0.660D	0.0 +1.20D+1.60L	-0.2302 +1.20D+1.60L	0.0 +1.20D+0.50L	0.0 +0.660D

Extreme Member Forces

Only Load Combinations giving maximum values are listed

Mmbr Label	Axial	Dist from "I" Joint	Moment	Dist from "I" Joint	Shear	Dist from "I" Joint
1-2 Max	-0.005383 k +0.660D	0.50 ft	-0.001020 k-ft +1.20D+0.50L	0.01020 ft	0.320 k +1.20D+1.60L	0.0 ft
1-2 Min	-0.06977 k +1.20D+1.60L	0.0 ft	-0.160 k-ft +1.20D+1.60L	0.50 ft	0.10 k +1.20D+0.50L	0.0 ft
10-11 Max	-0.002825 k +0.660D	2.50 ft	0.1210 k-ft +1.20D+1.60L	0.0 ft	0.1073 k +1.20D+1.60L	0.0 ft
10-11 Min	-0.1843 k +1.20D+1.60L	0.0 ft	-0.1474 k-ft +1.20D+1.60L	2.50 ft	0.000510 k +0.660D	0.0 ft
11-12 Max	-0.001265 k +0.660D	0.50 ft	0.001005 k-ft +1.40D	0.0 ft	0.3098 k +1.20D+1.60L	0.0 ft
11-12 Min	-0.1388 k +1.20D+1.60L	0.0 ft	-0.1993 k-ft +1.20D+1.60L	0.50 ft	0.002761 k +0.660D	0.0 ft
2-3 Max	-0.002825 k +0.660D	2.50 ft	0.01328 k-ft +1.20D+1.60L	0.0 ft	0.04459 k +1.20D+1.60L	0.0 ft
2-3 Min	-0.1275 k +1.20D+1.60L	0.0 ft	-0.09821 k-ft +1.20D+1.60L	2.50 ft	-0.001081 k +1.40D	0.0 ft
2-6 Max	0.2754 k +1.20D+1.60L	0.0 ft	0.1251 k-ft +1.20D+1.60L	4.920 ft	0.002584 k +1.40D	0.0 ft
2-6 Min	0.000510 k +0.660D	0.0 ft	-0.1733 k-ft +1.20D+1.60L	0.0 ft	-0.06305 k +1.20D+1.60L	4.920 ft
3-4 Max	-0.001265 k +0.660D	0.50 ft	0.06299 k-ft +1.20D+1.60L	0.50 ft	-0.002761 k +0.660D	0.0 ft
3-4 Min	-0.1620 k +1.20D+1.60L	0.0 ft	-0.003280 k-ft +1.20D+1.60L	0.0 ft	-0.1325 k +1.20D+1.60L	0.0 ft
3-7 Max	0.1771 k +1.20D+1.60L	0.0 ft	0.09830 k-ft +1.20D+1.60L	4.920 ft	0.002741 k +1.40D	0.0 ft
3-7 Min	0.002252 k +0.660D	0.0 ft	-0.09493 k-ft +1.20D+1.60L	0.0 ft	-0.04167 k +1.20D+1.60L	4.920 ft
4-8 Max	-0.002761 k +0.660D	0.0 ft	0.2485 k-ft +1.20D+1.60L	4.920 ft	0.1615 k +1.20D+1.60L	0.0 ft
4-8 Min	-0.4525 k +1.20D+1.60L	0.0 ft	-0.09805 k-ft +1.20D+1.60L	2.008 ft	-0.2369 k +1.20D+1.60L	4.920 ft

Extreme Joint Reactions

Only Load Combinations giving maximum values are listed

Joint Label		Joint Reactions X k	Y k	Z k-ft
10				
	Max			
	Min			
11				
	Max			
	Min			
12				
	Max			
	Min			

Extreme Member End Forces

Only Load Combinations giving maximum values are listed

Member Label		Member "I" End Forces Axial k	Shear k	Moment k-ft	Member "J" End Forces Axial k	Shear k	Moment k-ft
1-2	Max	0.06977 +1.20D+1.60L	0.320 +1.20D+1.60L	0.0 +1.20D+0.50L	-0.005383 +0.660D	0.0 +0.660D	0.160 +1.20D+1.60L
1-2	Min	0.005651 +0.660D	0.0 +0.660D	0.0 +1.20D+1.60L	-0.06929 +1.20D+1.60L	-0.320 +1.20D+1.60L	0.0 +0.660D
10-11	Max	0.1843 +1.20D+1.60L	0.1073 +1.20D+1.60L	0.1210 +1.20D+1.60L	-0.002825 +0.660D	-0.000510 +0.660D	0.1474 +1.20D+1.60L
10-11	Min	0.004164 +0.660D	0.000510 +0.660D	0.000754 +0.660D	-0.1818 +1.20D+1.60L	-0.1073 +1.20D+1.60L	0.000521 +0.660D
11-12	Max	0.1388 +1.20D+1.60L	0.3098 +1.20D+1.60L	0.001005 +1.40D	-0.001265 +0.660D	-0.002761 +0.660D	0.1993 +1.20D+1.60L
11-12	Min	0.001533 +0.660D	0.002761 +0.660D	-0.04440 +1.20D+1.60L	-0.1383 +1.20D+1.60L	-0.3098 +1.20D+1.60L	0.000907 +0.660D
2-3	Max	0.1275 +1.20D+1.60L	0.04459 +1.20D+1.60L	0.01328 +1.20D+1.60L	-0.002825 +0.660D	0.001081 +1.40D	0.09821 +1.20D+1.60L
2-3	Min	0.004164 +0.660D	-0.001081 +1.40D	-0.001599 +1.40D	-0.1251 +1.20D+1.60L	-0.04459 +1.20D+1.60L	-0.001104 +1.40D
2-6	Max	-0.000510 +0.660D	0.002584 +1.40D	0.001599 +1.40D	0.2754 +1.20D+1.60L	0.06305 +1.20D+1.60L	-0.001243 +0.660D
2-6	Min	-0.2754 +1.20D+1.60L	-0.05826 +1.20D+1.60L	-0.1733 +1.20D+1.60L	0.000510 +0.660D	0.001417 +0.660D	-0.1251 +1.20D+1.60L
3-4	Max	0.1620 +1.20D+1.60L	-0.002761 +0.660D	-0.000474 +0.660D	-0.001265 +0.660D	0.1325 +1.20D+1.60L	-0.000907 +0.660D
3-4	Min	0.001533 +0.660D	-0.1325 +1.20D+1.60L	-0.003280 +1.20D+1.60L	-0.1615 +1.20D+1.60L	0.002761 +0.660D	-0.06299 +1.20D+1.60L
3-7	Max	-0.002252 +0.660D	0.002741 +1.40D	0.002109 +1.40D	0.1771 +1.20D+1.60L	0.04167 +1.20D+1.60L	-0.001121 +0.660D
3-7	Min	-0.1771 +1.20D+1.60L	-0.03688 +1.20D+1.60L	-0.09493 +1.20D+1.60L	0.002252 +0.660D	0.001343 +0.660D	-0.09830 +1.20D+1.60L
4-8	Max	0.4525 +1.20D+1.60L	0.1615 +1.20D+1.60L	0.06299 +1.20D+1.60L	-0.002761 +0.660D	0.2369 +1.20D+1.60L	-0.001165 +0.660D
4-8	Min	0.002761 +0.660D	0.001265 +0.660D	0.000907 +0.660D	-0.4525 +1.20D+1.60L	0.001370 +0.660D	-0.2485 +1.20D+1.60L
5-6	Max	0.4521 +1.20D+1.60L	0.0 +1.40D	0.0 +0.660D	-0.009869 +0.660D	0.0 +1.20D+1.60L	0.0 +1.40D
5-6	Min	0.01014 +0.660D	0.0 +1.20D+1.60L	0.0 +1.20D+1.60L	-0.4516 +1.20D+1.60L	0.0 +1.40D	0.0 +1.20D+1.60L
6-10	Max	-0.000510 +0.660D	0.003006 +1.40D	0.002638 +1.40D	0.1073 +1.20D+1.60L	0.04593 +1.20D+1.60L	-0.000754 +0.660D
6-10	Min	-0.1073 +1.20D+1.60L	-0.04114 +1.20D+1.60L	-0.09319 +1.20D+1.60L	0.000510 +0.660D	0.001218 +0.660D	-0.1210 +1.20D+1.60L

Extreme Joint Displacements

Only Load Combinations giving maximum values are listed

Joint Label		Joint Displacements X in	Y in	Z Radians
9	Max	0.02541 L Only	0.0 +0.75L	-0.003644 +0.75L
9	Min	0.01906 +0.75L	0.0 L Only	-0.004859 L Only
10	Max	0.05457 L Only	-.000090 +0.75L	-0.003644 +0.75L
10	Min	0.04092 +0.75L	-0.000120 L Only	-0.004859 L Only
11	Max	0.2482 L Only	-0.000452 +0.75L	-0.002610 +0.75L
11	Min	0.1861 +0.75L	-0.000602 L Only	-0.003480 L Only
12	Max	0.2631 L Only	-0.000507 +0.75L	-0.000733 +0.75L
12	Min	0.1973 +0.75L	-0.000676 L Only	-0.000978 L Only

Extreme Joint Reactions

Only Load Combinations giving maximum values are listed

Joint Label		Joint Reactions X k	Y k	Z k-ft
1	Max	-0.150 +D+0.75L	0.03719 +D+L	
	Min	-0.20 +D+L	0.02789 +D+0.75L	
2	Max			
	Min			
3	Max			
	Min			
4	Max			
	Min			
5	Max		0.2710 +D+L	
	Min		0.2033 +D+0.75L	
6	Max			
	Min			
7	Max			
	Min			
8	Max			
	Min			
9	Max		0.1378 +D+L	
	Min		0.1033 +D+0.75L	

Deflection Load Combinations

IBC 2018

Load Combination Description	Load Combination Factors						
	Dead	Roof Live	Live	Snow	Wind	Seismic	Earth
+D+H	1.0						1.0
+D+L+H	1.0		1.0				1.0
+D+Lr+H	1.0	1.0					1.0
+D+S+H	1.0			1.0			1.0
+D+0.750Lr+0.750L+H	1.0	0.750	0.750				1.0
+D+0.750L+0.750S+H	1.0		0.750	0.750			1.0
+D+0.60W+H	1.0				0.60		1.0
+D+0.70E+H	1.0					0.70	1.0
+D+0.750Lr+0.750L+0.450W+H	1.0	0.750	0.750		0.450		1.0
+D+0.750L+0.750S+0.450W+H	1.0		0.750	0.750	0.450		1.0
+D+0.750L+0.750S+0.5250E+H	1.0		0.750	0.750		0.5250	1.0
+0.60D+0.60W+0.60H	0.60				0.60		0.60
+0.60D+0.70E+0.60H	0.60					0.70	0.60
D Only	1.0						
Lr Only		1.0					
L Only			1.0				
S Only				1.0			
W Only					1.0		
E Only						1.0	
H Only							1.0

Automatically Apply 100 % of member self-weight as D in the -Global Y direction.

Extreme Joint Displacements

Only Load Combinations giving maximum values are listed

Joint Label		Joint Displacements X in	Y in	Z Radians
1	Max	0.0 L Only	0.0 +0.750L	-0.006977 +0.750L
1	Min	0.0 +0.750L	0.0 L Only	-0.009303 L Only
2	Max	0.05252 L Only	-.0000240 +0.750L	-0.005741 +0.750L
2	Min	0.03939 +0.750L	-.0000320 L Only	-0.007655 L Only
3	Max	0.2462 L Only	-0.000270 +0.750L	-0.002476 +0.750L
3	Min	0.1846 +0.750L	-0.000360 L Only	-0.003302 L Only
4	Max	0.2672 L Only	-0.000335 +0.750L	-0.002932 +0.750L
4	Min	0.2004 +0.750L	-0.000446 L Only	-0.003909 L Only
5	Max	0.03956 L Only	0.0 +0.750L	-0.001804 +0.750L
5	Min	0.02967 +0.750L	0.0 L Only	-0.002406 L Only
6	Max	0.0540 L Only	-0.000177 +0.750L	-0.001804 +0.750L
6	Min	0.04050 +0.750L	-0.000237 L Only	-0.002406 L Only
7	Max	0.2471 L Only	-0.001030 +0.750L	-0.002441 +0.750L
7	Min	0.1853 +0.750L	-0.001374 L Only	-0.003254 L Only
8	Max	0.2647 L Only	-0.001201 +0.750L	-0.001786 +0.750L
8	Min	0.1986 +0.750L	-0.001602 L Only	-0.002382 L Only

Reaction Load Combinations — IBC 2018

Load Combination Description	Load Combination Factors						
	Dead	Roof Live	Live	Snow	Wind	Seismic	Earth
L Only			1.0				
S Only				1.0			
W Only					1.0		
E Only						1.0	
H Only							1.0

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Project Title: ACCESS DECK, RAMPS & STAIRS - WELCOME F
Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design - OSSC-2019

Printed: 23 MAY 2020, 10:22AM

2-D Frame

Lic. # : KW-06006137 BRIGGS ENGINEERING, PLLC

Wood Material Data...

6063-T5, 6063-T5, Density= 170.0pcf, FbT= 1psi, FbC= 1psi, Fv= 1psi, Ft= 1, Fc= 1psi, E Bend XX= 1800ksi, E BendMin XX= 1800ksi, E Beny YY= 1800ksi, E BendMin YY= 1800ksi, E Axial= 1800ksi, Species= , Grade= Any, Class=

Member Sections...

Prop Label	Group Tag	Material	Area	Depth	Width	Ixx	Iyy
HHS1.5x1.5x0.125	Guard Rail	6063-T5	0.6875 in^2	1.50 in	1.50 in	0.2184 in^4	0.2184 in^4

Joint Loads...

Note: Loads labeled "Global Y" act downward (in "-Y" direction)

Joint Label	Load Direction	Load Magnitude Dead	Roof Live	Live	Snow	Seismic	Wind	Earth
4	Global X			0.20				k

Member Point Loads...

Note: Loads labeled "Global Y" act downward (in "-Y" direction)

Member Label	Load Direction	Distance from "I" Joint	Load Magnitude Dead	Roof Live	Live	Snow	Seismic	Wind	Earth
8-12	Global Y	2 ft			0.20				k

Member Distributed Loads...

Note: Loads labeled "Global Y" act downward (in "-Y" direction)

Member Label	Load Direction	Load Extents Start / End	ft	Load Magnitude Dead	Roof Live	Live	Snow	Seismic	Wind	Earth
4-8	Global Y	0.0	Start Mag:			0.050				k/ft
		4.920	End Mag:			0.050				k/ft

Stress/Strength Load Combinations — IBC 2018

Load Combination Description	Lambda	Load Combination Factors Dead	0.2*Sds* Seismic	Roof Live	Live	Snow	Wind	Seismic	Rho	Earth
+1.40D+1.60H	0.6	1.40								1.60
+1.20D+0.50Lr+1.60L+1.60H	0.8	1.20			0.50	1.60				1.60
+1.20D+1.60L+0.50S+1.60H	0.8	1.20				1.60	0.50			1.60
+1.20D+1.60Lr+0.50L+1.60H	0.8	1.20			1.60	0.50				1.60
+1.20D+1.60Lr+0.50W+1.60H	0.8	1.20			1.60			0.50		1.60
+1.20D+0.50L+1.60S+1.60H	0.8	1.20				0.50	1.60			1.60
+1.20D+1.60S+0.50W+1.60H	0.8	1.20					1.60	0.50		1.60
+1.20D+0.50Lr+0.50L+W+1.60H	1	1.20			0.50	0.50		1.0		1.60
+1.20D+0.50L+0.50S+W+1.60H	1	1.20				0.50	0.50	1.0		1.60
+1.440D+0.50L+0.70S+1.30E+1.60H	0.8	1.20	0.240			0.50	0.70		1.30	1.30	1.60
+0.90D+W+0.90H	1	0.90						1.0			0.90
+0.660D+1.30E+0.90H	0.6	0.90	-0.240						1.30	1.30	0.90

Automatically Apply 100 % of member self-weight as D in the -Global Y direction.

Reaction Load Combinations — IBC 2018

Load Combination Description	Load Combination Factors Dead	Roof Live	Live	Snow	Wind	Seismic	Earth
+D+H	1.0						1.0
+D+L+H	1.0		1.0				1.0
+D+Lr+H	1.0	1.0					1.0
+D+S+H	1.0			1.0			1.0
+D+0.750Lr+0.750L+H	1.0	0.750	0.750				1.0
+D+0.750L+0.750S+H	1.0		0.750	0.750			1.0
+D+0.60W+H	1.0				0.60		1.0
+D+0.70E+H	1.0					0.70	1.0
+D+0.750Lr+0.750L+0.450W+H	1.0	0.750	0.750		0.450		1.0
+D+0.750L+0.750S+0.450W+H	1.0		0.750	0.750	0.450		1.0
+D+0.750L+0.750S+0.5250E+H	1.0		0.750	0.750		0.5250	1.0
+0.60D+0.60W+0.60H	0.60				0.60		0.60
+0.60D+0.70E+0.60H	0.60					0.70	0.60
D Only	1.0						
Lr Only		1.0					

Wood Material Data...

Description :

Joints...

Joint Label	Joint Coordinates X ft	Y ft	X Translational Restraint	Y Translational Restraint	Z Rotational Restraint	Joint Temp deg F
1	0.0	0.0	Fixed	Fixed		0
2	0.0	0.50				0
3	0.0	3.0				0
4	0.0	3.50				0
5	4.920	0.0		Fixed		0
6	4.920	0.50				0
7	4.920	3.0				0
8	4.920	3.50				0
9	9.840	0.0		Fixed		0
10	9.840	0.50				0
11	9.840	3.0				0
12	9.840	3.50				0

Members...

Member Label	Property Label	Endpoint Joints I Joint	J Joint	Member Length ft	Releases Specify Connectivity of Member Ends to Joints I End x	I End y	I End z (rotation)	J End x	J End y	J End z (rotation)
1-2	HHS1.5x1.5x0.125	1	2	0.500	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
10-11	HHS1.5x1.5x0.125	10	11	2.500	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
11-12	HHS1.5x1.5x0.125	11	12	0.500	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
2-3	HHS1.5x1.5x0.125	2	3	2.500	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
2-6	HHS1.5x1.5x0.125	2	6	4.920	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
3-4	HHS1.5x1.5x0.125	3	4	0.500	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
3-7	HHS1.5x1.5x0.125	3	7	4.920	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
4-8	HHS1.5x1.5x0.125	4	8	4.920	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
5-6	HHS1.5x1.5x0.125	5	6	0.500	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
6-10	HHS1.5x1.5x0.125	6	10	4.920	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
6-7	HHS1.5x1.5x0.125	6	7	2.500	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
7-11	HHS1.5x1.5x0.125	7	11	4.920	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
7-8	HHS1.5x1.5x0.125	7	8	0.500	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
8-12	HHS1.5x1.5x0.125	8	12	4.920	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
9-10	HHS1.5x1.5x0.125	9	10	0.500	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed

Member Stress Check Data...

Member Label	Unbraced Lengths Lu : z ft	Lu : y	Slenderness Factors K : z	K : y	AISC Bending & Stability Factors Cm	Cb
1-2	0.500	0.500	1.00	1.00	Internal	Internal
10-11	2.500	2.500	1.00	1.00	Internal	Internal
11-12	0.500	0.500	1.00	1.00	Internal	Internal
2-3	2.500	2.500	1.00	1.00	Internal	Internal
2-6	4.920	4.920	1.00	1.00	Internal	Internal
3-4	0.500	0.500	1.00	1.00	Internal	Internal
3-7	4.920	4.920	1.00	1.00	Internal	Internal
4-8	4.920	4.920	1.00	1.00	Internal	Internal
5-6	0.500	0.500	1.00	1.00	Internal	Internal
6-10	4.920	4.920	1.00	1.00	Internal	Internal
6-7	2.500	2.500	1.00	1.00	Internal	Internal
7-11	4.920	4.920	1.00	1.00	Internal	Internal
7-8	0.500	0.500	1.00	1.00	Internal	Internal
8-12	4.920	4.920	1.00	1.00	Internal	Internal
9-10	0.500	0.500	1.00	1.00	Internal	Internal

Materials...

Member Label	Youngs ksi	Density kcf	Thermal in/in/degr	Yield ksi
6063-T5	10,000.00	0.170	0.000000	16.00
Default	1.00	0.000	0.000000	1.00

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SERVING THE WESTERN US

Project Title: ACCESS DECK, RAMPS & STAIRS - WELCOME F
Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:15AM

Steel Column

File = E:\0-MODULAR\0-STANDARDS\CALCULATIONS\ENERCALC Data Files\wr.ec6

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Stair Intermediate Support Columns - 2x2x1/8

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
S Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
W Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
E Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
H Only	0.0000 in	0.000 ft	0.000 in	0.000 ft

Steel Section Properties : HSS2x2x1/8

Depth	=	2.000	in	I xx	=	0.49	in^4	J	=	0.796 in^4
Design Thick	=	0.116	in	S xx	=	0.49	in^3			
Width	=	2.000	in	R xx	=	0.761	in			
Wall Thick	=	0.125	in	Zx	=	0.584	in^3			
Area	=	0.840	in^2	I yy	=	0.486	in^4	C	=	0.817 in^3
Weight	=	3.050	plf	S yy	=	0.486	in^3			
				R yy	=	0.761	in			
Yog	=	0.000	in							

Sketches

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Steel Column

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Stair Intermediate Support Columns - 2x2x1/8

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
	k					k-ft			
+D+Lr+H	0.301								
+D+S+H	0.301								
+D+0.750Lr+0.750L+H	2.401								
+D+0.750L+0.750S+H	2.401								
+D+0.60W+H	0.301								
+D+0.70E+H	0.301								
+D+0.750Lr+0.750L+0.450W+H	2.401								
+D+0.750L+0.750S+0.450W+H	2.401								
+D+0.750L+0.750S+0.5250E+H	2.401								
+0.60D+0.60W+0.60H	0.181								
+0.60D+0.70E+0.60H	0.181								
D Only	0.301								
Lr Only									
L Only	2.800								
S Only									
W Only									
E Only									
H Only									

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
		k					k-ft			
Axial @ Base	Maximum	3.101								
"	Minimum									
Reaction, X-X Axis Base	Maximum	0.301								
"	Minimum	0.301								
Reaction, Y-Y Axis Base	Maximum	0.301								
"	Minimum	0.301								
Reaction, X-X Axis Top	Maximum	0.301								
"	Minimum	0.301								
Reaction, Y-Y Axis Top	Maximum	0.301								
"	Minimum	0.301								
Moment, X-X Axis Base	Maximum	0.301								
"	Minimum	0.301								
Moment, Y-Y Axis Base	Maximum	0.301								
"	Minimum	0.301								
Moment, X-X Axis Top	Maximum	0.301								
"	Minimum	0.301								
Moment, Y-Y Axis Top	Maximum	0.301								
"	Minimum	0.301								

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Distance		Max. Y-Y Deflection		Distance	
+D+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+L+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+Lr+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+S+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750Lr+0.750L+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750L+0.750S+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.60W+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.70E+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750Lr+0.750L+0.450W+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750L+0.750S+0.450W+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750L+0.750S+0.5250E+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+0.60D+0.60W+0.60H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+0.60D+0.70E+0.60H	0.0000	in	0.000	ft	0.000	in	0.000	ft
D Only	0.0000	in	0.000	ft	0.000	in	0.000	ft
Lr Only	0.0000	in	0.000	ft	0.000	in	0.000	ft
L Only	0.0000	in	0.000	ft	0.000	in	0.000	ft

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SERVING THE WESTERN US

Project Title: ACCESS DECK, RAMPS & STAIRS - WELCOME F
Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:15AM

Steel Column

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Stair Intermediate Support Columns - 2x2x1/8

Code References

Calculations per AISC 360-10, IBC 2015, CBC 2016, ASCE 7-10
Load Combinations Used : IBC 2015

General Information

Steel Section Name : HSS2x2x1/8
Analysis Method : Allowable Strength
Steel Stress Grade
Fy : Steel Yield 35.0 ksi
E : Elastic Bending Modulus 10,100.0 ksi

Overall Column Height 7.0 ft
Top & Bottom Fixity Top & Bottom Pinned
Brace condition for deflection (buckling) along columns :
X-X (width) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 7.0 ft, K = 1.0
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT X-X Axis = 7.0 ft, K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 21.350 lbs * Dead Load Factor
AXIAL LOADS . . .
Platform: Axial Load at 7.0 ft, D = 0.280, L = 2.80 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = 0.8593 : 1
Load Combination +D+L+H
Location of max.above base 0.0 ft
At maximum location values are . . .
Pa : Axial 3.101 k
Pn / Omega : Allowable 3.609 k
Ma-x : Applied 0.0 k-ft
Mn-x / Omega : Allowable 1.020 k-ft
Ma-y : Applied 0.0 k-ft
Mn-y / Omega : Allowable 1.020 k-ft

PASS Maximum Shear Stress Ratio = 0.0 : 1
Load Combination 0.0
Location of max.above base 0.0 ft
At maximum location values are . . .
Va : Applied 0.0 k
Vn / Omega : Allowable 0.0 k

Maximum Load Reactions . .
Top along X-X 0.0 k
Bottom along X-X 0.0 k
Top along Y-Y 0.0 k
Bottom along Y-Y 0.0 k

Maximum Load Deflections . . .
Along Y-Y 0.0 in at 0.0 ft above base
for load combination :
Along X-X 0.0 in at 0.0 ft above base
for load combination :

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios: Stress Ratio	Status	Location
+D+H	0.083	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+D+L+H	0.859	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+D+Lr+H	0.083	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+D+S+H	0.083	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+D+0.750Lr+0.750L+H	0.665	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+D+0.750L+0.750S+H	0.665	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+D+0.60W+H	0.083	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+1.116D+0.910E+H	0.093	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+D+0.750Lr+0.750L+0.450W+H	0.665	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+D+0.750L+0.750S+0.450W+H	0.665	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+1.087D+0.750L+0.750S+0.682E	0.673	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+0.60D+0.60W+0.60H	0.050	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+0.4838D+0.910E+0.60H	0.040	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base (k)	X-X Axis Reaction @ Base (k)	X-X Axis Reaction @ Top (k)	Y-Y Axis Reaction @ Base (k)	Y-Y Axis Reaction @ Top (k)	Mx - End Moments @ Base (k-ft)	Mx - End Moments @ Top (k-ft)	My - End Moments @ Base (k-ft)	My - End Moments @ Top (k-ft)
+D+H	0.301								
+D+L+H	3.101								

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Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:15AM

Steel Column

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Platform Columns - Adjacent Stairs - 2x2x1/8

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
S Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
W Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
E Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
H Only	0.0000 in	0.000 ft	0.000 in	0.000 ft

Steel Section Properties : HSS2x2x1/8

Depth	=	2.000	in	I xx	=	0.49	in^4	J	=	0.796 in^4
Design Thick	=	0.116	in	S xx	=	0.49	in^3			
Width	=	2.000	in	R xx	=	0.761	in			
Wall Thick	=	0.125	in	Zx	=	0.584	in^3			
Area	=	0.840	in^2	I yy	=	0.486	in^4	C	=	0.817 in^3
Weight	=	3.050	plf	S yy	=	0.486	in^3			
				R yy	=	0.761	in			
Yog	=	0.000	in							

Sketches

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Steel Column

Lic. # : KW-0600613 7 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Platform Columns - Adjacent Stairs - 2x2x1/8

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
	k					k-ft			
+D+Lr+H	0.286								
+D+S+H	0.286								
+D+0.750Lr+0.750L+H	2.274								
+D+0.750L+0.750S+H	2.274								
+D+0.60W+H	0.286								
+D+0.70E+H	0.286								
+D+0.750Lr+0.750L+0.450W+H	2.274								
+D+0.750L+0.750S+0.450W+H	2.274								
+D+0.750L+0.750S+0.5250E+H	2.274								
+0.60D+0.60W+0.60H	0.172								
+0.60D+0.70E+0.60H	0.172								
D Only	0.286								
Lr Only									
L Only	2.650								
S Only									
W Only									
E Only									
H Only									

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
		k					k-ft			
Axial @ Base	Maximum	2.936								
"	Minimum									
Reaction, X-X Axis Base	Maximum	0.286								
"	Minimum	0.286								
Reaction, Y-Y Axis Base	Maximum	0.286								
"	Minimum	0.286								
Reaction, X-X Axis Top	Maximum	0.286								
"	Minimum	0.286								
Reaction, Y-Y Axis Top	Maximum	0.286								
"	Minimum	0.286								
Moment, X-X Axis Base	Maximum	0.286								
"	Minimum	0.286								
Moment, Y-Y Axis Base	Maximum	0.286								
"	Minimum	0.286								
Moment, X-X Axis Top	Maximum	0.286								
"	Minimum	0.286								
Moment, Y-Y Axis Top	Maximum	0.286								
"	Minimum	0.286								

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Distance		Max. Y-Y Deflection		Distance	
+D+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+L+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+Lr+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+S+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750Lr+0.750L+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750L+0.750S+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.60W+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.70E+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750Lr+0.750L+0.450W+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750L+0.750S+0.450W+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750L+0.750S+0.5250E+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+0.60D+0.60W+0.60H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+0.60D+0.70E+0.60H	0.0000	in	0.000	ft	0.000	in	0.000	ft
D Only	0.0000	in	0.000	ft	0.000	in	0.000	ft
Lr Only	0.0000	in	0.000	ft	0.000	in	0.000	ft
L Only	0.0000	in	0.000	ft	0.000	in	0.000	ft

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SERVING THE WESTERN US

Project Title: ACCESS DECK, RAMPS & STAIRS - WELCOME F
Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:15AM

Steel Column

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Platform Columns - Adjacent Stairs - 2x2x1/8

Code References

Calculations per AISC 360-10, IBC 2015, CBC 2016, ASCE 7-10
Load Combinations Used : IBC 2015

General Information

Steel Section Name :	HSS2x2x1/8
Analysis Method :	Allowable Strength
Steel Stress Grade	
Fy : Steel Yield	35.0 ksi
E : Elastic Bending Modulus	10,100.0 ksi

Overall Column Height 7.0 ft
Top & Bottom Fixity Top & Bottom Pinned
Brace condition for deflection (buckling) along columns :
X-X (width) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 7.0 ft, K = 1.0
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT X-X Axis = 7.0 ft, K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 21.350 lbs * Dead Load Factor
AXIAL LOADS . . .
Platform: Axial Load at 7.0 ft, D = 0.2650, L = 2.650 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = 0.8136 : 1
Load Combination +D+L+H
Location of max.above base 0.0 ft
At maximum location values are . . .
Pa : Axial 2.936 k
Pn / Omega : Allowable 3.609 k
Ma-x : Applied 0.0 k-ft
Mn-x / Omega : Allowable 1.020 k-ft
Ma-y : Applied 0.0 k-ft
Mn-y / Omega : Allowable 1.020 k-ft

PASS Maximum Shear Stress Ratio = 0.0 : 1
Load Combination 0.0
Location of max.above base 0.0 ft
At maximum location values are . . .
Va : Applied 0.0 k
Vn / Omega : Allowable 0.0 k

Maximum Load Reactions . .

Top along X-X	0.0 k
Bottom along X-X	0.0 k
Top along Y-Y	0.0 k
Bottom along Y-Y	0.0 k

Maximum Load Deflections . . .

Along Y-Y 0.0 in at 0.0 ft above base
for load combination :
Along X-X 0.0 in at 0.0 ft above base
for load combination :

Load Combination Results

Load Combination	Max. Axial+Bending Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Max. Shear Ratio	Status	Location
+D+H	0.079	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+D+L+H	0.814	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+D+Lr+H	0.079	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+D+S+H	0.079	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+D+0.750Lr+0.750L+H	0.630	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+D+0.750L+0.750S+H	0.630	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+D+0.60W+H	0.079	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+1.116D+0.910E+H	0.089	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+D+0.750Lr+0.750L+0.450W+H	0.630	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+D+0.750L+0.750S+0.450W+H	0.630	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+1.087D+0.750L+0.750S+0.682E	0.637	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+0.60D+0.60W+0.60H	0.048	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft
+0.4838D+0.910E+0.60H	0.038	PASS	0.00 ft	1.00	1.00	110.38	110.38	0.000	PASS	0.00 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base (k)	X-X Axis Reaction @ Base (k)	X-X Axis Reaction @ Top (k)	Y-Y Axis Reaction @ Base (k)	Y-Y Axis Reaction @ Top (k)	Mx - End Moments @ Base (k-ft)	Mx - End Moments @ Top (k-ft)	My - End Moments @ Base (k-ft)	My - End Moments @ Top (k-ft)
+D+H	0.286								
+D+L+H	2.936								

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Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:14AM

Steel Column

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Platform Columns - Adjacent Stairs

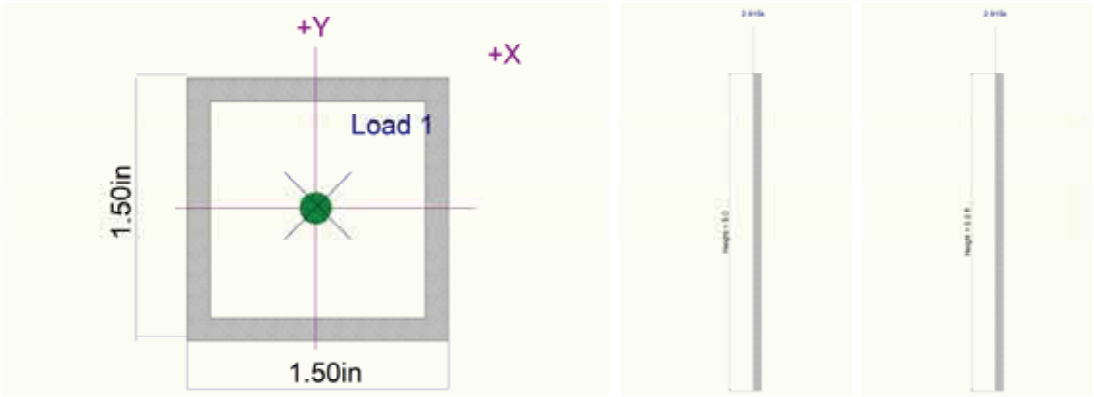
Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
S Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
W Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
E Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
H Only	0.0000 in	0.000 ft	0.000 in	0.000 ft

Steel Section Properties : HHS1.5x1.5x0.125

Depth	=	1.500	in	I xx	=	0.22	in^4	J	=	0.582 in^4
Design Thick	=	0.125	in	S xx	=	0.29	in^3			
Width	=	1.500	in	R xx	=	0.564	in			
Wall Thick	=	0.134	in	Zx	=	0.291	in^3			
Area	=	0.688	in^2	I yy	=	0.218	in^4	C	=	0.291 in^3
Weight	=	0.815	plf	S yy	=	0.291	in^3			
				R yy	=	0.564	in			
Yog	=	0.000	in							

Sketches



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Printed: 9 FEB 2019, 11:14AM

Steel Column

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Platform Columns - Adjacent Stairs

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
	k					k-ft			
+D+Lr+H	0.269								
+D+S+H	0.269								
+D+0.750Lr+0.750L+H	2.257								
+D+0.750L+0.750S+H	2.257								
+D+0.60W+H	0.269								
+D+0.70E+H	0.269								
+D+0.750Lr+0.750L+0.450W+H	2.257								
+D+0.750L+0.750S+0.450W+H	2.257								
+D+0.750L+0.750S+0.5250E+H	2.257								
+0.60D+0.60W+0.60H	0.161								
+0.60D+0.70E+0.60H	0.161								
D Only	0.269								
Lr Only									
L Only	2.650								
S Only									
W Only									
E Only									
H Only									

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
		k					k-ft			
Axial @ Base	Maximum	2.919								
"	Minimum									
Reaction, X-X Axis Base	Maximum	0.269								
"	Minimum	0.269								
Reaction, Y-Y Axis Base	Maximum	0.269								
"	Minimum	0.269								
Reaction, X-X Axis Top	Maximum	0.269								
"	Minimum	0.269								
Reaction, Y-Y Axis Top	Maximum	0.269								
"	Minimum	0.269								
Moment, X-X Axis Base	Maximum	0.269								
"	Minimum	0.269								
Moment, Y-Y Axis Base	Maximum	0.269								
"	Minimum	0.269								
Moment, X-X Axis Top	Maximum	0.269								
"	Minimum	0.269								
Moment, Y-Y Axis Top	Maximum	0.269								
"	Minimum	0.269								

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Distance		Max. Y-Y Deflection		Distance	
+D+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+L+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+Lr+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+S+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750Lr+0.750L+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750L+0.750S+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.60W+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.70E+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750Lr+0.750L+0.450W+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750L+0.750S+0.450W+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750L+0.750S+0.5250E+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+0.60D+0.60W+0.60H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+0.60D+0.70E+0.60H	0.0000	in	0.000	ft	0.000	in	0.000	ft
D Only	0.0000	in	0.000	ft	0.000	in	0.000	ft
Lr Only	0.0000	in	0.000	ft	0.000	in	0.000	ft
L Only	0.0000	in	0.000	ft	0.000	in	0.000	ft

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Project Title: ACCESS DECK, RAMPS & STAIRS - WELCOME F
Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:14AM

Steel Column

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Platform Columns - Adjacent Stairs

Code References

Calculations per AISC 360-10, IBC 2015, CBC 2016, ASCE 7-10
Load Combinations Used : IBC 2015

General Information

Steel Section Name :	HHS1.5x1.5x0.125
Analysis Method :	Allowable Strength
Steel Stress Grade	
Fy : Steel Yield	35.0 ksi
E : Elastic Bending Modulus	10,100.0 ksi

Overall Column Height 5.0 ft
Top & Bottom Fixity Top & Bottom Pinned
Brace condition for deflection (buckling) along columns :
X-X (width) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 5.0 ft, K = 1.0
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT X-X Axis = 5.0 ft, K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 4.075 lbs * Dead Load Factor
AXIAL LOADS . . .
Platform: Axial Load at 5.0 ft, D = 0.2650, L = 2.650 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = 0.9192 : 1
Load Combination +D+L+H
Location of max.above base 0.0 ft
At maximum location values are . . .
Pa : Axial 2.919 k
Pn / Omega : Allowable 3.176 k
Ma-x : Applied 0.0 k-ft
Mn-x / Omega : Allowable 0.5086 k-ft
Ma-y : Applied 0.0 k-ft
Mn-y / Omega : Allowable 0.5086 k-ft

PASS Maximum Shear Stress Ratio = 0.0 : 1
Load Combination 0.0
Location of max.above base 0.0 ft
At maximum location values are . . .
Va : Applied 0.0 k
Vn / Omega : Allowable 0.0 k

Maximum Load Reactions . .

Top along X-X	0.0 k
Bottom along X-X	0.0 k
Top along Y-Y	0.0 k
Bottom along Y-Y	0.0 k

Maximum Load Deflections . . .

Along Y-Y 0.0 in at 0.0 ft above base
for load combination :
Along X-X 0.0 in at 0.0 ft above base
for load combination :

Load Combination Results

Load Combination	Max. Axial+Bending Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Max. Shear Ratio	Status	Location
+D+H	0.085	PASS	0.00 ft	1.00	1.00	106.46	106.46	0.000	PASS	0.00 ft
+D+L+H	0.919	PASS	0.00 ft	1.00	1.00	106.46	106.46	0.000	PASS	0.00 ft
+D+Lr+H	0.085	PASS	0.00 ft	1.00	1.00	106.46	106.46	0.000	PASS	0.00 ft
+D+S+H	0.085	PASS	0.00 ft	1.00	1.00	106.46	106.46	0.000	PASS	0.00 ft
+D+0.750Lr+0.750L+H	0.711	PASS	0.00 ft	1.00	1.00	106.46	106.46	0.000	PASS	0.00 ft
+D+0.750L+0.750S+H	0.711	PASS	0.00 ft	1.00	1.00	106.46	106.46	0.000	PASS	0.00 ft
+D+0.60W+H	0.085	PASS	0.00 ft	1.00	1.00	106.46	106.46	0.000	PASS	0.00 ft
+1.116D+0.910E+H	0.095	PASS	0.00 ft	1.00	1.00	106.46	106.46	0.000	PASS	0.00 ft
+D+0.750Lr+0.750L+0.450W+H	0.711	PASS	0.00 ft	1.00	1.00	106.46	106.46	0.000	PASS	0.00 ft
+D+0.750L+0.750S+0.450W+H	0.711	PASS	0.00 ft	1.00	1.00	106.46	106.46	0.000	PASS	0.00 ft
+1.087D+0.750L+0.750S+0.682E	0.718	PASS	0.00 ft	1.00	1.00	106.46	106.46	0.000	PASS	0.00 ft
+0.60D+0.60W+0.60H	0.051	PASS	0.00 ft	1.00	1.00	106.46	106.46	0.000	PASS	0.00 ft
+0.4838D+0.910E+0.60H	0.041	PASS	0.00 ft	1.00	1.00	106.46	106.46	0.000	PASS	0.00 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
	k					k-ft			
+D+H	0.269								
+D+L+H	2.919								

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Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:14AM

Steel Column

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Platform Columns - Adjacent Building

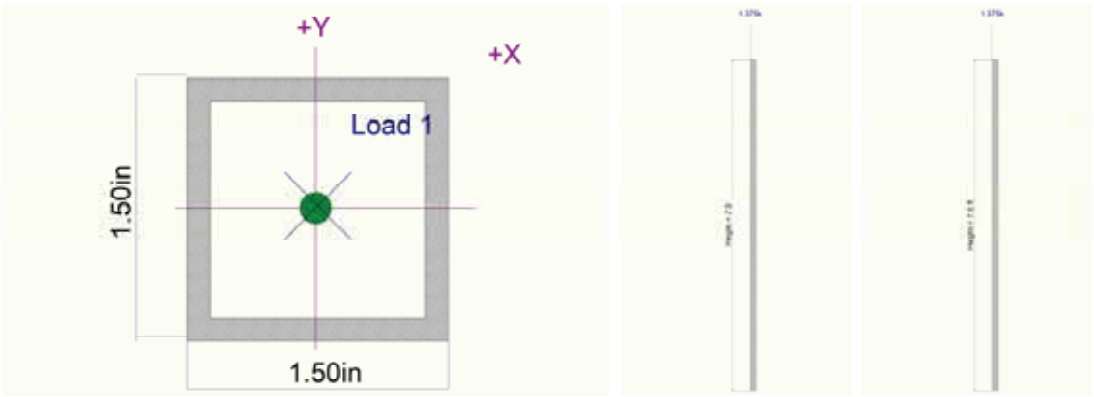
Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
S Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
W Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
E Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
H Only	0.0000 in	0.000 ft	0.000 in	0.000 ft

Steel Section Properties : HHS1.5x1.5x0.125

Depth	=	1.500	in	I xx	=	0.22	in^4	J	=	0.582 in^4
Design Thick	=	0.125	in	S xx	=	0.29	in^3			
Width	=	1.500	in	R xx	=	0.564	in			
Wall Thick	=	0.134	in	Zx	=	0.291	in^3			
Area	=	0.688	in^2	I yy	=	0.218	in^4	C	=	0.291 in^3
Weight	=	0.815	plf	S yy	=	0.291	in^3			
				R yy	=	0.564	in			
Yog	=	0.000	in							

Sketches



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Steel Column

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Description : Platform Columns - Adjacent Building

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
	k					k-ft			
+D+Lr+H	0.131								
+D+S+H	0.131								
+D+0.750Lr+0.750L+H	1.068								
+D+0.750L+0.750S+H	1.068								
+D+0.60W+H	0.131								
+D+0.70E+H	0.131								
+D+0.750Lr+0.750L+0.450W+H	1.068								
+D+0.750L+0.750S+0.450W+H	1.068								
+D+0.750L+0.750S+0.5250E+H	1.068								
+0.60D+0.60W+0.60H	0.078								
+0.60D+0.70E+0.60H	0.078								
D Only	0.131								
Lr Only									
L Only	1.250								
S Only									
W Only									
E Only									
H Only									

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
		k					k-ft			
Axial @ Base	Maximum	1.381								
"	Minimum									
Reaction, X-X Axis Base	Maximum	0.131								
"	Minimum	0.131								
Reaction, Y-Y Axis Base	Maximum	0.131								
"	Minimum	0.131								
Reaction, X-X Axis Top	Maximum	0.131								
"	Minimum	0.131								
Reaction, Y-Y Axis Top	Maximum	0.131								
"	Minimum	0.131								
Moment, X-X Axis Base	Maximum	0.131								
"	Minimum	0.131								
Moment, Y-Y Axis Base	Maximum	0.131								
"	Minimum	0.131								
Moment, X-X Axis Top	Maximum	0.131								
"	Minimum	0.131								
Moment, Y-Y Axis Top	Maximum	0.131								
"	Minimum	0.131								

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Distance		Max. Y-Y Deflection		Distance	
+D+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+L+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+Lr+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+S+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750Lr+0.750L+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750L+0.750S+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.60W+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.70E+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750Lr+0.750L+0.450W+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750L+0.750S+0.450W+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750L+0.750S+0.5250E+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+0.60D+0.60W+0.60H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+0.60D+0.70E+0.60H	0.0000	in	0.000	ft	0.000	in	0.000	ft
D Only	0.0000	in	0.000	ft	0.000	in	0.000	ft
Lr Only	0.0000	in	0.000	ft	0.000	in	0.000	ft
L Only	0.0000	in	0.000	ft	0.000	in	0.000	ft

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SERVING THE WESTERN US

Project Title: ACCESS DECK, RAMPS & STAIRS - WELCOME F
Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:14AM

Steel Column

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Platform Columns - Adjacent Building

Code References

Calculations per AISC 360-10, IBC 2015, CBC 2016, ASCE 7-10
Load Combinations Used : IBC 2015

General Information

Steel Section Name :	HHS1.5x1.5x0.125
Analysis Method :	Allowable Strength
Steel Stress Grade	
Fy : Steel Yield	35 ksi
E : Elastic Bending Modulus	10,100.0 ksi

Overall Column Height 7.0 ft
Top & Bottom Fixity Top & Bottom Pinned
Brace condition for deflection (buckling) along columns :
X-X (width) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 7.0 ft, K = 1.0
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT X-X Axis = 7.0 ft, K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 5.705 lbs * Dead Load Factor
AXIAL LOADS . . .
Platform: Axial Load at 7.0 ft, D = 0.1250, L = 1.250 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = 0.8522 : 1
Load Combination +D+L+H
Location of max.above base 0.0 ft
At maximum location values are . . .
Pa : Axial 1.381 k
Pn / Omega : Allowable 1.620 k
Ma-x : Applied 0.0 k-ft
Mn-x / Omega : Allowable 0.5086 k-ft
Ma-y : Applied 0.0 k-ft
Mn-y / Omega : Allowable 0.5086 k-ft

PASS Maximum Shear Stress Ratio = 0.0 : 1
Load Combination 0.0
Location of max.above base 0.0 ft
At maximum location values are . . .
Va : Applied 0.0 k
Vn / Omega : Allowable 0.0 k

Maximum Load Reactions . .
Top along X-X 0.0 k
Bottom along X-X 0.0 k
Top along Y-Y 0.0 k
Bottom along Y-Y 0.0 k

Maximum Load Deflections . . .
Along Y-Y 0.0 in at 0.0ft above base for load combination :
Along X-X 0.0 in at 0.0ft above base for load combination :

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios: Stress Ratio	Status	Location
+D+H	0.081	PASS	0.00 ft	1.00	1.00	149.04	149.04	0.000	PASS	0.00 ft
+D+L+H	0.852	PASS	0.00 ft	1.00	1.00	149.04	149.04	0.000	PASS	0.00 ft
+D+Lr+H	0.081	PASS	0.00 ft	1.00	1.00	149.04	149.04	0.000	PASS	0.00 ft
+D+S+H	0.081	PASS	0.00 ft	1.00	1.00	149.04	149.04	0.000	PASS	0.00 ft
+D+0.750Lr+0.750L+H	0.659	PASS	0.00 ft	1.00	1.00	149.04	149.04	0.000	PASS	0.00 ft
+D+0.750L+0.750S+H	0.659	PASS	0.00 ft	1.00	1.00	149.04	149.04	0.000	PASS	0.00 ft
+D+0.60W+H	0.081	PASS	0.00 ft	1.00	1.00	149.04	149.04	0.000	PASS	0.00 ft
+1.116D+0.910E+H	0.090	PASS	0.00 ft	1.00	1.00	149.04	149.04	0.000	PASS	0.00 ft
+D+0.750Lr+0.750L+0.450W+H	0.659	PASS	0.00 ft	1.00	1.00	149.04	149.04	0.000	PASS	0.00 ft
+D+0.750L+0.750S+0.450W+H	0.659	PASS	0.00 ft	1.00	1.00	149.04	149.04	0.000	PASS	0.00 ft
+1.087D+0.750L+0.750S+0.682E	0.666	PASS	0.00 ft	1.00	1.00	149.04	149.04	0.000	PASS	0.00 ft
+0.60D+0.60W+0.60H	0.048	PASS	0.00 ft	1.00	1.00	149.04	149.04	0.000	PASS	0.00 ft
+0.4838D+0.910E+0.60H	0.039	PASS	0.00 ft	1.00	1.00	149.04	149.04	0.000	PASS	0.00 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base (k)	X-X Axis Reaction @ Base (k)	X-X Axis Reaction @ Top (k)	Y-Y Axis Reaction @ Base (k)	Y-Y Axis Reaction @ Top (k)	Mx - End Moments @ Base (k-ft)	Mx - End Moments @ Top (k-ft)	My - End Moments @ Base (k-ft)	My - End Moments @ Top (k-ft)
+D+H	0.131								
+D+L+H	1.381								

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Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:14AM

General Section Property Calculator

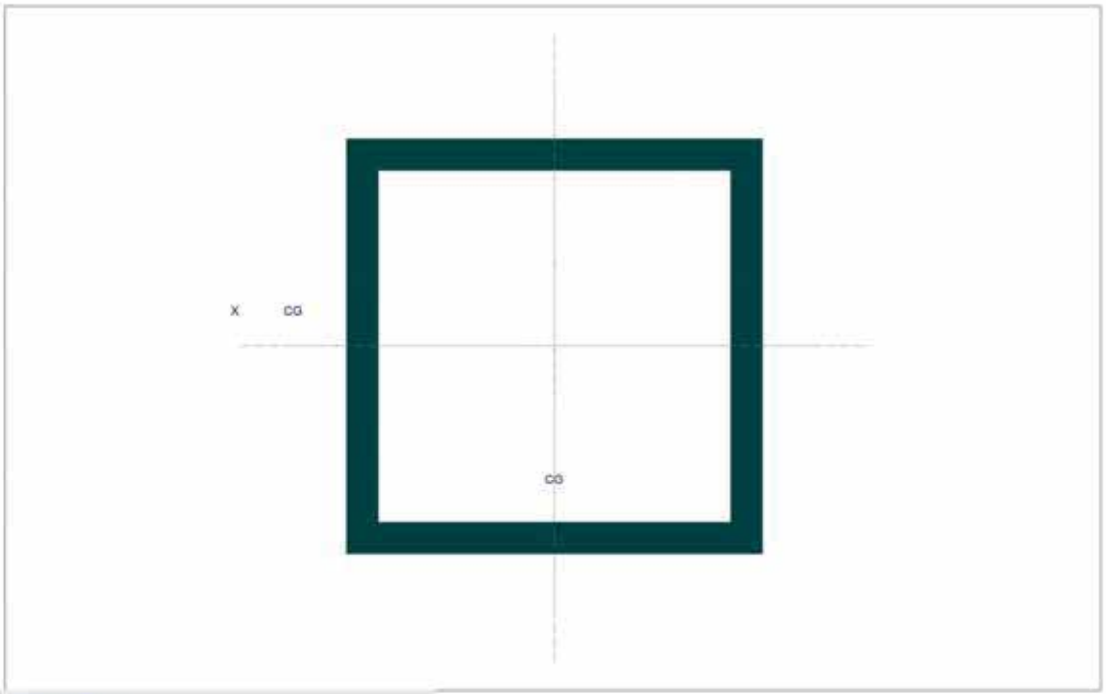
Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Post Section

Final Section Properties

Total Area	in^2	Ixx	in^4	Sxx : - Y	in^3		
		Iyy	in^4	Sxx : +Y	in^3		
Calculated final C.G. distance from Datum :				Syy : - X	in^3		
X cg Dist	in	Zxx	in^3	Syy : +X	in^3		
Y cg Dist	in	Zyy	in^3				
Edge Distances from CG. :				r xx	in		
+X	in	+Y	in	r yy	in		
-X	in	-Y	in				

Rotation of All Components @ Angle : 0.00 deg CCW



General Shapes

Tube : #1 — Xcg = 0.000 in — Ycg = 0.000 in — Rotation = 0 deg CCW

Total Height =	1.500 in	Total Width =	1.500 in	Left Thickness =	0.125 in
Right Thickness =	0.125 in	Bottom Thickness =	0.125 in	Top Thickness =	0.125 in

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Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:14AM

Steel Column

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Ramp Guardrail Post - 10' Section Middle Post Perpendicular Loading Governs - Aluminum 6061-T6

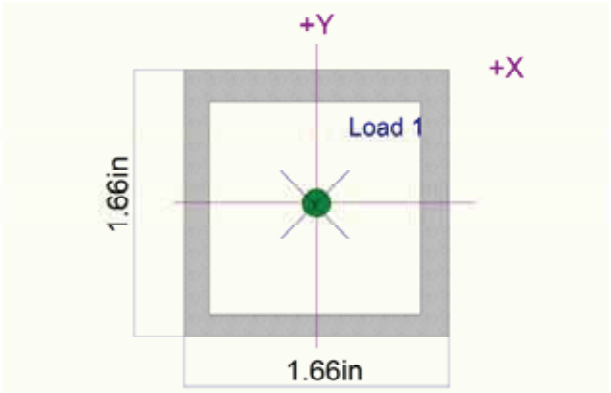
Maximum Deflections for Load Combinations

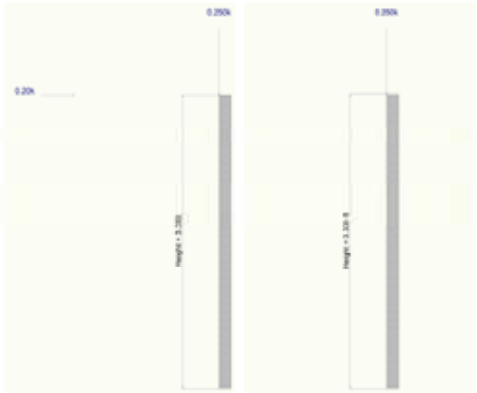
Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
Lr Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
L Only	0.0000 in	0.000 ft	1.192 in	3.330 ft
S Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
W Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
E Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
H Only	0.0000 in	0.000 ft	0.000 in	0.000 ft

Steel Section Properties : 1.5-Vert

Depth	=	1.656	in	I xx	=	0.36	in^4	J	=	0.710 in^4
Design Thick	=	0.156	in	S xx	=	0.41	in^3			
Width	=	1.656	in	R xx	=	0.599	in			
Wall Thick	=	0.168	in	Zx	=	0.501	in^3			
Area	=	0.911	in^2	I yy	=	0.355	in^4	C	=	0.050 in^3
Weight	=	1.080	plf	S yy	=	0.405	in^3			
				R yy	=	0.599	in			
Yog	=	0.000	in							

Sketches





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Steel Column

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Ramp Guardrail Post - 10' Section Middle Post Perpendicular Loading Governs - Aluminum 6061-T6

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction k @ Base	@ Top	Y-Y Axis Reaction k @ Base	@ Top	Mx - End Moments k-ft @ Base	@ Top	My - End Moments @ Base	@ Top
+D+H	0.004								
+D+L+H	0.254			0.200		-0.666			
+D+Lr+H	0.004								
+D+S+H	0.004								
+D+0.750Lr+0.750L+H	0.191			0.150		-0.500			
+D+0.750L+0.750S+H	0.191			0.150		-0.500			
+D+0.60W+H	0.004								
+D+0.70E+H	0.004								
+D+0.750Lr+0.750L+0.450W+H	0.191			0.150		-0.500			
+D+0.750L+0.750S+0.450W+H	0.191			0.150		-0.500			
+D+0.750L+0.750S+0.5250E+H	0.191			0.150		-0.500			
+0.60D+0.60W+0.60H	0.002								
+0.60D+0.70E+0.60H	0.002								
D Only	0.004								
Lr Only									
L Only	0.250			0.200		-0.666			
S Only									
W Only									
E Only									
H Only									

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction k @ Base	@ Top	Y-Y Axis Reaction k @ Base	@ Top	Mx - End Moments k-ft @ Base	@ Top	My - End Moments @ Base	@ Top
Axial @ Base	Maximum	0.254			0.200		-0.666			
"	Minimum									
Reaction, X-X Axis Base	Maximum	0.004								
"	Minimum	0.004								
Reaction, Y-Y Axis Base	Maximum	0.254			0.200		-0.666			
"	Minimum	0.004								
Reaction, X-X Axis Top	Maximum	0.004								
"	Minimum	0.004								
Reaction, Y-Y Axis Top	Maximum	0.004								
"	Minimum	0.004								
Moment, X-X Axis Base	Maximum	0.004								
"	Minimum	0.254	-0.666		0.200		-0.666			
Moment, Y-Y Axis Base	Maximum	0.004								
"	Minimum	0.004								
Moment, X-X Axis Top	Maximum	0.004								
"	Minimum	0.004								
Moment, Y-Y Axis Top	Maximum	0.004								
"	Minimum	0.004								

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Distance		Max. Y-Y Deflection		Distance	
+D+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+L+H	0.0000	in	0.000	ft	1.192	in	3.330	ft
+D+Lr+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+S+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750Lr+0.750L+H	0.0000	in	0.000	ft	0.894	in	3.330	ft
+D+0.750L+0.750S+H	0.0000	in	0.000	ft	0.894	in	3.330	ft
+D+0.60W+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.70E+H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+D+0.750Lr+0.750L+0.450W+H	0.0000	in	0.000	ft	0.894	in	3.330	ft
+D+0.750L+0.750S+0.450W+H	0.0000	in	0.000	ft	0.894	in	3.330	ft
+D+0.750L+0.750S+0.5250E+H	0.0000	in	0.000	ft	0.894	in	3.330	ft
+0.60D+0.60W+0.60H	0.0000	in	0.000	ft	0.000	in	0.000	ft
+0.60D+0.70E+0.60H	0.0000	in	0.000	ft	0.000	in	0.000	ft
D Only	0.0000	in	0.000	ft	0.000	in	0.000	ft

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Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:14AM

Steel Column

Lic. # : KW-06006137 Licensee : BRIGGS ENGINEERING, PLLC

Description : Ramp Guardrail Post - 10' Section Middle Post Perpendicular Loading Governs - Aluminum 6061-T6

Code References

Calculations per AISC 360-10, IBC 2015, CBC 2016, ASCE 7-10
Load Combinations Used : IBC 2012

General Information

Steel Section Name :	1.5-Vert	Overall Column Height	3.330 ft
Analysis Method :	Allowable Strength	Top & Bottom Fixity	Top Free, Bottom Fixed
Steel Stress Grade			
Fy : Steel Yield	35.0 ksi		
E : Elastic Bending Modulus	10,000.0 ksi		

Brace condition for deflection (buckling) along columns :
X-X (width) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 3.330 ft, K = 2.0
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT X-X Axis = 3.330 ft, K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 3.596 lbs * Dead Load Factor
AXIAL LOADS . . .
Railing Vertical Column: Axial Load at 3.330 ft, L = 0.250 k
BENDING LOADS . . .
Handrail Concentrated Load: Lat. Point Load at 3.330 ft creating Mx-x, L = 0.20 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio =	0.8093 : 1	
Load Combination	+D+L+H	
Location of max.above base	0.0 ft	
At maximum location values are . . .		
Pa : Axial	0.2536	k
Pn / Omega : Allowable	2.656	k
Ma-x : Applied	-0.6660	k-ft
Mn-x / Omega : Allowable	0.8745	k-ft
Ma-y : Applied	0.0	k-ft
Mn-y / Omega : Allowable	0.8745	k-ft
PASS Maximum Shear Stress Ratio =	0.04291 : 1	
Load Combination	+D+L+H	
Location of max.above base	0.0 ft	
At maximum location values are . . .		
Va : Applied	0.20	k
Vn / Omega : Allowable	4.661	k

Maximum Load Reactions . . .

Top along X-X	0.0 k
Bottom along X-X	0.0 k
Top along Y-Y	0.0 k
Bottom along Y-Y	0.20 k

Maximum Load Deflections . . .

Along Y-Y	1.192 in	at	3.330ft	above base
for load combination :	+D+L+H			
Along X-X	0.0 in	at	0.0ft	above base
for load combination :				

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios: Stress Ratio	Status	Location
+D+H	0.001	PASS	0.00 ft	1.00	1.00	133.33	66.67	0.000	PASS	0.00 ft
+D+L+H	0.809	PASS	0.00 ft	1.00	1.00	133.33	66.67	0.043	PASS	0.00 ft
+D+Lr+H	0.001	PASS	0.00 ft	1.00	1.00	133.33	66.67	0.000	PASS	0.00 ft
+D+S+H	0.001	PASS	0.00 ft	1.00	1.00	133.33	66.67	0.000	PASS	0.00 ft
+D+0.750Lr+0.750L+H	0.607	PASS	0.00 ft	1.00	1.00	133.33	66.67	0.032	PASS	0.00 ft
+D+0.750L+0.750S+H	0.607	PASS	0.00 ft	1.00	1.00	133.33	66.67	0.032	PASS	0.00 ft
+D+0.60W+H	0.001	PASS	0.00 ft	1.00	1.00	133.33	66.67	0.000	PASS	0.00 ft
+D+0.70E+H	0.001	PASS	0.00 ft	1.00	1.00	133.33	66.67	0.000	PASS	0.00 ft
+D+0.750Lr+0.750L+0.450W+H	0.607	PASS	0.00 ft	1.00	1.00	133.33	66.67	0.032	PASS	0.00 ft
+D+0.750L+0.750S+0.450W+H	0.607	PASS	0.00 ft	1.00	1.00	133.33	66.67	0.032	PASS	0.00 ft
+D+0.750L+0.750S+0.5250E+H	0.607	PASS	0.00 ft	1.00	1.00	133.33	66.67	0.032	PASS	0.00 ft
+0.60D+0.60W+0.60H	0.001	PASS	0.00 ft	1.00	1.00	133.33	66.67	0.000	PASS	0.00 ft
+0.60D+0.70E+0.60H	0.001	PASS	0.00 ft	1.00	1.00	133.33	66.67	0.000	PASS	0.00 ft

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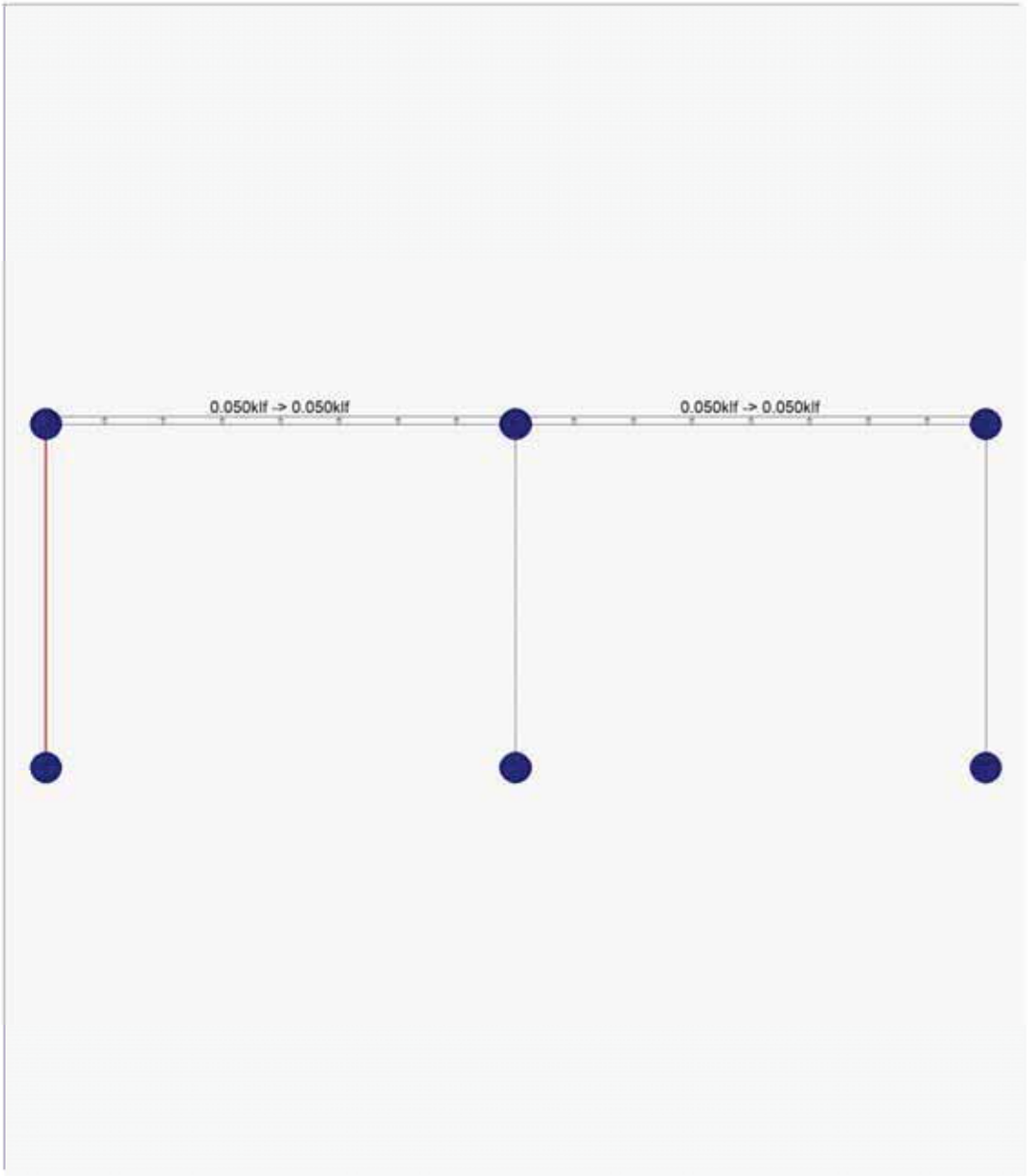
Printed: 9 FEB 2019, 11:14AM

2-D Frame

Lic. # : KW-06006137
Licensee : BRIGGS ENGINEERING, PLLC

Description : Std Al. Ramp Guardrail



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2-D Frame

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Std Al. Ramp Guardrail

Extreme Member Forces

Only Load Combinations giving maximum values are listed

Mmbr Label	Axial	Dist from "I" Joint	Moment	Dist from "I" Joint	Shear	Dist from "I" Joint
3-4	-0.1333 k	0.0 ft	0.2769 k-ft	0.0 ft	0.1299 k	0.0 ft
Max	+0.50L		+1.60L		+1.60L	
3-4	-0.4264 k	0.0 ft	-0.1986 k-ft	3.660 ft	0.04060 k	0.0 ft
Min	+1.60L		+1.60L		+0.50L	
4-6	-0.04535 k	0.0 ft	0.2367 k-ft	5.0 ft	0.1705 k	0.0 ft
Max	+0.50L		+1.60L		+1.60L	
4-6	-0.1451 k	0.0 ft	-0.09244 k-ft	2.143 ft	-0.2295 k	5.0 ft
Min	+1.60L		+1.60L		+1.60L	
5-6	-0.07171 k	0.0 ft	0.2944 k-ft	0.0 ft	0.1451 k	0.0 ft
Max	+0.50L		+1.60L		+1.60L	
5-6	-0.2295 k	0.0 ft	-0.2367 k-ft	3.660 ft	0.04535 k	0.0 ft
Min	+1.60L		+1.60L		+0.50L	

Member Stress Checks...

Stress Checks per AISC 360-10 & NDS 2015

Member Label	Section Label	Material	Max. Axial + Bending Stress Ratios				Max. Shear Stress Ratios			
			Load Combination	Ratio	Status	Dist (ft)	Load Combination	Ratio	Status	Dist (ft)
1-2	Rail-Vert	Steel	+1.60L	0.137	PASS	0.00	+1.60L	0.008	PASS	0.00
2-4	Rail -Horiz	Steel	+1.60L	0.870	PASS	5.00	+1.60L	0.262	PASS	5.00
3-4	Rail-Vert	Steel	+1.60L	0.226	PASS	0.00	+1.60L	0.022	PASS	0.00
4-6	Rail -Horiz	Steel	+1.60L	0.735	PASS	5.00	+1.60L	0.235	PASS	5.00
5-6	Rail-Vert	Steel	+1.60L	0.232	PASS	0.00	+1.60L	0.025	PASS	0.00

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SERVING THE WESTERN US

Project Title: ACCESS DECK, RAMPS & STAIRS - WELCOME F
Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:14AM

2-D Frame

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Std Al. Ramp Guardrail

Extreme Joint Reactions

Only Load Combinations giving maximum values are listed

Joint Label		Joint Reactions X k	Y k	Z k-ft
2	Max			
	Min			
3	Max	-0.06090 +0.75L	0.2665 L Only	0.1731 L Only
	Min	-0.08120 L Only	0.1999 +0.75L	0.1298 +0.75L
4	Max			
	Min			
5	Max	-0.06802 +0.75L	0.1434 L Only	0.1840 L Only
	Min	-0.09069 L Only	0.1076 +0.75L	0.1380 +0.75L
6	Max			
	Min			

Extreme Member End Forces

Only Load Combinations giving maximum values are listed

lember Label		Member " I " End Forces Axial k	Shear k	Moment k-ft	Member " J " End Forces Axial k	Shear k	Moment k-ft
1-2	Max	0.1441 +1.60L	0.04497 +1.60L	0.1730 +1.60L	0.0	0.0	0.0
1-2	Min	0.0	0.0	0.0	-0.1441 +1.60L	-0.04497 +1.60L	-0.008352 +1.60L
2-4	Max	0.0	0.1441 +1.60L	0.008352 +1.60L	0.04497 +1.60L	0.2559 +1.60L	0.0
2-4	Min	-0.04497 +1.60L	0.0	0.0	0.0	0.0	-0.2879 +1.60L
3-4	Max	0.4264 +1.60L	0.1299 +1.60L	0.2769 +1.60L	0.0	0.0	0.1986 +1.60L
3-4	Min	0.0	0.0	0.0	-0.4264 +1.60L	-0.1299 +1.60L	0.0
4-6	Max	0.1451 +1.60L	0.1705 +1.60L	0.08931 +1.60L	0.0	0.2295 +1.60L	0.0
4-6	Min	0.0	0.0	0.0	-0.1451 +1.60L	0.0	-0.2367 +1.60L
5-6	Max	0.2295 +1.60L	0.1451 +1.60L	0.2944 +1.60L	0.0	0.0	0.2367 +1.60L
5-6	Min	0.0	0.0	0.0	-0.2295 +1.60L	-0.1451 +1.60L	0.0

Extreme Member Forces

Only Load Combinations giving maximum values are listed

Mmbr Label		Axial	Dist from "I" Joint	Moment	Dist from "I" Joint	Shear	Dist from "I" Joint
1-2	Max	-0.04503 k +0.50L	0.0 ft	0.1730 k-ft +1.60L	0.0 ft	0.04497 k +1.60L	0.0 ft
1-2	Min	-0.1441 k +1.60L	0.0 ft	0.002610 k-ft +0.50L	3.660 ft	0.01405 k +0.50L	0.0 ft
2-4	Max	0.04497 k +1.60L	0.0 ft	0.2879 k-ft +1.60L	5.0 ft	0.1441 k +1.60L	0.0 ft
2-4	Min	0.01405 k +0.50L	0.0 ft	-0.1214 k-ft +1.60L	1.837 ft	-0.2559 k +1.60L	5.0 ft

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Description : Std Al. Ramp Guardrail

Deflection Load Combinations — IBC 2012

Load Combination Description	Load Combination Factors						
	Dead	Roof Live	Live	Snow	Wind	Seismic	Earth
+D+H	1.0						1.0
+D+L+H	1.0		1.0				1.0
+D+Lr+H	1.0	1.0					1.0
+D+S+H	1.0			1.0			1.0
+D+0.750Lr+0.750L+H	1.0	0.750	0.750				1.0
+D+0.750L+0.750S+H	1.0		0.750	0.750			1.0
+D+0.60W+H	1.0				0.60		1.0
+D+0.70E+H	1.0					0.70	1.0
+D+0.750Lr+0.750L+0.450W+H	1.0	0.750	0.750		0.450		1.0
+D+0.750L+0.750S+0.450W+H	1.0		0.750	0.750	0.450		1.0
+D+0.750L+0.750S+0.5250E+H	1.0		0.750	0.750		0.5250	1.0
+0.60D+0.60W+0.60H	0.60				0.60		0.60
+0.60D+0.70E+0.60H	0.60					0.70	0.60
D Only	1.0						
Lr Only		1.0					
L Only			1.0				
S Only				1.0			
W Only					1.0		
E Only						1.0	
H Only							1.0

Extreme Joint Displacements

Only Load Combinations giving maximum values are listed

Joint Label		Joint Displacements X in	Y in	Z Radians
1	Max	0.0 L Only	0.0 +0.750L	0.0 +0.750L
1	Min	0.0 +0.750L	0.0 L Only	0.0 L Only
2	Max	0.2406 L Only	-0.000326 +0.750L	-0.006309 +0.750L
2	Min	0.1805 +0.750L	-0.000434 L Only	-0.008412 L Only
3	Max	0.0 L Only	0.0 +0.750L	0.0 +0.750L
3	Min	0.0 +0.750L	0.0 L Only	0.0 L Only
4	Max	0.2412 L Only	-0.000964 +0.750L	-0.002724 +0.750L
4	Min	0.1809 +0.750L	-0.001285 L Only	-0.003632 L Only
5	Max	0.0 L Only	0.0 +0.750L	0.0 +0.750L
5	Min	0.0 +0.750L	0.0 L Only	0.0 L Only
6	Max	0.2392 L Only	-0.000519 +0.750L	-0.002011 +0.750L
6	Min	0.1794 +0.750L	-0.000691 L Only	-0.002681 L Only

Extreme Joint Reactions

Only Load Combinations giving maximum values are listed

Joint Label		Joint Reactions X k	Y k	Z k-ft
1	Max	-0.02108 +0.750L	0.09006 L Only	0.1081 L Only
	Min	-0.02811 L Only	0.06754 +0.750L	0.08107 +0.750L

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Description : Std Al. Ramp Guardrail

Stress/Strength Load Combinations — IBC 2012

Load Combination Description	Lambda	Load Combination Factors: Dead	0.2*Sds* Seismic	Roof Live	Live	Snow	Wind	Seismic	Rho	Earth
+1.40D+1.60H	0.6	1.40								1.60
+1.20D+0.50Lr+1.60L+1.60H	0.8	1.20		0.50	1.60					1.60
+1.20D+1.60L+0.50S+1.60H	0.8	1.20			1.60	0.50				1.60
+1.20D+1.60Lr+0.50L+1.60H	0.8	1.20		1.60	0.50					1.60
+1.20D+1.60Lr+0.50W+1.60H	0.8	1.20		1.60			0.50			1.60
+1.20D+0.50L+1.60S+1.60H	0.8	1.20			0.50	1.60				1.60
+1.20D+1.60S+0.50W+1.60H	0.8	1.20				1.60	0.50			1.60
+1.20D+0.50Lr+0.50L+W+1.60	1	1.20		0.50	0.50		1.0			1.60
+1.20D+0.50L+0.50S+W+1.60H	1	1.20			0.50	0.50	1.0			1.60
+1.20D+0.50L+0.70S+E+1.60H	0.8	1.20			0.50	0.70				1.60
+0.90D+W+0.90H	1	0.90					1.0			0.90
+0.90D+E+0.90H	0.6	0.90								0.90

Reaction Load Combinations — IBC 2012

Load Combination Description	Load Combination Factors: Dead	Roof Live	Live	Snow	Wind	Seismic	Earth
+D+H	1.0						1.0
+D+L+H	1.0		1.0				1.0
+D+Lr+H	1.0	1.0					1.0
+D+S+H	1.0			1.0			1.0
+D+0.750Lr+0.750L+H	1.0	0.750	0.750				1.0
+D+0.750L+0.750S+H	1.0		0.750	0.750			1.0
+D+0.60W+H	1.0				0.60		1.0
+D+0.70E+H	1.0					0.70	1.0
+D+0.750Lr+0.750L+0.450W+H	1.0	0.750	0.750		0.450		1.0
+D+0.750L+0.750S+0.450W+H	1.0		0.750	0.750	0.450		1.0
+D+0.750L+0.750S+0.5250E+H	1.0		0.750	0.750		0.5250	1.0
+0.60D+0.60W+0.60H	0.60				0.60		0.60
+0.60D+0.70E+0.60H	0.60					0.70	0.60
D Only	1.0						
Lr Only		1.0					
L Only			1.0				
S Only				1.0			
W Only					1.0		
E Only						1.0	
H Only							1.0

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2-D Frame

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Description : Std Al. Ramp Guardrail

Joints...

Joint Label	Joint Coordinates X ft	Y ft	X Translational Restraint	Y Translational Restraint	Z Rotational Restraint	Joint Temp deg F
1	0.0	0.0	Fixed	Fixed	Fixed	0
2	0.0	3.660				0
3	5.0	0.0	Fixed	Fixed	Fixed	0
4	5.0	3.660				0
5	10.0	0.0	Fixed	Fixed	Fixed	0
6	10.0	3.660				0

Members...

Member Label	Property Label	Endpoint Joints I Joint	J Joint	Member Length ft	Releases Specify Connectivity of Member Ends to Joints I End x	I End y	I End z (rotation)	J End x	J End y	J End z (rotation)
1-2	Rail-Vert	1	2	3.660	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
2-4	Rail -Horiz	2	4	5.000	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
3-4	Rail-Vert	3	4	3.660	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
4-6	Rail -Horiz	4	6	5.000	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
5-6	Rail-Vert	5	6	3.660	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed

Member Stress Check Data...

Member Label	Unbraced Lengths Lu : z ft	Lu : y	Slenderness Factors K : z	K : y	AISC Bending & Stability Factors Cm	Cb
1-2	3.660	3.660	1.00	1.00	Internal	Internal
2-4	5.000	5.000	1.00	1.00	Internal	Internal
3-4	3.660	3.660	1.00	1.00	Internal	Internal
4-6	5.000	5.000	1.00	1.00	Internal	Internal
5-6	3.660	3.660	1.00	1.00	Internal	Internal

Materials...

Member Label	Youngs ksi	Density kcf	Thermal in/degr	Yield ksi
6061-T6	10,000.00	0.167	0.001230	35.00
6063-T5	10,000.00	0.167	0.001230	16.00
Default	1.00	0.000	0.000000	1.00
Steel	29,000.00	0.490	0.000650	50.00

Member Sections...

Prop Label	Group Tag	Material	Area	Depth	Width	Ixx	Iyy
1.5" Handrail	Rail -Horiz	6063-T5	0.2715 in^2	1.50 in	1.50 in	0.1745 in^4	0.1745 in^4
1.5-Vert	Rail-Vert	6061-T6	0.9110 in^2	1.656 in	1.656 in	0.3550 in^4	0.3550 in^4
Default	Group	Default	1.0 in^2	0.0 in	0.0 in	1.0 in^4	1.0 in^4

Joint Loads...

Note: Loads labeled "Global Y" act downward (in "-Y" direction)

Joint Label	Load Direction	Load Magnitude Dead	Roof Live	Live	Snow	Seismic	Wind	Earth
4	Global X			0.20				k

Member Distributed Loads...

Note: Loads labeled "Global Y" act downward (in "-Y" direction)

Member Label	Load Direction	Load Extents Start / End ft		Load Magnitude Dead	Roof Live	Live	Snow	Seismic	Wind	Earth
2-4	Global Y	0.0	Start Mag :			0.050				k/ft
		5.0	End Mag :			0.050				k/ft
4-6	Global Y	0.0	Start Mag :			0.050				k/ft
		5.0	End Mag :			0.050				k/ft

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2-D Frame

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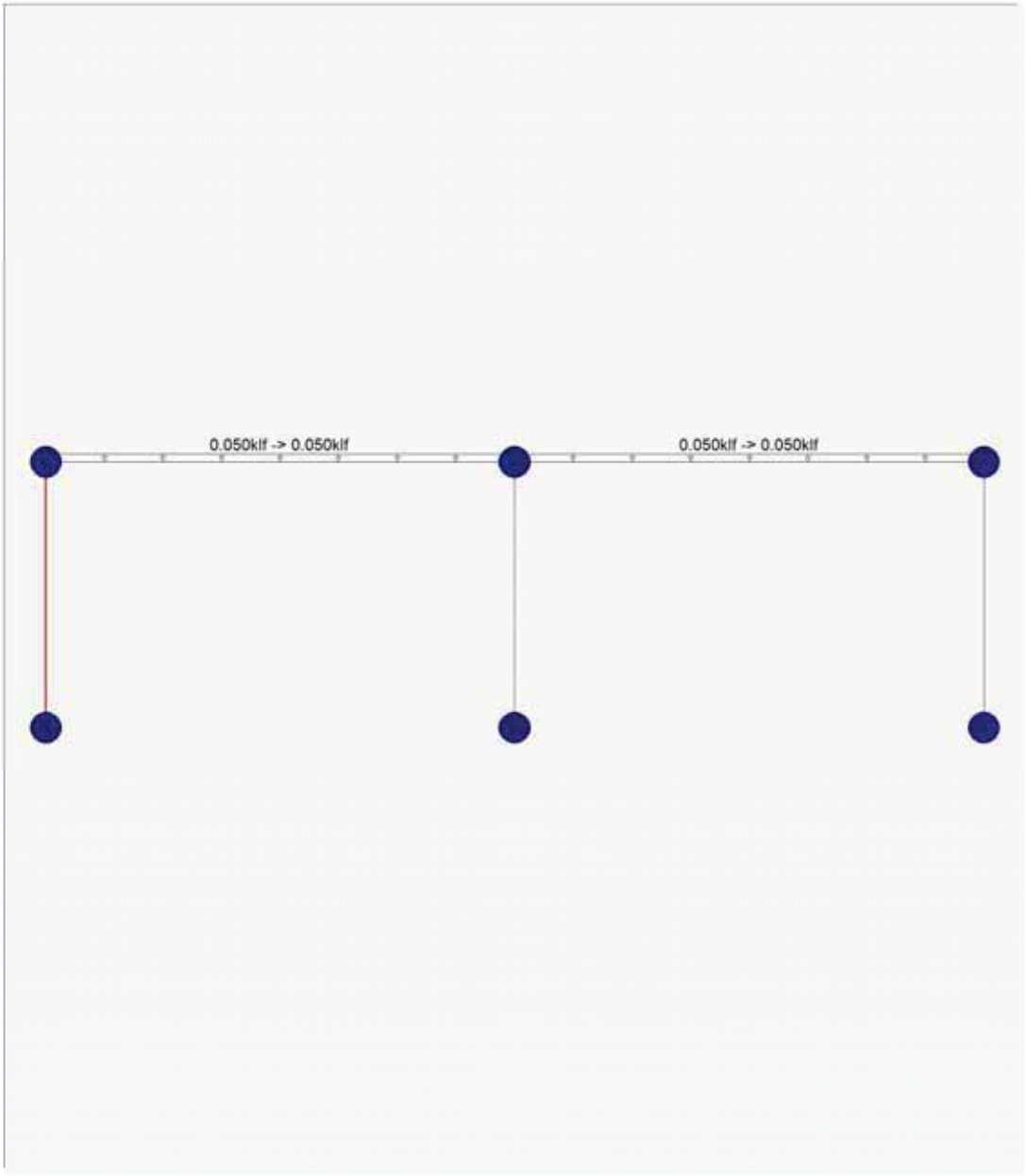
Description : Std Al. Ramp Rail



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Description : Std Al. Ramp Rail

Extreme Member Forces

Only Load Combinations giving maximum values are listed

Mmbr Label	Axial	Dist from "I" Joint	Moment	Dist from "I" Joint	Shear	Dist from "I" Joint
3-4	-0.1319 k	0.0 ft	0.2219 k-ft	0.0 ft	0.1297 k	0.0 ft
Max	+0.50L		+1.60L		+1.60L	
3-4	-0.4219 k	0.0 ft	-0.1451 k-ft	2.830 ft	0.04053 k	0.0 ft
Min	+1.60L		+1.60L		+0.50L	
4-6	-0.05115 k	0.0 ft	0.2111 k-ft	5.0 ft	0.1803 k	0.0 ft
Max	+0.50L		+1.60L		+1.60L	
4-6	-0.1637 k	0.0 ft	-0.09074 k-ft	2.245 ft	-0.2198 k	5.0 ft
Min	+1.60L		+1.60L		+1.60L	
5-6	-0.06867 k	0.0 ft	0.2521 k-ft	0.0 ft	0.1637 k	0.0 ft
Max	+0.50L		+1.60L		+1.60L	
5-6	-0.2198 k	0.0 ft	-0.2111 k-ft	2.830 ft	0.05115 k	0.0 ft
Min	+1.60L		+1.60L		+0.50L	

Member Stress Checks...

Stress Checks per AISC 360-10 & NDS 2015

Member Label	Section Label	Material	Max. Axial + Bending Stress Ratios				Max. Shear Stress Ratios			
			Load Combination	Ratio	Status	Dist (ft)	Load Combination	Ratio	Status	Dist (ft)
1-2	Rail-Vert	Steel	+1.60L	0.099	PASS	0.00	+1.60L	0.005	PASS	0.00
2-4	Rail -Horiz	Steel	+1.60L	0.591	PASS	5.00	+1.60L	0.188	PASS	5.00
3-4	Rail-Vert	Steel	+1.60L	0.180	PASS	0.00	+1.60L	0.022	PASS	0.00
4-6	Rail -Horiz	Steel	+1.60L	0.507	PASS	5.00	+1.60L	0.171	PASS	5.00
5-6	Rail-Vert	Steel	+1.60L	0.198	PASS	0.00	+1.60L	0.028	PASS	0.00

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Description : Std Al. Ramp Rail

Extreme Joint Reactions

Only Load Combinations giving maximum values are listed

Joint Label		Joint Reactions X k	Y k	Z k-ft
2	Max			
	Min			
3	Max	-0.06079 +0.75L	0.2637 L Only	0.1387 L Only
	Min	-0.08106 L Only	0.1978 +0.75L	0.1040 +0.75L
4	Max			
	Min			
5	Max	-0.07672 +0.75L	0.1373 L Only	0.1576 L Only
	Min	-0.1023 L Only	0.1030 +0.75L	0.1182 +0.75L
6	Max			
	Min			

Extreme Member End Forces

Only Load Combinations giving maximum values are listed

lember Label		Member " I " End Forces Axial k	Shear k	Moment k-ft	Member " J " End Forces Axial k	Shear k	Moment k-ft
1-2	Max	0.1583 +1.60L	0.02664 +1.60L	0.1244 +1.60L	0.0	0.0	0.0
1-2	Min	0.0	0.0	0.0	-0.1583 +1.60L	-0.02664 +1.60L	-0.04903 +1.60L
2-4	Max	0.0	0.1583 +1.60L	0.04903 +1.60L	0.02664 +1.60L	0.2417 +1.60L	0.0
2-4	Min	-0.02664 +1.60L	0.0	0.0	0.0	0.0	-0.2574 +1.60L
3-4	Max	0.4219 +1.60L	0.1297 +1.60L	0.2219 +1.60L	0.0	0.0	0.1451 +1.60L
3-4	Min	0.0	0.0	0.0	-0.4219 +1.60L	-0.1297 +1.60L	0.0
4-6	Max	0.1637 +1.60L	0.1803 +1.60L	0.1123 +1.60L	0.0	0.2198 +1.60L	0.0
4-6	Min	0.0	0.0	0.0	-0.1637 +1.60L	0.0	-0.2111 +1.60L
5-6	Max	0.2198 +1.60L	0.1637 +1.60L	0.2521 +1.60L	0.0	0.0	0.2111 +1.60L
5-6	Min	0.0	0.0	0.0	-0.2198 +1.60L	-0.1637 +1.60L	0.0

Extreme Member Forces

Only Load Combinations giving maximum values are listed

Mmbr Label		Axial	Dist from "I" Joint	Moment	Dist from "I" Joint	Shear	Dist from "I" Joint
1-2	Max	-0.04948 k +0.50L	0.0 ft	0.1244 k-ft +1.60L	0.0 ft	0.02664 k +1.60L	0.0 ft
1-2	Min	-0.1583 k +1.60L	0.0 ft	0.01532 k-ft +0.50L	2.830 ft	0.008323 k +0.50L	0.0 ft
2-4	Max	0.02664 k +1.60L	0.0 ft	0.2574 k-ft +1.60L	5.0 ft	0.1583 k +1.60L	0.0 ft
2-4	Min	0.008323 k +0.50L	0.0 ft	-0.1076 k-ft +1.60L	1.939 ft	-0.2417 k +1.60L	5.0 ft

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Description : Std Al. Ramp Rail

Deflection Load Combinations — IBC 2012

Load Combination Description	Load Combination Factors						
	Dead	Roof Live	Live	Snow	Wind	Seismic	Earth
+D+H	1.0						1.0
+D+L+H	1.0		1.0				1.0
+D+Lr+H	1.0	1.0					1.0
+D+S+H	1.0			1.0			1.0
+D+0.750Lr+0.750L+H	1.0	0.750	0.750				1.0
+D+0.750L+0.750S+H	1.0		0.750	0.750			1.0
+D+0.60W+H	1.0				0.60		1.0
+D+0.70E+H	1.0					0.70	1.0
+D+0.750Lr+0.750L+0.450W+H	1.0	0.750	0.750		0.450		1.0
+D+0.750L+0.750S+0.450W+H	1.0		0.750	0.750	0.450		1.0
+D+0.750L+0.750S+0.5250E+H	1.0		0.750	0.750		0.5250	1.0
+0.60D+0.60W+0.60H	0.60				0.60		0.60
+0.60D+0.70E+0.60H	0.60					0.70	0.60
D Only	1.0						
Lr Only		1.0					
L Only			1.0				
S Only				1.0			
W Only					1.0		
E Only						1.0	
H Only							1.0

Extreme Joint Displacements

Only Load Combinations giving maximum values are listed

Joint Label		Joint Displacements X in	Y in	Z Radians
1	Max	0.0 L Only	0.0 +0.750L	0.0 +0.750L
1	Min	0.0 +0.750L	0.0 L Only	0.0 L Only
2	Max	0.1209 L Only	-0.000277 +0.750L	-0.004666 +0.750L
2	Min	0.09071 +0.750L	-0.000369 L Only	-0.006222 L Only
3	Max	0.0 L Only	0.0 +0.750L	0.0 +0.750L
3	Min	0.0 +0.750L	0.0 L Only	0.0 L Only
4	Max	0.1213 L Only	-0.000737 +0.750L	-0.002067 +0.750L
4	Min	0.09099 +0.750L	-0.000983 L Only	-0.002756 L Only
5	Max	0.0 L Only	0.0 +0.750L	0.0 +0.750L
5	Min	0.0 +0.750L	0.0 L Only	0.0 L Only
6	Max	0.1191 L Only	-0.000384 +0.750L	-0.001105 +0.750L
6	Min	0.08929 +0.750L	-0.000512 L Only	-0.001473 L Only

Extreme Joint Reactions

Only Load Combinations giving maximum values are listed

Joint Label		Joint Reactions X k	Y k	Z k-ft
1	Max	-0.01249 +0.750L	0.09895 L Only	0.07775 L Only
	Min	-0.01665 L Only	0.07421 +0.750L	0.05832 +0.750L

BRIGGS ENGINEERING, Inc.
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SERVING THE WESTERN US

Project Title: ACCESS DECK, RAMPS & STAIRS - WELCOME F
Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:14AM

2-D Frame

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Std Al. Ramp Rail

Stress/Strength Load Combinations — IBC 2012

Load Combination Description	Lambda	Load Combination Factors								
		Dead	0.2*Sds* Seismic	Roof Live	Live	Snow	Wind	Seismic	Rho	Earth
+1.40D+1.60H	0.6	1.40								1.60
+1.20D+0.50Lr+1.60L+1.60H	0.8	1.20		0.50	1.60					1.60
+1.20D+1.60L+0.50S+1.60H	0.8	1.20			1.60	0.50				1.60
+1.20D+1.60Lr+0.50L+1.60H	0.8	1.20		1.60	0.50					1.60
+1.20D+1.60Lr+0.50W+1.60H	0.8	1.20		1.60			0.50			1.60
+1.20D+0.50L+1.60S+1.60H	0.8	1.20			0.50	1.60				1.60
+1.20D+1.60S+0.50W+1.60H	0.8	1.20				1.60	0.50			1.60
+1.20D+0.50Lr+0.50L+W+1.60	1	1.20		0.50	0.50		1.0			1.60
+1.20D+0.50L+0.50S+W+1.60H	1	1.20			0.50	0.50	1.0			1.60
+1.20D+0.50L+0.70S+E+1.60H	0.8	1.20			0.50	0.70				1.60
+0.90D+W+0.90H	1	0.90					1.0			0.90
+0.90D+E+0.90H	0.6	0.90								0.90

Reaction Load Combinations — IBC 2012

Load Combination Description	Load Combination Factors						
	Dead	Roof Live	Live	Snow	Wind	Seismic	Earth
+D+H	1.0						1.0
+D+L+H	1.0		1.0				1.0
+D+Lr+H	1.0	1.0					1.0
+D+S+H	1.0			1.0			1.0
+D+0.750Lr+0.750L+H	1.0	0.750	0.750				1.0
+D+0.750L+0.750S+H	1.0		0.750	0.750			1.0
+D+0.60W+H	1.0				0.60		1.0
+D+0.70E+H	1.0					0.70	1.0
+D+0.750Lr+0.750L+0.450W+H	1.0	0.750	0.750		0.450		1.0
+D+0.750L+0.750S+0.450W+H	1.0		0.750	0.750	0.450		1.0
+D+0.750L+0.750S+0.5250E+H	1.0		0.750	0.750		0.5250	1.0
+0.60D+0.60W+0.60H	0.60				0.60		0.60
+0.60D+0.70E+0.60H	0.60					0.70	0.60
D Only	1.0						
Lr Only		1.0					
L Only			1.0				
S Only				1.0			
W Only					1.0		
E Only						1.0	
H Only							1.0

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Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:14AM

2-D Frame

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Std Al. Ramp Rail

Joints...

Joint Label	Joint Coordinates X ft	Y ft	X Translational Restraint	Y Translational Restraint	Z Rotational Restraint	Joint Temp deg F
1	0.0	0.0	Fixed	Fixed	Fixed	0
2	0.0	2.830				0
3	5.0	0.0	Fixed	Fixed	Fixed	0
4	5.0	2.830				0
5	10.0	0.0	Fixed	Fixed	Fixed	0
6	10.0	2.830				0

Members...

Member Label	Property Label	Endpoint Joints I Joint	J Joint	Member Length ft	Releases Specify Connectivity of Member Ends to Joints I End x	I End y	I End z (rotation)	J End x	J End y	J End z (rotation)
1-2	Rail-Vert	1	2	2.830	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
2-4	Rail -Horiz	2	4	5.000	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
3-4	Rail-Vert	3	4	2.830	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
4-6	Rail -Horiz	4	6	5.000	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
5-6	Rail-Vert	5	6	2.830	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed

Member Stress Check Data...

Member Label	Unbraced Lengths Lu : z ft	Lu : y	Slenderness Factors K : z	K : y	AISC Bending & Stability Factors Cm	Cb
1-2	2.830	2.830	1.00	1.00	Internal	Internal
2-4	5.000	5.000	1.00	1.00	Internal	Internal
3-4	2.830	2.830	1.00	1.00	Internal	Internal
4-6	5.000	5.000	1.00	1.00	Internal	Internal
5-6	2.830	2.830	1.00	1.00	Internal	Internal

Materials...

Member Label	Youngs ksi	Density kcf	Thermal in/degr	Yield ksi
6061-T6	10,000.00	0.167	0.001230	35.00
6063-T5	10,000.00	0.167	0.001230	21.00
Default	1.00	0.000	0.000000	1.00
Steel	29,000.00	0.490	0.000650	50.00

Member Sections...

Prop Label	Group Tag	Material	Area	Depth	Width	Ixx	Iyy
1.5" Handrail	Rail -Horiz	6063-T5	0.2715 in^2	1.50 in	1.50 in	0.1745 in^4	0.1745 in^4
1.5-Vert	Rail-Vert	6061-T6	0.9110 in^2	1.656 in	1.656 in	0.3550 in^4	0.3550 in^4
Default	Group	Default	1.0 in^2	0.0 in	0.0 in	1.0 in^4	1.0 in^4

Joint Loads...

Note: Loads labeled "Global Y" act downward (in "-Y" direction)

Joint Label	Load Direction	Load Magnitude Dead	Roof Live	Live	Snow	Seismic	Wind	Earth
4	Global X			0.20				k

Member Distributed Loads...

Note: Loads labeled "Global Y" act downward (in "-Y" direction)

Member Label	Load Direction	Load Extents Start / End ft		Load Magnitude Dead	Roof Live	Live	Snow	Seismic	Wind	Earth
2-4	Global Y	0.0	Start Mag :			0.050				k/ft
		5.0	End Mag :			0.050				k/ft
4-6	Global Y	0.0	Start Mag :			0.050				k/ft
		5.0	End Mag :			0.050				k/ft

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Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design - OSSC-2019

Printed: 23 MAY 2020, 10:26AM

Steel Beam

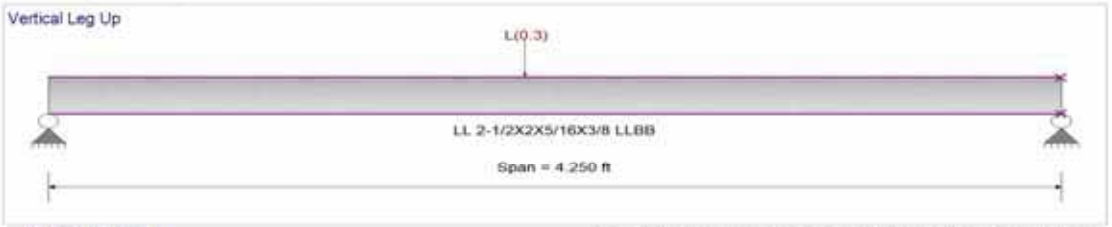
DESCRIPTION: 51" Tread Design - Conc

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : 2009 IBC & ASCE 7-05

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	31.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	10,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Load(s) for Span Number 1
Point Load : L = 0.30 k @ 2.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.156 : 1	Maximum Shear Stress Ratio =	0.010 : 1
Section used for this span	LL 2-1/2X2X5/16X3/8	Section used for this span	LL 2-1/2X2X5/16X3/8
Ma : Applied	0.337 k-ft	Va : Applied	0.1779 k
Mn / Omega : Allowable	2.160 k-ft	Vn/Omega : Allowable	17.403 k
Load Combination	+D+L	Load Combination	+D+L
Location of maximum on span	2.004 ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.052 in	Ratio =	971 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.057 in	Ratio =	900 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
D Only													
Dsgn. L = 4.25 ft	1	0.009	0.001	0.02		0.02	3.61	2.16	1.00	1.00	0.02	29.06	17.40
+D+L													
Dsgn. L = 4.25 ft	1	0.156	0.010	0.34		0.34	3.61	2.16	1.00	1.00	0.18	29.06	17.40
+D+0.750L													
Dsgn. L = 4.25 ft	1	0.119	0.008	0.26		0.26	3.61	2.16	1.00	1.00	0.14	29.06	17.40
+0.60D													
Dsgn. L = 4.25 ft	1	0.006	0.001	0.01		0.01	3.61	2.16	1.00	1.00	0.01	29.06	17.40

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.0567	2.089		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.178	0.160
Overall MINimum	0.011	0.011
D Only	0.019	0.019
+D+L	0.178	0.160
+D+0.750L	0.138	0.125
+0.60D	0.011	0.011
L Only	0.159	0.141

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Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design - OSSC-2019

Printed: 23 MAY 2020, 10:26AM

Steel Beam

DESCRIPTION: 51" Tread Design - Unif

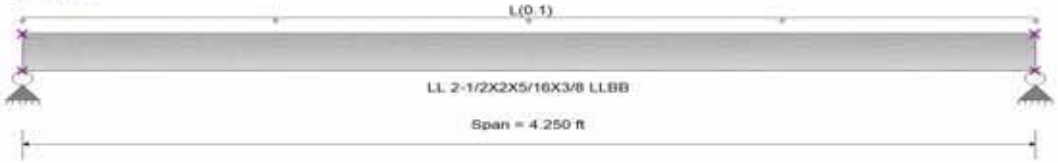
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : 2009 IBC & ASCE 7-05

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		

Vertical Leg Up



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Uniform Load : L = 0.10 k/ft, Tributary Width = 1.0 ft, (Unif Load)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.071 : 1	Maximum Shear Stress Ratio =	0.008 : 1
Section used for this span	LL 2-1/2X2X5/16X3/8	Section used for this span	LL 2-1/2X2X5/16X3/8
Ma : Applied	0.246 k-ft	Va : Applied	0.2316 k
Mn / Omega : Allowable	3.484 k-ft	Vn/Omega : Allowable	28.069 k
Load Combination	+D+L	Load Combination	+D+L
Location of maximum on span	2.118 ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.016 in	Ratio =	3,166 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.018 in	Ratio =	2906 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
D Only													
Dsgn. L = 4.25 ft	1	0.006	0.001	0.02		0.02	5.82	3.48	1.14	1.00	0.02	46.88	28.07
+D+L													
Dsgn. L = 4.25 ft	1	0.071	0.008	0.25		0.25	5.82	3.48	1.14	1.00	0.23	46.88	28.07
+D+0.750L													
Dsgn. L = 4.25 ft	1	0.054	0.006	0.19		0.19	5.82	3.48	1.14	1.00	0.18	46.88	28.07
+0.60D													
Dsgn. L = 4.25 ft	1	0.003	0.000	0.01		0.01	5.82	3.48	1.14	1.00	0.01	46.88	28.07

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.0176	2.132		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.232	0.232
Overall MINimum	0.011	0.011
D Only	0.019	0.019
+D+L	0.232	0.232
+D+0.750L	0.178	0.178
+0.60D	0.011	0.011
L Only	0.213	0.213

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Project Descr: Standard Deck/Stair Design

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General Section Property Calculator

File = E:\BRIGGS\STANDARDS\CALCULATIONS\ENERCALC Data Files\wr.ecb

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Tread Al. Section

L : #3 — Xcg = 5.941 in — Ycg = 0.000 in — Rotation = 90 deg CCW

Width =	1.445 in	Height =	1.000 in	Vert. Section Width	0.118 in
Horiz. Section Heig	0.118 in				

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General Section Property Calculator

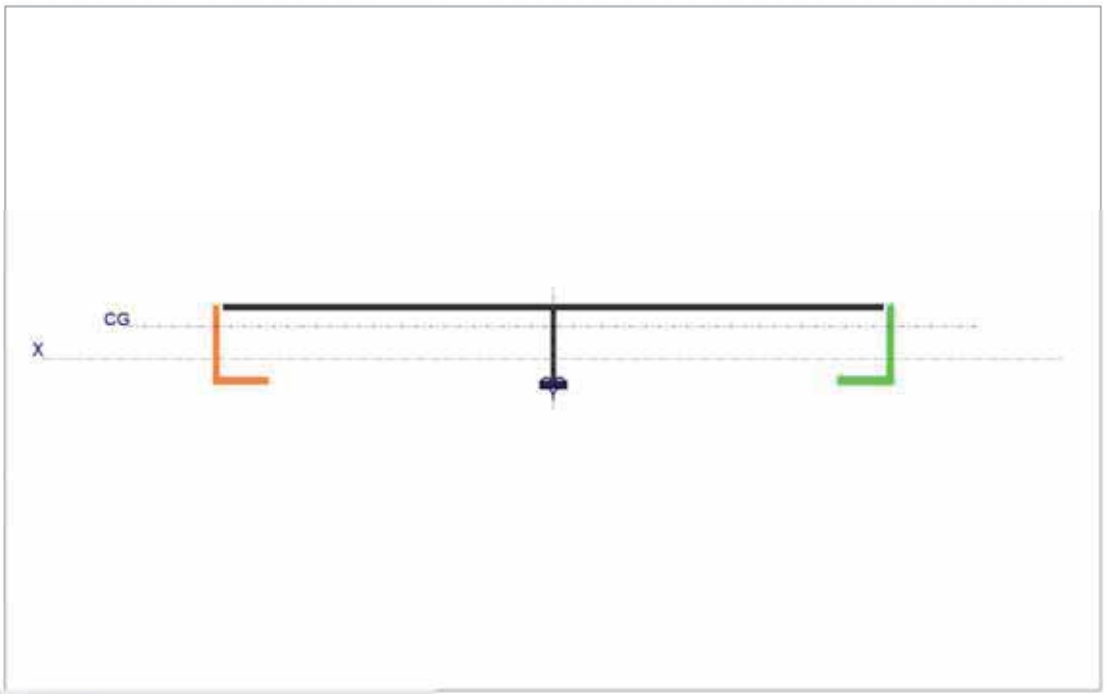
Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Tread Al. Section

Final Section Properties

Total Area	in^2	Ixx	in^4	Sxx : - Y	in^3
		Iyy	in^4	Sxx : +Y	in^3
Calculated final C.G. distance from Datum :				Syy : - X	in^3
X cg Dist	in	Zxx	in^3	Syy : +X	in^3
Y cg Dist	in	Zyy	in^3		
Edge Distances from CG. :				r xx	in
+X	in	+Y	in	r yy	in
-X	in	-Y	in		

Rotation of All Components @ Angle: 0.00 deg CCW



General Shapes

L : #1		Xcg =	-5.941 in	Ycg =	0.000 in	Rotation =	0 deg CCW
Width =	1.000 in	Height =		1.445 in	Vert. Section Width		0.118 in
Horiz. Section Heig	0.118 in						
1 : #2		Xcg =	0.000 in	Ycg =	0.800 in	Rotation =	0 deg CCW
Top Flange Width =	12.000 in	Top Flange Thick =		0.118 in	Web Thickness =		0.118 in
Bottom Flange Width	0.500 in	Bottom Flange Thic		0.157 in	Top Height =		1.563 in

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Project Title: ACCESS DECK, RAMPS & STAIRS - WELCOME F
Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design - OSSC-2019

Printed: 23 MAY 2020, 11:35AM

Multiple Simple Beam

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Lic. # : KW-06006137 BRIGGS ENGINEERING, PLLC

Steel Beam Design : 4' Clr 42" Rise - 7 Risers - 6 Steps - AL 6065-T6

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16

STEEL Section : **HSSRECT_SS 0.25x8, Defined Brace Spacing, 1st at ft and spacec**
Using Allowable Strength Design with IBC 2018 Load Combinations, Major Axis Bending

Fy = 35.0 ksi E = 9,900.0 ksi

Steel Section Data :

Depth =	8.000 in	Wall Thick	0.050 in	Area =	2.000 in^2	Width	0.250 in		
I xx =	10.67 in^4	yy =	0.010 in^4	Iz =	0.807 in^4	Zx =	4.000 in^3	Zy =	0.125 in^3
Weight =	2.361 plf	J =	0.042 in^4						

Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.00240, L = 0.10 k/ft, Trib= 2.0 ft

Design Summary

Max fb/Fb Ratio = 0.449 : 1
Mu : Applied 0.932 k-ft at 3.000 ft in Span # 1
Mn / Omega : Allow 2.075 k-ft
Load Comb : +D+L

Max fv/FvRatio = 0.727 : 1
Vu : Applied 0.6215 k at 0.000 ft in Span # 1
Vn / Omega : Allow 0.8552 k
Load Comb : +D+L

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.02	0.60					
Right Support	0.02	0.60					

Max Deflections

Transient Downward	0.056 in	Total Downward	0.058 in
Ratio	1296		1251
	LC: L Only		LC: +D+L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Steel Beam Design : 4' Clr 48" Rise - 8 Risers - 7 Steps - AL 6065-T6

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16

STEEL Section : **HSSRECT_SS 0.25x8, Defined Brace Spacing, 1st at ft and spacec**
Using Allowable Strength Design with IBC 2018 Load Combinations, Major Axis Bending

Fy = 35.0 ksi E = 9,900.0 ksi

Steel Section Data :

Depth =	8.000 in	Wall Thick	0.050 in	Area =	2.000 in^2	Width	0.250 in		
I xx =	10.67 in^4	yy =	0.010 in^4	Iz =	0.807 in^4	Zx =	4.000 in^3	Zy =	0.125 in^3
Weight =	2.361 plf	J =	0.042 in^4						

Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.00240, L = 0.10 k/ft, Trib= 2.0 ft

Design Summary

Max fb/Fb Ratio = 0.612 : 1
Mu : Applied 1.269 k-ft at 3.500 ft in Span # 1
Mn / Omega : Allow 2.075 k-ft
Load Comb : +D+L

Max fv/FvRatio = 0.848 : 1
Vu : Applied 0.7251 k at 0.000 ft in Span # 1
Vn / Omega : Allow 0.8552 k
Load Comb : +D+L

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.03	0.70					
Right Support	0.03	0.70					

Max Deflections

Transient Downward	0.103 in	Total Downward	0.107 in
Ratio	816		788
	LC: L Only		LC: +D+L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

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Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design - OSSC-2019

Printed: 23 MAY 2020, 11:35AM

Multiple Simple Beam

Description : Std Stair Stringers

Steel Beam Design : 4' Clr 30" Rise - 5 Risers - 4 Steps - AL 6065-T6

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16

STEEL Section : **HSSRECT_SS 0.25x8, Defined Brace Spacing, 1st at ft and spacec**
Using Allowable Strength Design with IBC 2018 Load Combinations, Major Axis Bending

Fy = 35.0 ksi E = 9,900.0 ksi

Steel Section Data : Depth = 8.000 in, Wall Thick 0.050 in, Area = 2.000 in^2, Width 0.250 in
I xx = 10.67 in^4, yy = 0.010 in^4, Iz = 0.807 in^4, Zx = 4.000 in^3, Zy = 0.125 in^3
Weight = 2.361 plf, J = 0.042 in^4

Applied Loads
Beam self weight calculated and added to loads
Unif Load: D = 0.00240, L = 0.10 k/ft, Trib= 2.0 ft

Design Summary

Max fb/Fb Ratio = 0.200 : 1
Mu : Applied 0.414 k-ft at 2.000 ft in Span # 1
Mn / Omega : Allow 2.075 k-ft
Load Comb : +D+L

Max fv/FvRatio = 0.484 : 1
Vu : Applied 0.4143 k at 0.000 ft in Span # 1
Vn / Omega : Allow 0.8552 k
Load Comb : +D+L

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.01	0.40					
Right Support	0.01	0.40					

Max Deflections

Transient Downward	0.011 in	Total Downward	0.011 in
Ratio	4376		4225
	LC: L Only		LC: +D+L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Steel Beam Design : 4' Clr 36" Rise - 6 Risers - 5 Steps - AL 6065-T6

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16

STEEL Section : **HSSRECT_SS 0.25x8, Defined Brace Spacing, 1st at ft and spacec**
Using Allowable Strength Design with IBC 2018 Load Combinations, Major Axis Bending

Fy = 35.0 ksi E = 9,900.0 ksi

Steel Section Data : Depth = 8.000 in, Wall Thick 0.050 in, Area = 2.000 in^2, Width 0.250 in
I xx = 10.67 in^4, yy = 0.010 in^4, Iz = 0.807 in^4, Zx = 4.000 in^3, Zy = 0.125 in^3
Weight = 2.361 plf, J = 0.042 in^4

Applied Loads
Beam self weight calculated and added to loads
Unif Load: D = 0.00240, L = 0.10 k/ft, Trib= 2.0 ft

Design Summary

Max fb/Fb Ratio = 0.312 : 1
Mu : Applied 0.647 k-ft at 2.500 ft in Span # 1
Mn / Omega : Allow 2.075 k-ft
Load Comb : +D+L

Max fv/FvRatio = 0.606 : 1
Vu : Applied 0.5179 k at 0.000 ft in Span # 1
Vn / Omega : Allow 0.8552 k
Load Comb : +D+L

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.02	0.50					
Right Support	0.02	0.50					

Max Deflections

Transient Downward	0.027 in	Total Downward	0.028 in
Ratio	2240		2163
	LC: L Only		LC: +D+L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

BRIGGS ENGINEERING

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Project Title: ACCESS DECK, RAMPS & STAIRS - WELCOME F
Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design - OSSC-2019

Printed: 23 MAY 2020, 10:32AM

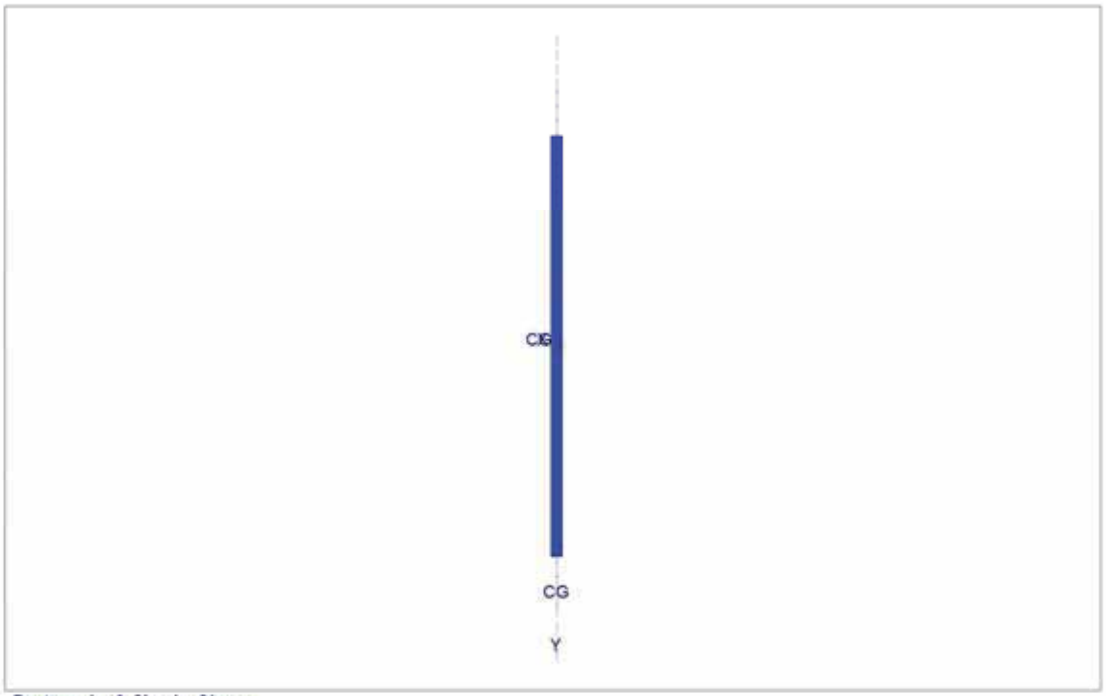
General Section Property Calculator

DESCRIPTION: Stair Stringer - 0.25x8

Final Section Properties

Total Area	2.0 in^2	Ixx	10.666 in^4	Sxx : - Y	2.667 in^3
		Iyy	0.01041 in^4	Sxx : +Y	2.667 in^3
Calculated final C.G. distance from Datum :				Syy : - X	0.08331 in^3
X cg Dist	0.0 in	Zxx	4.0 in^3	Syy : +X	0.08331 in^3
Y cg Dist	0.0 in	Zyy	0.1250 in^3		
Edge Distances from CG. :				r xx	2.309 in
+X	0.1250 in	+Y	4.0 in	r yy	0.07216 in
-X	-0.1250 in	-Y	in		

Rotation of All Components @ Angle: 0.00 deg CCW



Rectangular & Circular Shapes

	Height =	8.000 in	Width =	0.250 in	Rotation =	0 deg CCW
Rectangular Shape : 1	Area =	2.000 in^2	Xcg =	0.000 in		
			Ycg =	0.000 in		

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Project Title: ACCESS DECK, RAMPS & STAIRS - WELCOME F
Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:14AM

General Section Property Calculator

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Platform-Side Rail

Rectangular Shape : 2	Height =	0.250	in	Width =	1.750	in	Rotation = 0 deg CCW
	Area =	0.438	in^2	Xcg =	1.125	in	
				Ycg =	2.375	in	

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Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:14AM

General Section Property Calculator

File = E:\0-MODULAR\0-STANDARDS\CALCULATIONS\ENERCALC Data Files\wr.ec6

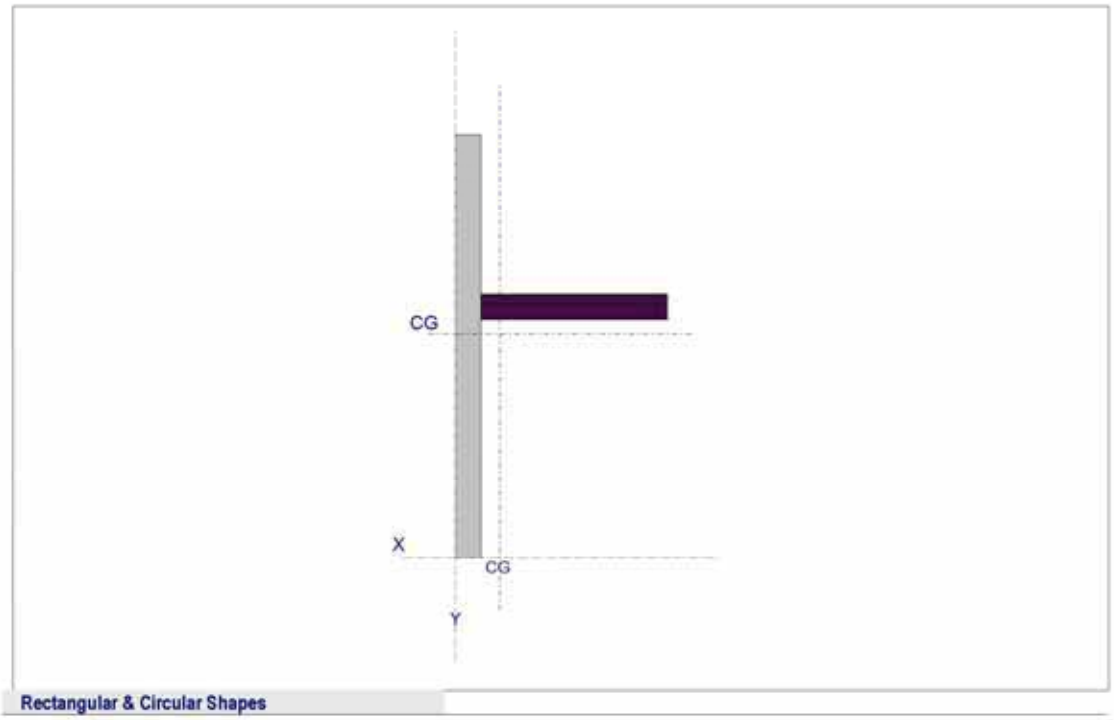
Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Platform-Side Rail

Final Section Properties

Total Area	in^2	Ixx	in^4	Sxx : - Y	in^3
		Iyy	in^4	Sxx : +Y	in^3
Calculated final C.G. distance from Datum :				Syy : - X	in^3
X cg Dist	in	Zxx	in^3	Syy : +X	in^3
Y cg Dist	in	Zyy	in^3		
Edge Distances from CG :				r xx	in
+X	in	+Y	in	r yy	in
-X	in	-Y	in		

Rotation of All Components @ Angle : 0.00 deg CCW



Rectangular & Circular Shapes

	Height =		Width =		Rotation =
Rectangular Shape : 1	4.000 in		0.250 in		0 deg CCW
Area =	1.000 in^2	Xcg =	0.125 in		
		Ycg =	2.000 in		

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Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:14AM

General Section Property Calculator

File = E:\0-MCOULARD-STANDARDS\CALCULATIONS\ENERCALC Data Files\wr.ecb

Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Ramp-Side Rail

Rectangular Shape : 2	Height =	0.250	in	Width =	1.750	in	Rotation = 0 deg CCW
	Area =	0.438	in^2	Xcg =	1.125	in	
				Ycg =	0.375	in	

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Project Title: ACCESS DECK, RAMPS & STAIRS - WELCOME F
Engineer: Dean Briggs
Project ID: 201910.01.3
Project Descr: Standard Deck/Stair Design

Printed: 9 FEB 2019, 11:14AM

General Section Property Calculator

File = E:\0-MODULAR\0-STANDARDS\CALCULATIONS\ENERCALC Data Files\wr.ec6

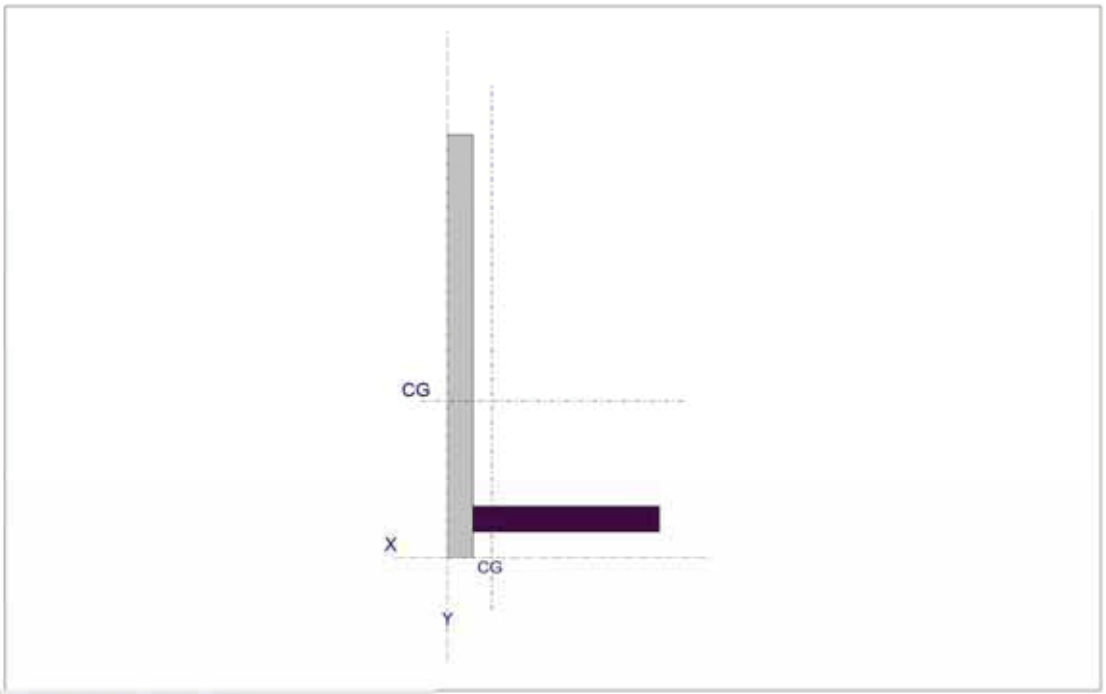
Lic. # : KW-06006137 — Licensee : BRIGGS ENGINEERING, PLLC

Description : Ramp-Side Rail

Final Section Properties

Total Area	in^2	Ixx	in^4	Sxx : - Y	in^3
		Iyy	in^4	Sxx : +Y	in^3
Calculated final C.G. distance from Datum :				Syy : - X	in^3
X cg Dist	in	Zxx	in^3	Syy : +X	in^3
Y cg Dist	in	Zyy	in^3		
Edge Distances from CG. :				r xx	in
+X	in	+Y	in	r yy	in
-X	in	-Y	in		

Rotation of All Components @ Angle : 0.00 deg CCW



Rectangular & Circular Shapes

	Height =		Width =		Rotation =	
Rectangular Shape : 1	4.000	in	0.250	in	0	deg CCW
Area =	1.000	in^2	Xcg =	0.125	in	
			Ycg =	2.000	in	