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Units system: English

File name: N:\SHARED\DOCUMENTS\PROJECTS\C-1344\Mill Room without Mill 2 250 psf.adv\

Steel Code Check

Design code: ANSI/AISC 360-05 ASD

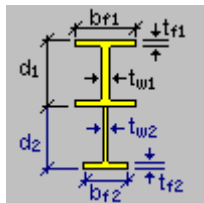
Note.- Only currently selected steel members are printed. AISI elements are not printed

Report: Comprehensive AISC

Member : 7 (Mill 1&2 Beams)
Design status : OK

PROPERTIES

Section : WWT 16x40 6x13



W Flange width (bf1)	8.42	[in]
WT Flange width (bf2)	6.49	[in]
W Depth (d1)	21.62	[in]
WT Depth (d2)	6.11	[in]
W Flange thickness (tf1)	0.93	[in]
WT Flange thickness (tf2)	0.52	[in]
W Web thickness (tw1)	0.58	[in]
WT Web thickness (tw2)	0.30	[in]

Section properties

	Unit	Major axis	Minor axis
Full unreduced cross-sectional area (A)	[in2]	32.79	
Moment of Inertia (local axes) (I)	[in4]	3181.33	104.72
Moment of Inertia (principal axes) (I')	[in4]	3181.33	104.72
Bending constant for moments (principal axis) (J')	[in]	0.00	0.00
Radius of gyration (local axes) (r)	[in]	9.85	1.79
Radius of gyration (principal axes) (r')	[in]	9.85	1.79
Saint-Venant torsion constant (J)	[in4]	6.22	
Warping constant of the cross-section (Cw)	[in6]	12816.80	
Distance from centroid to shear center (principal axis) (xo, yo)	[in]	0.00	-0.61
Top elastic section modulus of the section (local axis) (S top)	[in3]	239.92	24.87
Bottom elastic section modulus of the section (local axis) (S bot)	[in3]	219.85	24.87
Top elastic section modulus of the section (principal axis) (S' top)	[in3]	239.92	24.87
Bottom elastic section modulus of the section (principal axis) (S' bot)	[in3]	219.85	24.87
Plastic section modulus (local axis) (Z)	[in3]	295.33	38.44
Plastic section modulus (principal axis) (Z')	[in3]	295.33	38.44
Polar radius of gyration (ro)	[in]	10.03	
Area for shear (Aw)	[in2]	19.04	13.76
Torsional modulus (1/C)	--	0.15	

Material : A36

Properties	Unit	Value
Yield stress (Fy):	[Kip/in2]	36.00
Tensile strength (Fu):	[Kip/in2]	58.00
Elasticity Modulus (E):	[Kip/in2]	29000.00
Shear modulus for steel (G):	[Kip/in2]	11507.94

DESIGN CRITERIA

Description	Unit	Major axis	Minor axis
Top unbraced length between lateral supports (LbTop)	[ft]	21.33	
Bottom unbraced length between lateral supports (LbBop)	[ft]	21.33	
Effective length factor (K)	--	1.00	1.00
Effective length factor for torsion	--	1.00	
Length for axial tension (L)	[ft]	21.33	
Unbraced compression length (Lx, Ly)	[ft]	21.33	21.33
Length for torsion and lateral-torsional buckling	[ft]	21.33	
Additional hypotheses			
Continuous lateral torsional restraint		No	
Tension field action		No	

SERVICE CONDITIONS

Verification	Unit	Value	Ctrl EQ	Reference
Tension				
Maximum geometric slenderness (L/r)	--	143.25		(Sec. D1)
Compression				
Geometric critical slenderness (KL/r)	--	143.25		(Sec. E2)

DESIGN CHECKS

DESIGN FOR FLEXURE $\Omega = 1.67$



Bending about major axis, M33

Ratio	:	0.34		
Capacity	:	375.12 [Kip*ft]	Ctrl Eq.	: D2 at 52.08%
Demand	:	-128.18 [Kip*ft]	Reference	: (Sec. F)

Intermediate results	Unit	Value	Reference
<u>Yielding (Mp)</u>	[Kip*ft]	885.99	(Sec. F)
<u>Lateral-torsional buckling (LTB Mn)</u>	[Kip*ft]	626.45	(Sec. F)
Limiting unbraced length for yielding (Lp)	[ft]	7.44	(Sec. F)
Limiting unbraced length for inelastic LTB (Lr)	[ft]	24.44	(Sec. F)
Modification factor for lateral-torsional buckling (Cb)	--	1.16	(Sec. F1)
Lateral-torsional factor (c)	--	1.00	(Sec. F2.2)
Calculated stress for nominal flexural strength (FL)	[Kip/in2]	25.20	(Sec. F4.2)
Radius of gyration of the flange (rt)	[in]	1.47	(Sec. F4.2)
Effective radius of gyration (rts)	[in]	2.20	(Sec. F2.2)
Web area ratio (aw)	--	4.24	(Sec. F4.2)
Web plastification factor (Rpc)	--	1.34	(Sec. F4.1)
Critical stress (Fcr)	[Kip/in2]	35.58	(Sec. F)
Slenderness parameter for web (λ)	--	35.67	(Sec. B4)
Limiting slenderness parameter for compact (λ_p)	--	68.69	(Sec. B4)

Limiting slenderness parameter for non-compact web (λ_r)	--	161.78	(Sec. B4)
Web local buckling (WLB Mn)	--	N/A	(Sec. F)
Local buckling (LB Mn)	--	N/A	(Sec. F)
Flange local buckling (FLB Mn)	[Kip*ft]	675.86	(Sec. F)
Slenderness parameter for flange (λ)	--	19.50	(Sec. B4)
Limiting slenderness parameter for compact flange (λ_p)	--	10.79	(Sec. B4)
Limiting slenderness parameter for non-compact flange (λ_r)	--	28.38	(Sec. B4)
Coefficient for slender stiffened elements (kc)	--	0.56	(Sec. F3-2)
Critical stress (Fcr)	[Kip/in2]	30.65	(Sec. F)
Tension flange yielding (TFY Mn)	--	N/A	(Sec. F)

Bending about minor axis, M22

Ratio	:	0.00		Ctrl Eq.	:	D2 at 0.00%
Capacity	:	50.35 [Kip*ft]		Reference	:	(Sec. F)
Demand	:	0.00 [Kip*ft]				

Intermediate results	Unit	Value	Reference
Yielding (Mp)	[Kip*ft]	115.33	(Sec. F)
Flange local buckling (FLB Mn)	[Kip*ft]	84.08	(Sec. F)
Slenderness parameter for flange (λ)	--	19.50	(Sec. B4)
Limiting slenderness parameter for compact flange (λ_p)	--	10.79	(Sec. B4)
Limiting slenderness parameter for non-compact flange (λ_r)	--	28.38	(Sec. B4)
Coefficient for slender stiffened elements (kc)	--	0.56	(Sec. F3-2)
Critical stress (Fcr)	[Kip*ft]	2.55	(Sec. F)

DESIGN FOR SHEAR



Shear parallel to major axis, V3 ($\Omega = 1.67$)

Ratio	:	0.00		Ctrl Eq.	:	D2 at 0.00%
Capacity	:	246.21 [Kip]		Reference	:	(Sec. G)
Demand	:	0.00 [Kip]				

Intermediate results	Unit	Value	Reference
Web Shear coefficient (Cv)	--	1.00	
Web plate buckling coefficient (kv)	--	1.20	(Sec. G2)

Shear parallel to minor axis, V2 ($\Omega = 1.67$)

Ratio	:	0.13		Ctrl Eq.	:	D2 at 100.00%
Capacity	:	177.91 [Kip]		Reference	:	(Sec. G)
Demand	:	-23.95 [Kip]				

Intermediate results	Unit	Value	Reference
Web Shear coefficient (Cv)	--	1.00	
Web plate buckling coefficient (kv)	--	5.00	(Sec. G2)

DESIGN FOR TENSION $\Omega = 1.67$



Tension

Ratio : 0.00
Capacity : 706.88 [Kip]
Demand : 0.00 [Kip]

Ctrl Eq. : D1 at 0.00%
Reference : (Sec. D)

DESIGN FOR COMPRESSION $\Omega = 1.67$ ✓

Compression

Ratio : 0.00
Capacity : 239.77 [Kip]
Demand : 0.00 [Kip]

Ctrl Eq. : D4 at 0.00%
Reference : (Sec. E)

Intermediate results	Unit	Value	Reference
Slenderness parameter for web (λ_w)	--	35.67	(Sec. B4)
Limiting slenderness parameter for non-compact web (λ_{rw})	--	39.74	(Sec. B4)
Slenderness parameter for flange (λ_f)	--	19.50	(Sec. B4)
Limiting slenderness parameter for non-compact flange (λ_{rf})	--	21.29	(Sec. B4)
Elastic flexural stress (F_{ex})	[Kip/in ²]	423.72	(Eq. E4-9)
Elastic flexural stress (F_{ey})	[Kip/in ²]	13.95	(Ec. E4-10)
Elastic torsional buckling stress (F_{ez})	[Kip/in ²]	38.70	(Eq. E4-11)
Critical elastic flexural-torsional buckling stress (F_e)	[Kip/in ²]	13.92	(Sec.E4)
Critical flexural buckling stress (F_{cr})	[Kip/in ²]	12.23	(Sec.E)
Critical flexural-torsional buckling stress (F_{crTor})	[Kip/in ²]	12.21	(Sec.E4)
Stress reduction factor in unstiffened elements (Q_s)	--	1.00	(Sec.E7)
Effective section reduction factor in stiffened elements (Q_a)	--	1.00	(Sec.E7)
Effective area at a uniform stress (A_{eff})	[in ²]	32.79	(Sec.E7)

DESIGN FOR TORSION $\Omega = 1.67$ ✓

Torsion

Ratio : 0.00
Capacity : 7.21 [Kip*ft]
Demand : 0.00 [Kip*ft]

Ctrl Eq. : D2 at 0.00%
Reference : (Sec. H3)

Intermediate results	Unit	Value	Reference
Critical stress (F_{cr})	[Kip/in ²]	21.60	(Sec. H)

INTERACTION ✓

Combined axial and flexure interaction value

Ratio : 0.34
Ctrl Eq. : D2 at 52.08%
Reference : (H1-1b)

Combined shear and torsion interaction value

Ratio : 0.13
Ctrl Eq. : D2 at 100.00%
Reference : (Ec. 4.9) DG 9

CRITICAL STRENGTH RATIO ✓

Ratio	:	0.34		
Ctrl Eq.	:	D2 at 52.08%	Reference	: (H1-1b)