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Units system: English

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

Steel Code Check

Design code: ANSI/AISC 360-05 ASD

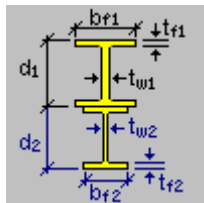
Note.- Only currently selected steel members are printed. AISI elements are not printed

Report: Comprehensive AISC

Member : 7 (Mill 1&2 Beams)
Design status : N.G.

PROPERTIES

Section : W&W 16x40 6x20



Flange width (sup) (bf1)	7.00	[in]
Flange width (inf) (bf2)	6.08	[in]
Depth (sup) (d1)	16.01	[in]
Depth (inf) (d2)	6.38	[in]
Flange thickness (sup) (tf1)	0.51	[in]
Flange thickness (inf) (tf2)	0.46	[in]
Web thickness (sup) (tw1)	0.31	[in]
Web thickness (inf) (tw2)	0.32	[in]

Section properties

	Unit	Major axis	Minor axis
Full unreduced cross-sectional area (A)	[in2]	19.23	
Moment of Inertia (local axes) (I)	[in4]	1145.33	45.97
Moment of Inertia (principal axes) (I')	[in4]	1145.33	45.97
Bending constant for moments (principal axis) (J')	[in]	1.66	0.00
Radius of gyration (local axes) (r)	[in]	7.72	1.55
Radius of gyration (principal axes) (r')	[in]	7.72	1.55
Saint-Venant torsion constant (J)	[in4]	1.20	
Warping constant of the cross-section (Cw)	[in6]	3227.78	
Distance from centroid to shear center (principal axis) (xo, yo)	[in]	0.00	1.14
Top elastic section modulus of the section (local axis) (S top)	[in3]	92.89	13.13
Bottom elastic section modulus of the section (local axis) (S bot)	[in3]	113.85	13.13
Top elastic section modulus of the section (principal axis) (S' top)	[in3]	92.89	13.13
Bottom elastic section modulus of the section (principal axis) (S' bot)	[in3]	113.85	13.13
Plastic section modulus (local axis) (Z)	[in3]	129.88	20.78
Plastic section modulus (principal axis) (Z')	[in3]	129.88	20.78
Polar radius of gyration (ro)	[in]	7.87	
Area for shear (Aw)	[in2]	12.60	6.63
Torsional modulus (1/C)	--	0.42	

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)	--	165.57		(Sec. D1)
Compression				
Geometric critical slenderness (KL/r)	--	165.57		(Sec. E2)

DESIGN CHECKS

DESIGN FOR FLEXURE $\Omega = 1.67$



Bending about major axis, M33

Ratio	:	1.00		
Capacity	:	128.04 [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]	389.64	(Sec. F)
<u>Lateral-torsional buckling (LTB Mn)</u>	[Kip*ft]	213.83	(Sec. F)
Limiting unbraced length for yielding (Lp)	[ft]	6.44	(Sec. F)
Limiting unbraced length for inelastic LTB (Lr)	[ft]	18.17	(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]	1.53	(Sec. F4.2)
Effective radius of gyration (rts)	[in]	1.84	(Sec. F2.2)
Web area ratio (aw)	--	2.14	(Sec. F4.2)
Web plastification factor (Rpc)	--	1.14	(Sec. F4.1)
Critical stress (Fcr)	[Kip/in2]	22.54	(Sec. F)
Slenderness parameter for web (λ)	--	50.84	(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)	--	N/A	(Sec. F)
Slenderness parameter for flange (λ)	--	6.93	(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)
Tension flange yielding (TFY Mn)	--	N/A	(Sec. F)

Bending about minor axis, M22

Ratio	:	0.00		Ctrl Eq.	:	D2 at 0.00%
Capacity	:	37.33 [Kip*ft]		Reference	:	(Sec. F)
Demand	:	0.00 [Kip*ft]				

Intermediate results	Unit	Value	Reference
Yielding (Mp)	[Kip*ft]	62.35	(Sec. F)
Flange local buckling (FLB Mn)	--	N/A	(Sec. F)
Slenderness parameter for flange (λ)	--	6.93	(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)

DESIGN FOR SHEAR

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

Ratio	:	0.00		Ctrl Eq.	:	D2 at 0.00%
Capacity	:	163.01 [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	:	0.28		Ctrl Eq.	:	D2 at 100.00%
Capacity	:	85.69 [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		Ctrl Eq.	:	D1 at 0.00%
Capacity	:	414.49 [Kip]		Reference	:	(Sec. D)
Demand	:	0.00 [Kip]				

DESIGN FOR COMPRESSION $\Omega = 1.67$

Compression

Ratio : 0.00
Capacity : 105.39 [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)	--	50.84	(Sec. B4)
Limiting slenderness parameter for non-compact web (λ_{rw})	--	39.74	(Sec. B4)
Slenderness parameter for flange (λ_f)	--	6.93	(Sec. B4)
Limiting slenderness parameter for non-compact flange (λ_{rf})	--	15.89	(Sec. B4)
Elastic flexural stress (Fex)	[Kip/in ²]	260.16	(Eq. E4-9)
Elastic flexural stress (Fey)	[Kip/in ²]	10.44	(Ec. E4-10)
Elastic torsional buckling stress (Fez)	[Kip/in ²]	23.41	(Eq. E4-11)
Critical elastic flexural-torsional buckling stress (Fe)	[Kip/in ²]	10.44	(Sec.E4)
Critical flexural buckling stress (Fcr)	[Kip/in ²]	9.16	(Sec.E)
Critical flexural-torsional buckling stress (FcrTor)	[Kip/in ²]	9.15	(Sec.E4)
Stress reduction factor in unstiffened elements (Qs)	--	1.00	(Sec.E7)
Effective section reduction factor in stiffened elements (Qa)	--	1.00	(Sec.E7)
Effective area at a uniform stress (Aeff)	[in ²]	19.23	(Sec.E7)

DESIGN FOR TORSION $\Omega = 1.67$



Torsion

Ratio : 0.00
Capacity : 2.56 [Kip*ft]
Demand : 0.00 [Kip*ft]

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

Intermediate results

	Unit	Value	Reference
Critical stress (Fcr)	[Kip/in ²]	21.60	(Sec. H)

INTERACTION



Combined axial and flexure interaction value

Ratio : 1.00
Ctrl Eq. : D2 at 52.08%
Reference : (H1-1b)

Combined shear and torsion interaction value

Ratio : 0.28
Ctrl Eq. : D2 at 100.00%
Reference : (Ec. 4.9) DG 9

CRITICAL STRENGTH RATIO



Ratio : 1.00
Ctrl Eq. : D2 at 52.08%
Reference : (H1-1b)