DESIGN OF BEAM-COLUMNS© also see the accompanying discussion

BEAMCOL©

Job Notes

Example Problem 1. See Figure 2. Eccentric load = 1000 pounds. Major axis e = 1.0", minor axis e = .5"
Major axis side uniform load moment =800 lb-ft, minor axis side load moment = 200 lb-ft.
Full 3"x6" length = 96", with intermediate weak axis bracing at 2'-8" o.c.
Normal loads and conditions No. 2 Doug Fir-Larch Check adequacy

Fill in yellow cells below
Red cells are calculated
Light green cells are tables

Except for the yellow cells, this spreadsheet is protected to prevent accidental loss of the formulas

Load Duration Factors, C_D	
permanent	0.9
occupancy live	1
snow	1.15
construction	1.25
wind, quake	1.6

LOAD DESCRIPTION		
Major axis moment due to side load A =	800	lb-ft
Minor axis moment due to side load B=	200	lb-ft
Axial (column) load =	1000	pounds
Major axis eccentricity (e_1) =	1.00	inches
Minor axis eccentricity (e_2) =	0.50	inches
STRESS ADJUSTMENT FACTORS		
load duration factor, C_D	1.00	
size factor, C_F for bending	1.30	
size factor, C_F for compression	1.10	
wet service factor, C_M for bending	1.00	
wet service factor, C_M for compression	1.00	
wet service factor, C_M, for M. of elasticity	1.00	
temperature factor, C_t, bending & compres.	1.00	
temperature factor, C_t, for M. of elasticity	1.00	
incised factor, C_i, bending and compres.	1.00	
incised factor, C_i, for M. of elasticity	1.00	
flat use factor, C_{fu}	1.15	
repetitive member factor, C_r	1.00	
buckling stiffness factor, C_T	1.00	
SHAPE AND SUPPORT PARAMETERS		
section width, b =	3	inches
section depth, d =	6	inches
lateral support spacing, L_U =	32	inches

L_U/d =	5.33			
Effective bending length, L_e =	65.9	inches		
K_{bE} =	0.439			
E =	1600000	psi		
R_b =	6.63			
F_{bE} =	15990			
F_b=	900	psi		
F_b*=	1170			
C_L=	0.995	F_{b1}' =	1165	psi
COLUMN PARAMETERS		F_{b2}' =	1345	psi
$K_{e\ major}$=	1.00			
$K_{e\ minor}$=	0.80			
c =	0.80			
K_{cE} =	0.30			
L_{e1} =	96	inches		
L_{e2} =	32	inches		
Q =	16.00			
F_{cE} =	1875			
F_c =	1350	psi		
F_c *=	1485	psi		
J =	1.41			
C_p=	0.765	F_c'=	1135	psi
F_{cE1} =	1875	f_c =	56	A = 1.00
F_{cE2} =	4220	f_{b1} =	533	B = 1.00
		f_{b2} =	267	
I =	0.767 1.00			

design is O.K

Engineering Properties of S	
	Mod. c
(grade)	No. 1
Doug Fir-Larch	1,700,000
Eastern Hemlock	1,100,000
Hem-Fir	1,500,000
Hem-Fir (north)	1,600,000
Red Oak	1,300,000
Redwood	1,300,000
South'n Pine	1,700,000
Spruce,Pine,Fir	1,400,000
Westn Cedar	1,000,000

Engineering Properties of S	
Posts & Timbers	Mod
(grade)	No. 1
Doug Fir-Larch	1,600,000
Eastern Hemlock	1,200,000
Hem-Fir	1,300,000
Hem-Fir (north)	1,300,00(
Red Oak	1,200,00(
Redwood	1,300,00(
South'n Pine	1,500,00(
Spruce,Pine,Fir	1,300,00(
Westn Cedar	1,000,00(

Temperature Factors, C_t

	M.C.	100<T 125	125<T 150
F_b , F_c	19%	0.8	0.7
E	any	0.9	0.9

Size Factors, C_F for 2" and 4" lumber (for timbers see formulas)

Grade	Select Structural, No. 1, No. 2, No. 3						
width	2,3	4	5	6	8	10	12
for F_b	1.5	1.5	1.4	1.3	1.2	1.1	1
for F_c	1.15	1.15	1.1	1.1	1.05	1	1

Flat Use Factors, C_{fu}

Width	2,3	4	5	6	8	10 and wider
2" and 3" thick	1	1.1	1.1	1.15	1.15	1.2
4" thick	-	1	1.05	1.05	1.05	1.1

Effective Bending Length, L_e

beam type	load type/location	when Lu/d < 7	when Lu/d 7
cantilever	uniformly distributed	Le = 1.33Lu	Le = .90Lu + 3d
cantilever	concentrated at unsupported end	Le = 1.87 Lu	Le = 1.44Lu + 3d
cantilever	other	Le = 2.06 Lu	see note below*
single span	uniformly distributed	Le = 2.06 Lu	Le = 1.63Lu + 3d
single span	conc. load & no lateral support at center	Le = 1.80 Lu	Le = 1.37Lu + 3d
single span	conc. load & lateral support at center	Le = 1.11 Lu	Le = 1.11 Lu
single span	conc. load & lateral support at 1/3 pts	Le = 1.68 Lu	Le = 1.68 Lu
single span	conc. load & lateral support at 1/4 pts	Le = 1.54 Lu	Le = 1.54 Lu
single span	conc. load & lateral support at 1/5 pts	Le = 1.68 Lu	Le = 1.68 Lu
single span	conc. load & lateral support at 1/6 pts	Le = 1.73 Lu	Le = 1.73 Lu
single span	conc. load & lateral support at 1/7 pts	Le = 1.78 Lu	Le = 1.78 Lu
single span	7 conc. loads & lateral supports	Le = 1.84 Lu	Le = 1.84 Lu
single span	equal end moments	Le = 1.84 Lu	Le = 1.84 Lu
single span	other incl eccentric	Le = 2.06 Lu	see note below*
multiple span	as single span or engineering analysis		

when 7 Lu/d 14.3 Le = 1.63Lu + 3d when Lu/d >14.3 Le = 1.84 Lu