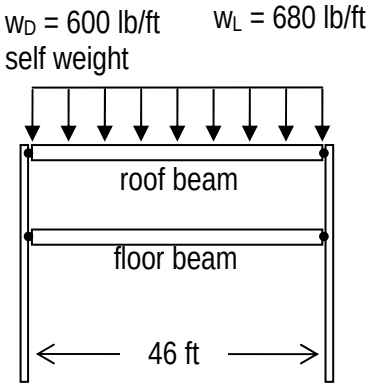
ENDS 231: Practice Quiz 5

Clearly show your work and answer.

A pinned frame design consists of simply supported beams spanning 46 ft connected to centrically loaded columns. The roof beam must support 600 lb/ft of dead load (from materials), the self weight, and 680 lb/ft of live load. The beam is fully braced.



The column supporting the roof and first floor beam is 28 ft tall. It can be considered to be pinned at the base and braced in the weak axis (y-y) at 11.1 ft and 19 ft from the base and at the roof. The first floor beam and the roof beam brace the column in the weak axis (x-x).

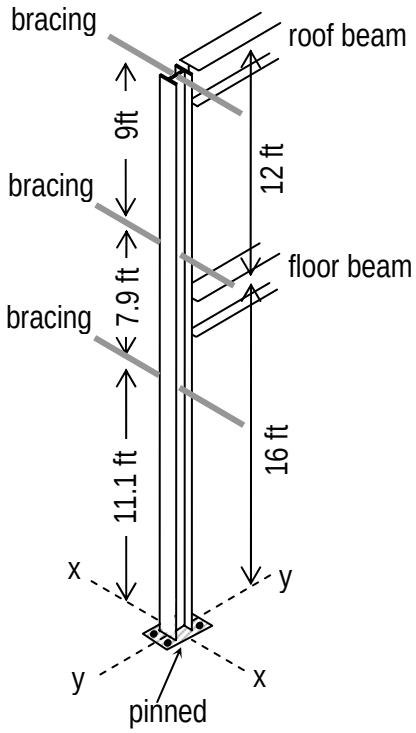
All members are A992 steel (F_y = 50 ksi and F_u= 65 ksi, E = 30 x 10^3 ksi). Use the charts provided *on the following page.*

a) Using Allowable Stress Design methodology, select the most economical beam section *based on strength only* when F_b = 30 ksi, and F_v = 19 ksi.

b) If a W16x36 is used for the beam, is it adequate for deflection when the limit *for live load only* is L/120? (A = 10.6 in^2, d = 15.86 in, t_w = 0.295 in, b_f = 6.985 in, t_f = 0.43 in, I_x = 448 in^4, S_x = 56.5 in^3, I_y = 24.5 in^4, S_y = 7.00 in^3)

c) If a W10x45 is used for the column, is it adequate to support 300 k by Allowable Stress Design? (A = 13.3 in^2, I_x = 248 in^4, r_x = 4.33 in, I_y = 53.4 in^4, r_y = 2.01 in)

d) *[some short question from the text material]*



Answers:

a) $S_{x\text{-}req'd}$* = 142.6 in^3, W24x68, $f_{v\text{-}max}$ = 3.14 ksi.

b) Δ_{LL}= 5.09 in, Not OK.

b) P_a = *some decision you make between* 287 k or 335 k., (so Not OK or OK).

Disclaimer: Answers have NOT been painstakingly researched.

S_x In.^{3}	Shape	Depth d In.	Web Thickness t_w (in.)
176	**W 24× 76**	**23⅞**	0.440
175	W 16×100	17	0.585
173	W 14×109	14⅜	0.525
171	W 21× 83	21⅜	0.515
166	W 18× 86	18⅜	0.480
157	W 14× 99	14⅛	0.485
155	W 16× 89	16¾	0.525
154	**W 24× 68**	**23¾**	0.415
151	W 21× 73	21¼	0.455
146	W 18× 76	18¼	0.425
143	W 14× 90	14	0.440
140	**W 21× 68**	**21⅛**	0.430
134	W 16× 77	16½	0.455
131	**W 24× 62**	**23¾**	0.430
127	**W 21× 62**	**21**	0.400
127	W 18× 71	18½	0.495
123	W 14× 82	14¼	0.510
118	W 12× 87	12½	0.515
117	W 18× 65	18⅜	0.450
117	W 16× 67	16⅜	0.395
114	**W 24× 55**	**23⅝**	0.395
112	W 14× 74	14⅛	0.450
111	W 21× 57	21	0.405
108	W 18× 60	18¼	0.415
107	W 12× 79	12⅜	0.470
103	W 14× 68	14	0.415
98.3	**W 18× 55**	**18⅛**	0.390
97.4	W 12× 72	12¼	0.430
94.5	**W 21× 50**	**20⅞**	0.380
92.2	W 16× 57	16⅜	0.430
92.2	W 14× 61	13⅞	0.375
88.9	**W 18× 50**	**18**	0.355
87.9	W 12× 65	12⅛	0.390

Allowable stress with F_y = 65 ksi

$\frac{KL}{r}$	F_a (ksi)
36	26.38
37	26.25
38	26.11
39	25.97
40	25.83
41	25.69
42	25.55
43	25.40
44	25.26
45	25.11
46	24.96
47	24.81
48	24.66
49	24.51
50	24.35
51	24.19
52	24.04
53	23.88
54	23.72
55	23.55
56	23.39
57	23.22
58	23.06
59	22.89
60	22.72
61	22.55
62	22.37
63	22.20
64	22.02
65	21.85
66	21.67
67	21.49
68	21.31
69	21.12
70	20.94
71	20.75
72	20.56
73	20.38
74	20.10
75	19.99