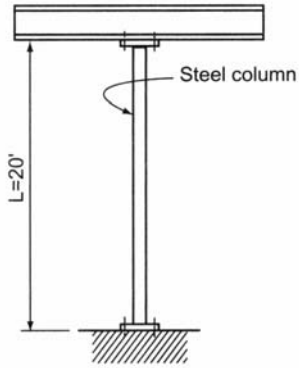
ENDS 231. Assignment #11

Date: 4/12/07, *due 4/19/07* *Pass-fail work*

Problems: from Onouye, Chapter 10.
*Note: Problems marked with a * have been altered with respect to the problem stated in the text.*

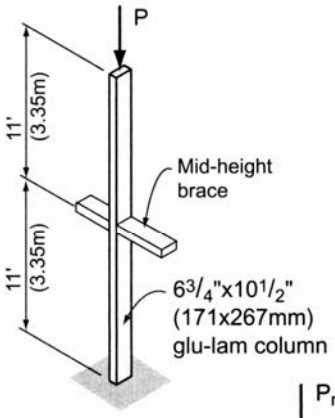
***Use A992 steel, and increase the load to 46 kips. Also select the column using LRFD design method and the column chart knowing the load is a dead load, and there is an additional live load of 70 k. F_y = 50 ksi, E = 30,000 ksi, γ_D = 1.2, γ_L = 1.6**

10.3.9 What is the most economical W8 (*W200*) column for Problem **10.3.8** to support a load of ~~30 k~~ and a length of L = 20 ft. Assume ~~F_y = 36 ksi~~ and K = 1.0.



Partial answers to check with:
ASD: $A_{req'd} \geq 10.82$ in^2 with F_a = 10.72,
LRFD: P_u = 167 k, $\phi_c P_n$ = ___k

10.4.3 Determine the axial load capacity of a $6\frac{3}{4}$" × $10\frac{1}{2}$" glu-lam column with an area A = 70.88 in.^{2}, assuming lateral bracing about the weak axis at the midheight level. Assume pin connections top and bottom in both directions of buckling. (F_c = 1650 psi; $E = 1.8 \times 10^6$ psi)



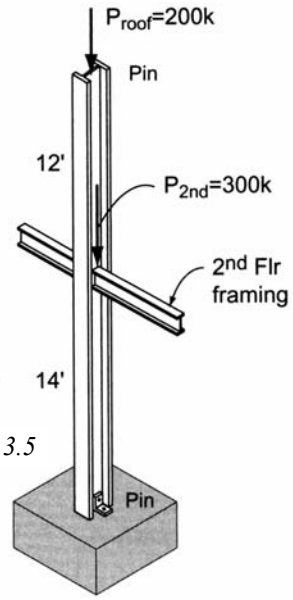
Problem 10.4.3

Partial answers to check with:
(C_D = 1) F'_c = 1021 psi, P_a = 72.4 k

***Use a W14 x 109 of A992 steel (F_y = 50 ksi, F_b = 33 ksi, E = 30x10^3 ksi). And assume that the second-floor load is applied at an eccentricity (e) of 4 inches in the direction of the framing.**

10.3.5 A two-story, continuous ~~W12×106~~ column supports a roof load of 200 kips and an intermediate (second floor) load of 300 kips. Assume the top and bottom have pin connections. Is the column section shown adequate?

~~***Note:*** Assume the second-floor load to be applied at the top of the column—this will result in a somewhat conservative answer. The concept of intermediate loads is much more complicated and will not be discussed further in this text.~~



Problem 10.3.5

Partial answers to check with:
kL/r_x = 50.2, kL/r_y = 45, f_b = 19.6 ksi, interaction: 1.09

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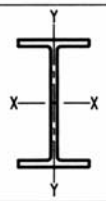

F_y = 36 ksi
F_y = 50 ksi

COLUMNS
W shapes
Design axial strength in kips (ϕ = 0.85)

Designation		W8												W8			
Wt./ft		67		58		48		40		35		31		28		24	
F_y		36	50	36	50	36	50	36	50	36	50	36	50	36	50	36	50
Effective length KL (ft) with respect to least radius of gyration r_y	0	603	837	523	727	431	599	358	497	315	438	279	388	252	351	217	301
	6	567	770	492	667	405	549	335	454	295	399	261	354	228	303	195	260
	7	555	746	481	647	396	532	327	439	288	386	255	342	219	288	188	247
	8	541	721	469	624	386	513	319	423	280	372	248	329	210	271	180	232
	9	526	693	455	599	374	492	309	405	272	356	240	315	200	253	171	217
	10	509	662	441	572	362	470	298	386	262	339	232	300	189	235	162	200
	11	492	631	425	544	349	446	287	366	252	321	223	284	178	216	152	184
	12	473	598	409	515	335	422	275	345	242	303	214	268	167	197	142	168
	13	453	564	391	485	321	397	263	324	231	284	204	251	155	178	132	151
	14	433	529	374	455	306	372	251	303	220	265	194	234	143	160	122	136
	15	412	494	355	425	291	347	238	281	208	246	184	217	132	142	112	121
	16	391	460	337	394	276	321	225	260	197	228	174	200	121	125	102	106
	17	370	425	318	365	260	297	211	239	185	209	163	184	110	111	93	94
	18	349	392	300	335	245	272	198	219	174	191	153	168	99	99	84	84
	19	328	359	281	307	229	249	185	199	162	174	143	153	89	89	75	75
	20	307	328	263	279	214	226	173	180	151	157	133	138	80	80	68	68
	22	266	271	228	231	185	187	148	149	129	130	114	114	66	66	56	56
	24	228	228	194	194	157	157	125	125	109	109	96	96	56	56	47	47
	26	194	194	165	165	134	134	107	107	93	93	82	82	51	51	44	44
	28	167	167	143	143	115	115	92	92	80	80	70	70	47	47	40	40
	30	146	146	124	124	100	100	80	80	70	70	61	61	44	44		
	32	128	128	109	109	88	88	70	70	61	61	54	54				
	33	120	120	103	103	83	83	66	66	58	58	51	51				
	34	113	113	97	97	78	78	62	62								
	35	107	107	91	91												
Properties																	Prop
u		2.03	1.96	2	1.93	1.97	1.87	1.93	1.8	1.89	1.74	1.85	1.65	2.17	1.87	2.07	1.71
P_{wo} (kips)		147	205	120	167	86	119	69	96	56	78	48	67	48	67	39	54
P_{wi} (kips/in.)		21	28	18	26	14	20	13	18	11	16	10	14	10	14	9	12
P_{wb} (kips)		648	764	464	547	224	264	163	192	104	123	81	95	81	95	52	61
P_{fb} (kips)		177	246	133	185	95	132	64	88	50	69	38	53	44	61	32	45
L_p (ft)		8.8	7.5	8.8	7.4	8.7	7.4	8.5	7.2	8.5	7.2	8.4	7.1	6.8	5.7	6.7	5.7
L_r (ft)		64.0	41.9	55.9	36.8	46.7	31.1	39.1	26.5	35.1	24.1	32.0	22.4	27.2	18.8	24.3	17.2
A (in.^{2})		19.7		17.1		14.1		11.7		10.3		9.13		8.25		7.08	
I_x (in.^{4})		272		228		184		146		127		110		98.0		82.8	
I_y (in.^{4})		88.6		75.1		60.9		49.1		42.6		37.1		21.7		18.3	
r_y (in.)		2.12		2.10		2.08		2.04		2.03		2.02		1.62		1.61	
Ratio r_x / r_y		1.75		1.74		1.74		1.73		1.73		1.72		2.13		2.12	
$P_{ex}(KL)^2 / 10^4$		7800		6520		5260		4170		3630		3150		2810		2370	
$P_{ey}(KL)^2 / 10^4$		2530		2160		1750		1390		1210		1070		620		525	

Note: Heavy line indicates Kl / r of 200.

ompact; see discussion preceding colu
e indicates Kl / r of 200