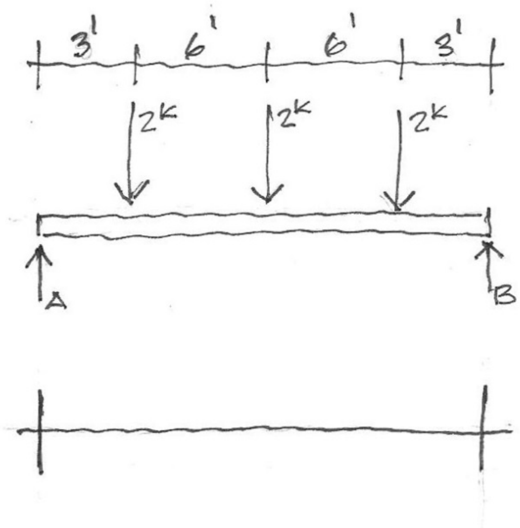
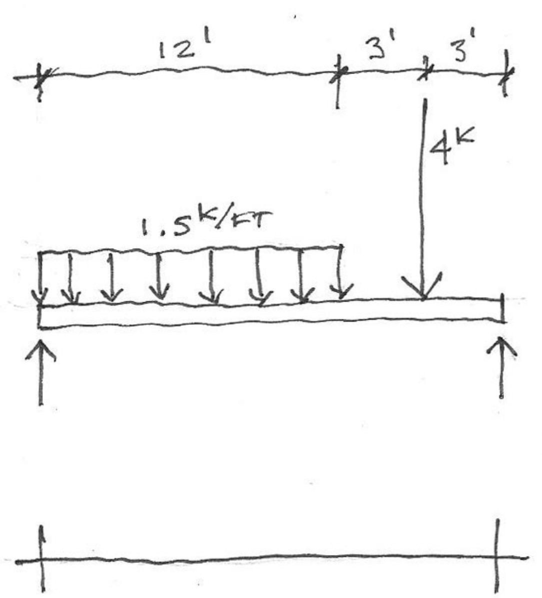
1. Where in the beam shown is the moment the highest



How about for this one?



2. You are working on a hospital in Japan in an area of high seismic risk. At a preliminary design review there are various concepts being considered. Which is the most sensible approach?

    a. 8 story "L" shaped building
    b. 6 story symmetrical "+" shaped building
    c. 5 story square building
    d. You should not build a hospital in a seismic zone

3. The contractor is about to place the concrete for a complicated but important structural wall, but something seems a bit off and you are worried. Which concrete test would you look to first for reassurance?

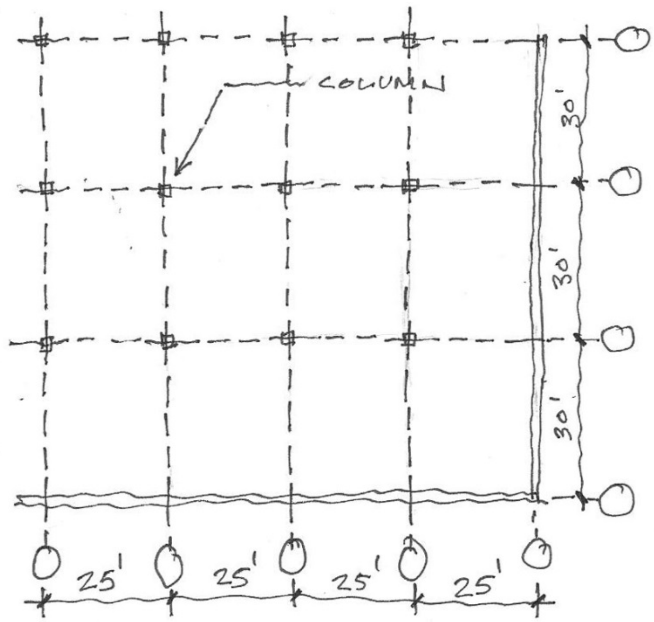
    a. Hydration Test
    b. Core Test
    c. Slump Cone
    d. Cylinder Test
    e. Penetration Test

4. The framing plan shown is for a 2 story simple light manufacturing building. If the loads are as follows (axial loads only):
   Live Load of 2nd floor – 80 psf
   Dead Load of 2nd floor – 20 psf
   Live Load of the roof – 30 psf
   Dead Load of the roof – 20 psf
   Ignore the slab on grade first floor

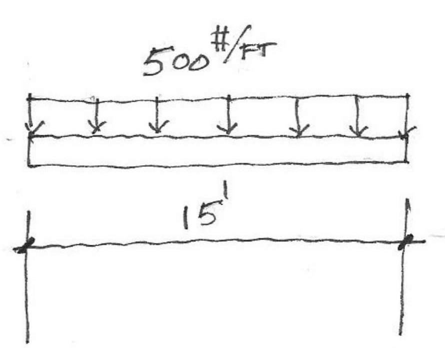
   What is the total load of the column indicated?

   ___________ kips

   If the soil below that column is capable of 4000 psf, what is the size of the footing?
   a. 4' x 7'
   b. 6' x 6'
   c. 29 s.f.
   d. 28,125

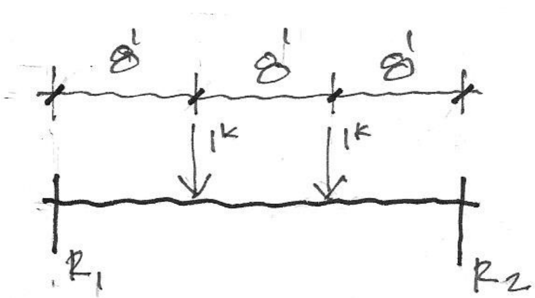


5. During production of the SD set, the architect realizes that the zoning height limitations may be a problem and therefore must get a reasonably accurate typical floor to floor height for the design on the midrise office building. Presuming a 1kip/ft. loading, and the beams are 20' long, and you are likely to use A50 steel, what wide flange would you use? (assume braced laterally)

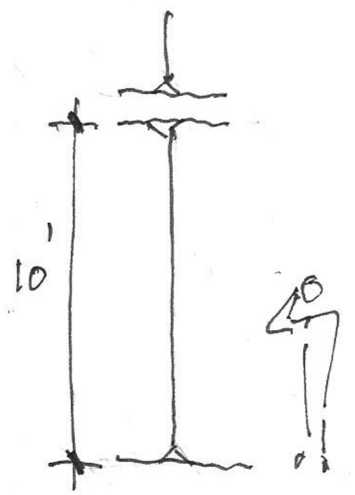


6. Which is most likely NOT to have camber built in?
    a. Composite deck
    b. Double T
    c. Open web steel LH joists
    d. Wood glulam

7. You have a wood structure, and the engineer says that the horizontal shear stress capacity of the 2x12's is lacking, but you don't trust her, as she has been on Facebook during the entire conversation. You decide to check for yourself. If the highest shear stress allowable for Doug. Fir-Larch is 180psi, then does this loading work? (assume adjustment factors of 1.0)



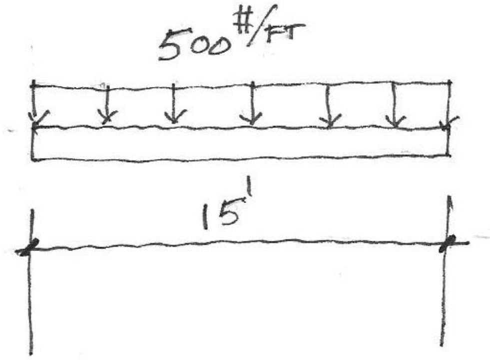
8. The current DD design calls for a 10' W10x33 column in a building you are working on. What are the most important elements for understanding what the maximum allowable load would be? (F_y = 50ksi)



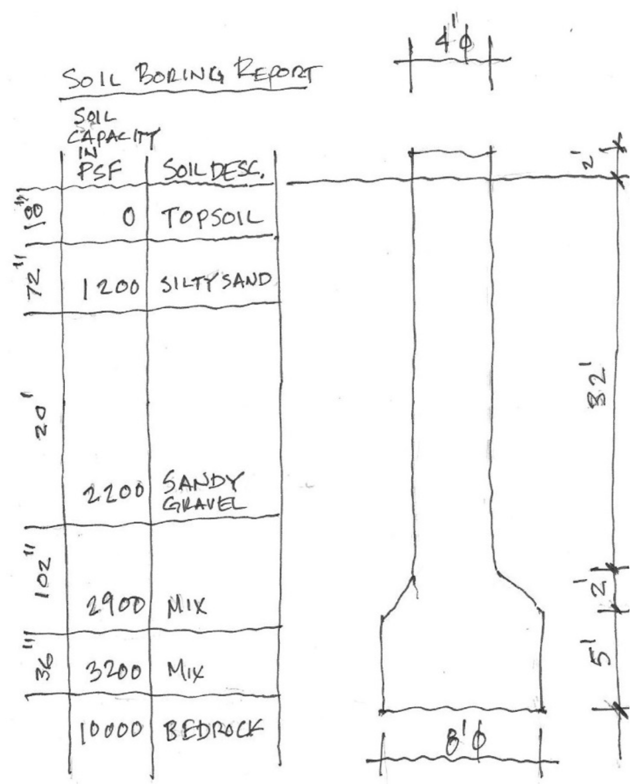
9. Does the wood 3x6 beam work for deflection with the loading shown?

   E for Doug Fir = 1,900,000

   Moment of Inertia = 34.66 in^4



10. For the belled caisson with the soil boring report shown, calculate the axial loading bearing capacity for this foundation element (assume the topsoil is organic material and provides no bearing capacity)



Bending (Flexure) (Beams)

$$M = F_b * S_x$$

$F_b = 0.66 * F_y$ (for braced beams)

Axial Load (Columns)

$$P = F_a * A_g$$

$$C_c = \sqrt{\frac{2*\pi^2*E}{F_y}}$$

When KL / r < Cc

$$F_a = \frac{\left[1 - \frac{\left(\frac{KL}{r}\right)^2}{2*C_c{}^2}\right]*F_y}{\frac{5}{3} + \frac{3*\left(\frac{KL}{r}\right)}{8*C_c} - \frac{\left(\frac{KL}{r}\right)^3}{8*C_c{}^3}}$$

When KL / r > Cc

$$F_a = \frac{12*\pi^2*E}{23*\left(\frac{KL}{r}\right)^2}$$

Shear (Wood beams only)

$$V = \frac{3}{2} * F_v * A$$

Deflection (Beams)

$$\Delta = \frac{5*w*L^4}{384*E*I}$$

ALLOWABLE STRESS DESIGN SELECTION TABLE
For shapes used as beams

S_x

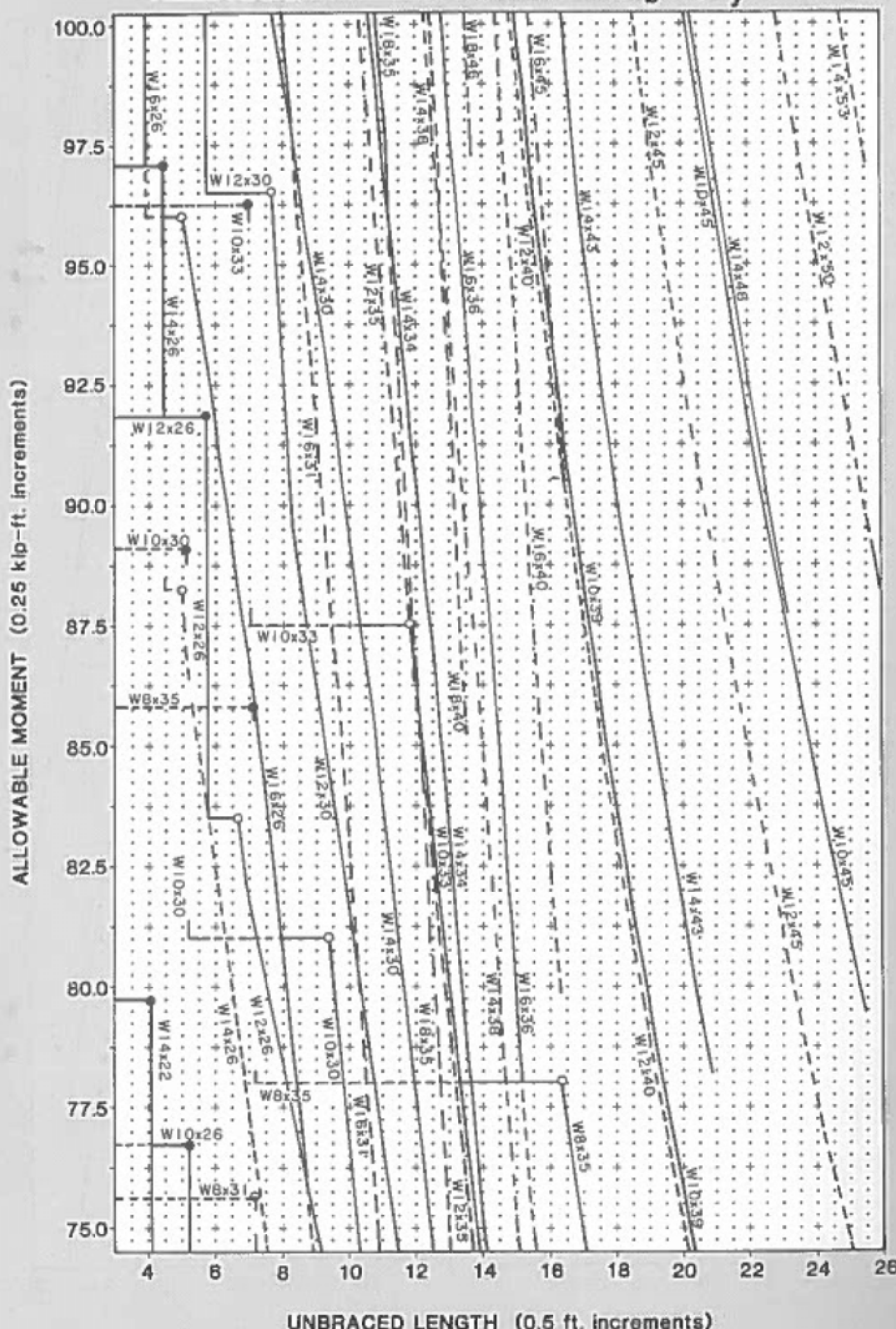
F_y = 50 ksi							F_y = 36 ksi		
L_c	L_u	M_R	S_x	Shape	Depth d	F_y'	L_c	L_u	M_R
Ft	Ft	Kip-ft	In.^{3}		In.	Ksi	Ft	Ft	Kip-ft
5.4	5.9	188	68.4	W 18×40	17⅞	—	6.3	8.2	135
9.0	22.4	183	66.7	W 10×60	10¼	—	10.6	31.1	132
6.3	7.4	178	64.7	W 16×40	16	—	7.4	10.2	128
7.2	14.1	178	64.7	W 12×50	12¼	—	8.5	19.6	128
7.2	10.4	172	62.7	W 14×43	13⅝	—	8.4	14.4	124
9.0	20.3	165	60.0	W 10×54	10⅛	63.5	10.6	28.2	119
7.2	12.8	160	58.1	W 12×45	12	—	8.5	17.7	115
4.8	5.6	158	57.6	W 18×35	17¾	—	6.3	6.7	114
6.3	6.7	155	56.5	W 16×36	15⅞	64.0	7.4	8.8	112
6.1	8.3	150	54.6	W 14×38	14⅛	—	7.1	11.5	108
9.0	18.7	150	54.6	W 10×49	10	53.0	10.6	26.0	108
7.2	11.5	143	51.9	W 12×40	12	—	8.4	16.0	103
7.2	16.4	135	49.1	W 10×45	10⅛	—	8.5	22.8	97
6.0	7.3	134	48.6	W 14×34	14	—	7.1	10.2	96
4.9	5.2	130	47.2	W 16×31	15⅞	—	5.8	7.1	93
5.9	9.1	125	45.6	W 12×35	12½	—	6.9	12.6	90
7.2	14.2	116	42.1	W 10×39	9⅞	—	8.4	19.8	83
6.0	6.5	116	42.0	W 14×30	13⅞	55.3	7.1	8.7	83
5.8	7.8	106	38.6	W 12×30	12⅜	—	6.9	10.8	76
4.0	5.1	106	38.4	W 16×26	15¾	—	5.6	6.0	76
4.5	5.1	97	35.3	W 14×26	13⅞	—	5.3	7.0	70
7.1	11.9	96	35.0	W 10×33	9¾	50.5	8.4	16.5	69
5.8	6.7	92	33.4	W 12×26	12¼	57.9	6.9	9.4	66
5.2	9.4	89	32.4	W 10×30	10½	—	6.1	13.1	64
7.2	16.3	86	31.2	W 8×35	8⅛	64.4	8.5	22.6	62
4.1	4.7	80	29.0	W 14×22	13¾	—	5.3	5.6	57
5.2	8.2	77	27.9	W 10×26	10⅜	—	6.1	11.4	55
7.2	14.5	76	27.5	W 8×31	8	50.0	8.4	20.1	54
3.6	4.6	70	25.4	W 12×22	12¼	—	4.3	6.4	50
5.9	12.6	67	24.3	W 8×28	8	—	6.9	17.5	48
5.2	6.8	64	23.2	W 10×22	10⅛	—	6.1	9.4	46
3.6	3.8	59	21.3	W 12×19	12⅛	—	4.2	5.3	42
2.6	3.4	58	21.1	M 14×18	14	—	3.6	4.0	42
5.8	10.9	57	20.9	W 8×24	7⅞	64.1	6.9	15.2	41
3.6	5.2	52	18.8	W 10×19	10¼	—	4.2	7.2	37
4.7	8.5	50	18.2	W 8×21	8¼	—	5.6	11.8	36

ALLOWABLE STRESS DESIGN SELECTION TABLE
For shapes used as beams

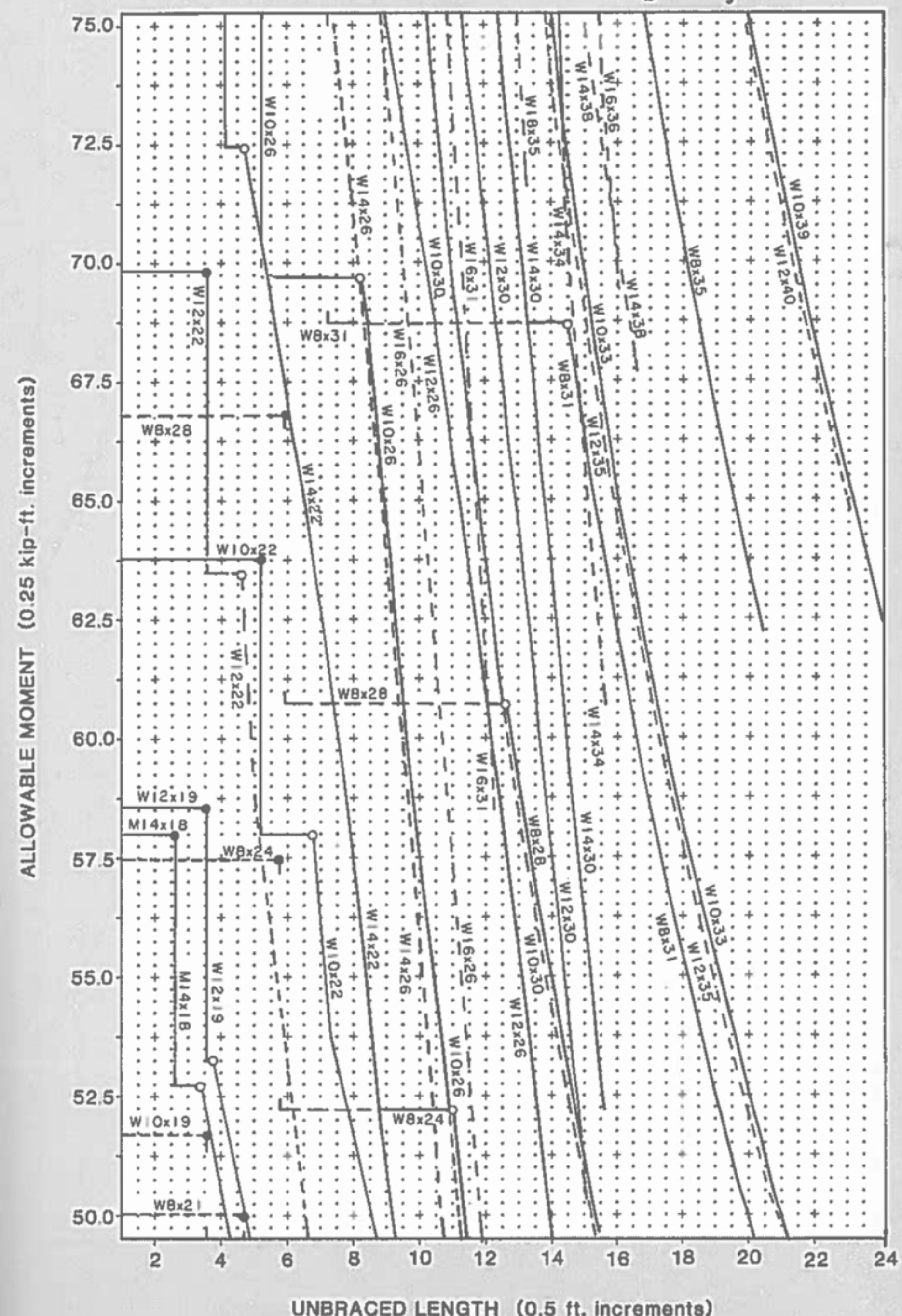
S_x

F_y = 50 ksi							F_y = 36 ksi		
L_c	L_u	M_R	S_x	Shape	Depth d	F_y'	L_c	L_u	M_R
Ft	Ft	Kip-ft	In^3		In	Ksi	Ft	Ft	Kip-ft
2.9	3.6	47	17.1	W 12×16	12	—	4.1	4.3	34
5.4	14.4	46	16.7	W 6×25	6⅜	—	6.4	20.0	33
3.6	4.4	45	16.2	W 10×17	10⅛	—	4.2	6.1	32
4.7	7.1	42	15.2	W 8×18	8⅛	—	5.5	9.9	30
2.5	3.6	41	14.9	W 12×14	11⅞	54.3	3.5	4.2	30
3.6	3.7	38	13.8	W 10×15	10	—	4.2	5.0	27
5.4	11.8	37	13.4	W 6×20	6¼	62.1	6.4	16.4	27
5.3	12.5	36	13.0	M 6×20	6	—	6.3	17.4	26
1.9	2.6	33	12.0	M 12×11.8	12	—	2.7	3.0	24
3.6	5.2	32	11.8	W 8×15	8⅛	—	4.2	7.2	23
2.8	3.6	30	10.9	W 10×12	9⅞	47.5	3.9	4.3	22
1.8	2.6	30	10.9	M 12×10.8	12	—	2.5	3.1	22
1.6	2.8	28	10.3	M 12×10	12	—	2.3	3.3	20
3.6	8.7	28	10.2	W 6×16	6¼	—	4.3	12.0	20
4.5	14.0	28	10.2	W 5×19	5⅛	—	5.3	19.5	20
3.6	4.3	27	9.91	W 8×13	8	—	4.2	5.9	20
5.4	8.7	25	9.72	W 6×15	6	31.8	6.3	12.0	19
4.5	13.9	26	9.63	M 5×18.9	5	—	5.3	19.3	19
4.5	12.0	23	8.51	W 5×16	5	—	5.3	16.7	17
3.4	3.7	21	7.81	W 8×10	7⅞	45.8	4.2	4.7	15
1.9	2.3	21	7.76	M 10× 9	10	—	2.6	2.7	15
3.6	6.2	20	7.31	W 6×12	6	—	4.2	8.6	14
1.6	2.3	19	6.94	M 10× 8	10	—	2.3	2.7	14
1.6	2.3	18	6.57	M 10× 7.5	10	—	2.2	2.7	13
3.5	4.8	15	5.56	W 6× 9	5⅞	50.3	4.2	6.7	11
3.6	11.2	15	5.46	W 4×13	4⅛	—	4.3	15.6	11
1.8	2.0	13	4.62	M 8× 6.5	8	—	2.4	2.5	9
1.7	1.8	7	2.40	M 6× 4.4	6	—	1.9	2.4	5

ALLOWABLE MOMENTS IN BEAMS ($C_b = 1$, $F_y = 50$ ksi)



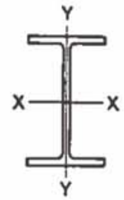
ALLOWABLE MOMENTS IN BEAMS ($C_b = 1$, $F_y = 50$ ksi)



F_y = 36 ksi

F_y = 50 ksi

COLUMNS
W shapes
Allowable axial loads in kips



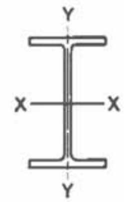
Designation	W10											
Wt./ft	60		54		49		45		39		33	
F_y	36	50	36	50	36	50	36	50	36	50	36	50
Effective length in ft KL with respect to least radius of gyration r_y												
0	380	528	341	474	311	432	287	399	248	345	210	291
6	353	482	317	433	289	394	260	351	224	303	189	255
7	348	472	312	423	284	385	253	340	218	293	184	246
8	341	461	306	414	279	376	247	328	213	283	179	237
9	335	450	300	403	273	367	240	316	206	272	173	228
10	328	437	294	392	268	357	232	303	200	260	167	217
11	321	425	288	381	262	346	224	289	193	248	161	207
12	313	412	281	369	256	335	216	274	186	235	155	196
13	306	398	274	356	249	324	208	259	178	221	149	184
14	297	383	267	343	242	312	199	243	170	207	142	171
15	289	368	259	330	235	299	190	227	162	193	135	159
16	280	353	251	316	228	286	180	209	154	177	127	145
17	271	337	243	301	221	273	170	191	145	161	120	131
18	262	320	235	286	213	259	160	172	136	144	112	117
19	253	303	226	271	205	245	149	154	126	130	103	105
20	243	285	217	255	197	230	138	139	116	117	95	95
22	222	248	199	221	180	198	115	115	97	97	78	78
24	201	209	179	186	161	167	97	97	81	81	66	66
26	177	178	158	159	142	143	82	82	69	69	56	56
28	154	154	137	137	123	123	71	71	60	60	48	48
30	134	134	119	119	107	107	62	62	52	52	42	42
32	118	118	105	105	94	94	54	54	46	46	37	37
33	111	111	99	99	88	88	51	51	43	43		
34	104	104	93	93	83	83						
36	93	93	83	83	74	74						
Properties												
U	2.55	2.55	2.56	2.56	2.57	2.57	3.25	3.25	3.28	3.28	3.35	3.35
P_{wo} (kips)	99	138	83	116	73	101	79	109	64	89	55	77
P_{wi} (kips/in.)	15	21	13	19	12	17	13	18	11	16	10	15
P_{wb} (kips)	239	282	163	193	127	149	138	163	101	119	79	93
P_{fb} (kips)	104	145	85	118	71	98	86	120	63	88	43	59
L_c (ft)	10.6	9.0	10.6	9.0	10.6	9.0	8.5	7.2	8.4	7.2	8.4	7.1
L_u (ft)	31.1	22.4	28.2	20.3	26.0	18.7	22.8	16.4	19.8	14.2	16.5	11.9
A (in.^{2})	17.6		15.8		14.4		13.3		11.5		9.71	
I_x (in.^{4})	341		303		272		248		209		170	
I_y (in.^{4})	116		103		93.4		53.4		45.0		36.6	
r_y (in.)	2.57		2.56		2.54		2.01		1.98		1.94	
Ratio r_x/r_y	1.71		1.71		1.71		2.15		2.16		2.16	
B_x } Bending	0.264		0.263		0.264		0.271		0.273		0.277	
B_y } factors	0.765		0.767		0.770		1.000		1.018		1.055	
$a_x/10^6$	50.5		45.0		40.6		37.2		31.2		25.4	
$a_y/10^6$	17.3		15.4		13.8		8.0		6.7		5.4	
F'_{ex} $(K_xL_x)^2/10^2$ (kips)	200		198		196		194		189		182	
F'_{ey} $(K_yL_y)^2/10^2$ (kips)	68.5		68.0		66.9		41.9		40.7		39.0	

Note: Heavy line indicates Kl/r of 200.

F_y = 36 ksi

F_y = 50 ksi

COLUMNS
W shapes
Allowable axial loads in kips



Designation	W8											
Wt./ft	67		58		48		40		35		31	
F_y	36	50	36	50	36	50	36	50	36	50	36	50
Effective length in ft KL with respect to least radius of gyration r_y												
0	426	591	369	513	305	423	253	351	222	309	197	274
6	387	525	336	455	276	375	229	310	201	272	178	241
7	379	510	328	442	270	363	223	300	197	264	174	234
8	370	494	320	428	263	352	218	290	191	255	170	226
9	360	477	312	413	256	339	212	279	186	246	165	217
10	350	459	303	397	249	326	205	268	180	236	160	208
11	339	440	293	380	241	312	199	256	174	225	154	199
12	328	420	283	363	233	297	192	244	168	214	149	189
13	316	399	273	344	224	282	184	231	162	202	143	179
14	304	378	263	325	215	266	177	217	155	190	137	168
15	292	355	251	305	206	249	169	203	148	177	131	156
16	279	331	240	284	196	232	160	188	141	164	124	145
17	265	307	228	263	186	214	152	172	133	150	117	132
18	251	281	216	240	176	195	143	156	125	136	110	119
19	236	254	203	217	165	175	134	140	117	122	103	107
20	221	230	190	196	154	158	124	126	109	110	95	97
22	190	190	162	162	131	131	104	104	91	91	80	80
24	159	159	136	136	110	110	88	88	76	76	67	67
26	136	136	116	116	94	94	75	75	65	65	57	57
28	117	117	100	100	81	81	64	64	56	56	49	49
30	102	102	87	87	70	70	56	56	49	49	43	43
32	90	90	76	76	62	62	49	49	43	43	38	38
33	84	84	72	72	58	58	46	46	40	40	35	35
34	79	79	68	68	55	55	44	44				
35	75	75	64	64								
Properties												
U	2.48	2.48	2.50	2.50	2.54	2.54	2.56	2.56	2.59	2.58	2.61	2.61
P_{wo} (kips)	147	205	120	167	86	119	69	96	56	78	48	67
P_{wi} (kips/in.)	21	29	18	26	14	20	13	18	11	16	10	14
P_{wb} (kips)	744	877	533	628	257	303	187	221	120	141	93	110
P_{fb} (kips)	197	273	148	205	106	147	71	98	55	77	43	59
L_c (ft)	8.7	7.4	8.7	7.4	8.6	7.3	8.5	7.2	8.5	7.2	8.4	7.2
L_u (ft)	39.9	28.7	35.3	25.4	30.3	21.8	25.3	18.2	22.6	16.3	20.1	14.5
A (in.^{2})	19.7		17.1		14.1		11.7		10.3		9.13	
I_x (in.^{4})	272		228		184		146		127		110	
I_y (in.^{4})	88.6		75.1		60.9		49.1		42.6		37.1	
r_y (in.)	2.12		2.10		2.08		2.04		2.03		2.02	
Ratio r_x/r_y	1.75		1.74		1.74		1.73		1.73		1.72	
B_x } Bending	0.326		0.329		0.326		0.330		0.330		0.332	
B_y } factors	0.921		0.934		0.940		0.959		0.972		0.985	
$a_x/10^6$	40.6		33.9		27.4		21.7		18.9		16.4	
$a_y/10^6$	13.2		11.2		9.1		7.3		6.3		5.6	
F'_{ex} $(K_xL_x)^2/10^2$ (kips)	144		138		135		129		128		125	
F'_{ey} $(K_yL_y)^2/10^2$ (kips)	46.6		45.7		44.9		43.2		42.7		42.3	

Note: Heavy line indicates Kl/r of 200.

TABLE 12.3-1 HORIZONTAL STRUCTURAL IRREGULARITIES

	Irregularity Type and Description	Reference Section	Seismic Design Category Application
1a.	**Torsional Irregularity** is defined to exist where the maximum story drift, computed including accidental torsion, at one end of the structure transverse to an axis is more than 1.2 times the average of the story drifts at the two ends of the structure. Torsional irregularity requirements in the reference sections apply only to structures in which the diaphragms are rigid or semirigid.	12.3.3.4 12.8.4.3 12.7.3 12.12.1 Table 12.6-1 Section 16.2.2	D, E, and F C, D, E, and F B, C, D, E, and F C, D, E, and F D, E, and F B, C, D, E, and F
1b.	**Extreme Torsional Irregularity** is defined to exist where the maximum story drift, computed including accidental torsion, at one end of the structure transverse to an axis is more than 1.4 times the average of the story drifts at the two ends of the structure. Extreme torsional irregularity requirements in the reference sections apply only to structures in which the diaphragms are rigid or semirigid.	12.3.3.1 12.3.3.4 12.7.3 12.8.4.3 12.12.1 Table 12.6-1 Section 16.2.2	E and F D B, C, and D C and D C and D D B, C, and D
2.	**Reentrant Corner Irregularity** is defined to exist where both plan projections of the structure beyond a reentrant corner are greater than 15% of the plan dimension of the structure in the given direction.	12.3.3.4 Table 12.6-1	D, E, and F D, E, and F
3.	**Diaphragm Discontinuity Irregularity** is defined to exist where there are diaphragms with abrupt discontinuities or variations in stiffness, including those having cutout or open areas greater than 50% of the gross enclosed diaphragm area, or changes in effective diaphragm stiffness of more than 50% from one story to the next.	12.3.3.4 Table 12.6-1	D, E, and F D, E, and F
4.	**Out-of-Plane Offsets Irregularity** is defined to exist where there are discontinuities in a lateral force-resistance path, such as out-of-plane offsets of the vertical elements.	12.3.3.4 12.3.3.3 12.7.3 Table 12.6-1 16.2.2	D, E, and F B, C, D, E, and F B, C, D, E, and F D, E, and F B, C, D, E, and F
5.	**Nonparallel Systems-Irregularity** is defined to exist where the vertical lateral force-resisting elements are not parallel to or symmetric about the major orthogonal axes of the seismic force–resisting system.	12.5.3 12.7.3 Table 12.6-1 Section 16.2.2	C, D, E, and F B, C, D, E, and F D, E, and F B, C, D, E, and F

TABLE 12.3-2 VERTICAL STRUCTURAL IRREGULARITIES

	Irregularity Type and Description	Reference Section	Seismic Design Category Application
1a.	**Stiffness-Soft Story Irregularity** is defined to exist where there is a story in which the lateral stiffness is less than 70% of that in the story above or less than 80% of the average stiffness of the three stories above.	Table 12.6-1	D, E, and F
1b.	**Stiffness-Extreme Soft Story Irregularity** is defined to exist where there is a story in which the lateral stiffness is less than 60% of that in the story above or less than 70% of the average stiffness of the three stories above.	12.3.3.1 Table 12.6-1	E and F D, E, and F
2.	**Weight (Mass) Irregularity** is defined to exist where the effective mass of any story is more than 150% of the effective mass of an adjacent story. A roof that is lighter than the floor below need not be considered.	Table 12.6-1	D, E, and F
3.	**Vertical Geometric Irregularity** is defined to exist where the horizontal dimension of the seismic force–resisting system in any story is more than 130% of that in an adjacent story.	Table 12.6-1	D, E, and F
4.	**In-Plane Discontinuity in Vertical Lateral Force-Resisting Element Irregularity** is defined to exist where an in-plane offset of the lateral force-resisting elements is greater than the length of those elements or there exists a reduction in stiffness of the resisting element in the story below.	12.3.3.3 12.3.3.4 Table 12.6-1	B, C, D, E, and F D, E, and F D, E, and F
5a.	**Discontinuity in Lateral Strength–Weak Story Irregularity** is defined to exist where the story lateral strength is less than 80% of that in the story above. The story lateral strength is the total lateral strength of all seismic-resisting elements sharing the story shear for the direction under consideration.	12.3.3.1 Table 12.6-1	E and F D, E, and F
5b.	**Discontinuity in Lateral Strength–Extreme Weak Story Irregularity** is defined to exist where the story lateral strength is less than 65% of that in the story above. The story strength is the total strength of all seismic-resisting elements sharing the story shear for the direction under consideration.	12.3.3.1 12.3.3.2 Table 12.6-1	D, E, and F B and C D, E, and F