TAUBMAN COLLEGE
ARCHITECTURE & URBAN PLANNING
UNIVERSITY OF MICHIGAN

Arch324
STRUCTURES II

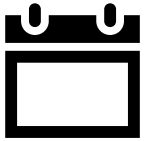
Winter 2026
Recitation

FACULTY: Prof. Peter von Bülow
Mohsen Vatandoost

Welcome to Recitation session 02/20

Mohsen Vatandoost {Ph.D., M.Sc., M. Arch}
mohsenv@umich.edu

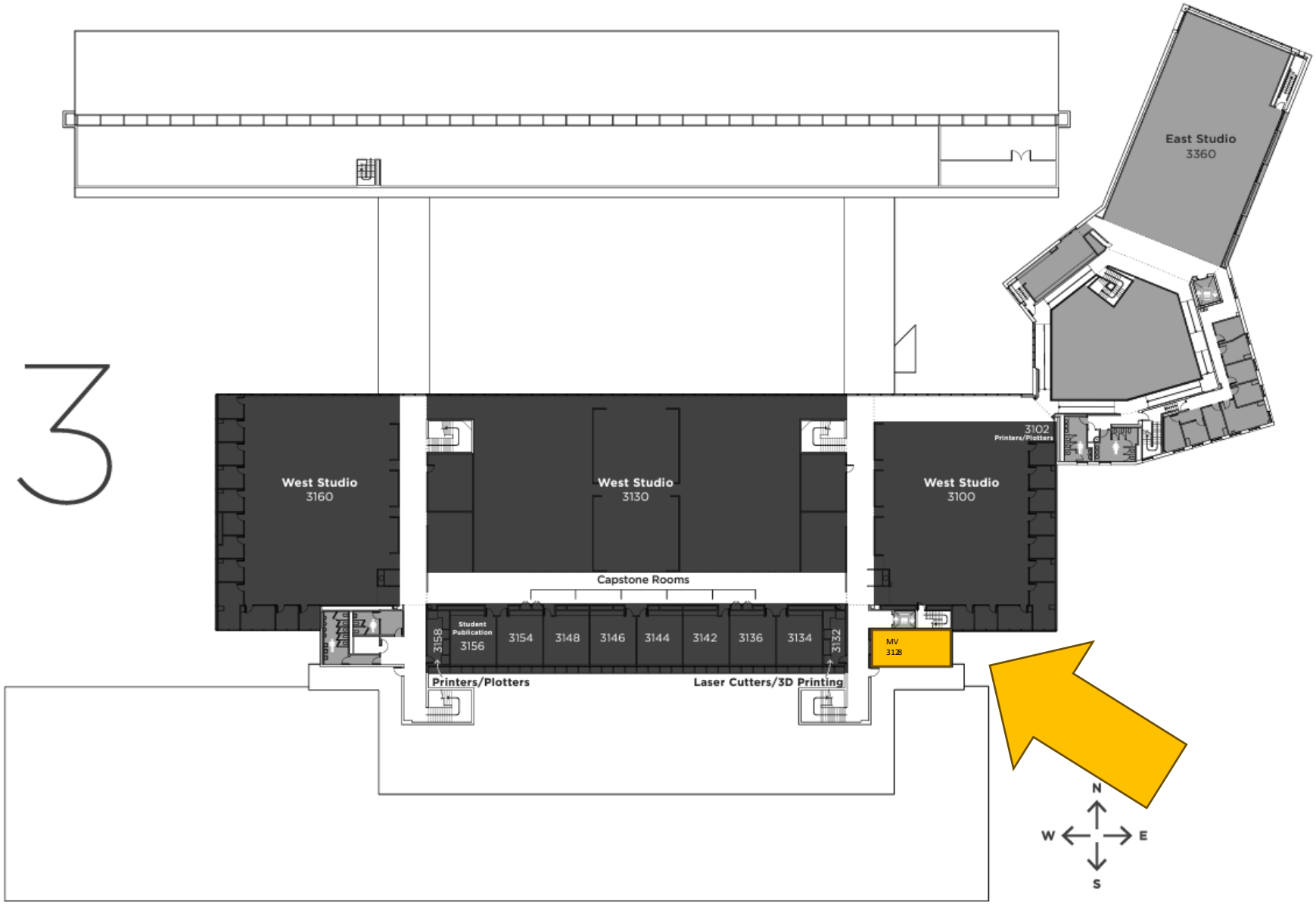
Office: Room 3128
hours:
Fri: 11:30 – 12:30
Mon, Wed: 11:00 - 12:00
walk-ins welcome!



Click here to make an appointment

Please feel free to ask questions.

Where can you find me?



Welcome to Recitation session 02/20

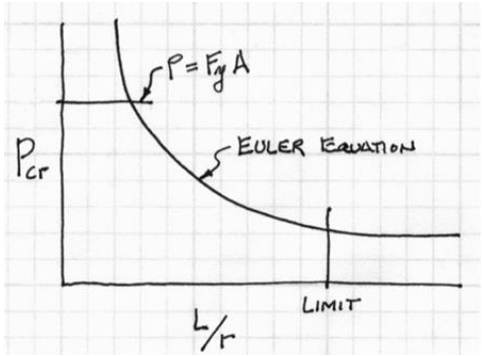
Outline:

- Quick **Recap** of the week
- Provide the solution for the assignment **(Homework 6)**
- Answering student's questions
- Lab: **Steel Column**
- **Tower Project:** Look for feedbacks on Preliminary report

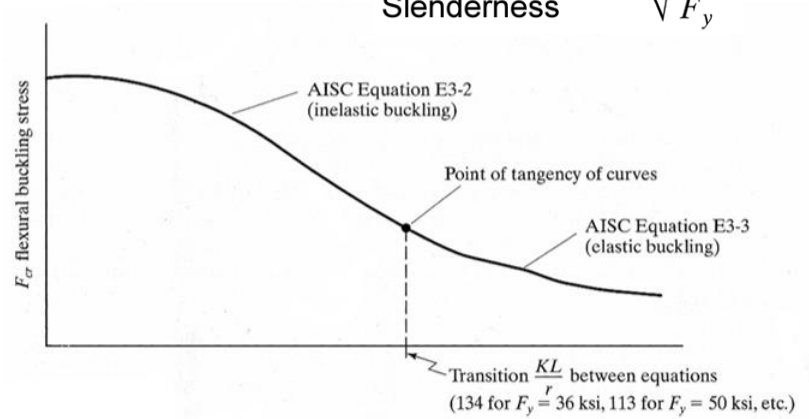
Please feel free to ask questions.

Recap of the week

Steel Columns



Transition Slenderness $4.71\sqrt{\frac{E}{F_y}}$



$$slenderness = \frac{KL}{r}$$

short intermediate long

Euler equation:

$$F_e = \frac{\pi^2 E}{\left(\frac{KL}{r}\right)^2}$$

Short & Intermediate Columns:

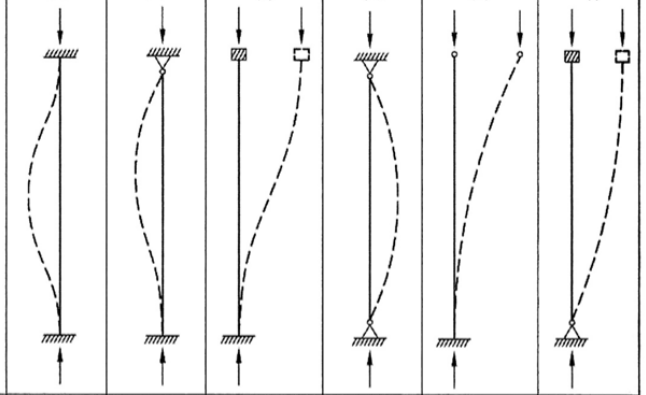
$$F_{cr} = \left[0.658^{\frac{F_y}{F_e}}\right] F_y$$

Equation E3-2

Long Columns:

$$F_{cr} = 0.877 F_e$$

TABLE C-A-7.1
Approximate Values of Effective Length Factor, *K*

	(a)	(b)	(c)	(d)	(e)	(f)
Buckled shape of column is shown by dashed line						
Theoretical *K* value	0.5	0.7	1.0	1.0	2.0	2.0
Recommended design value when ideal conditions are approximated	0.65	0.80	1.2	1.0	2.1	2.0
End condition code	Rotation fixed and translation fixed Rotation free and translation fixed Rotation fixed and translation free Rotation free and translation free					

Provide the solution for the assignment – **HW6**

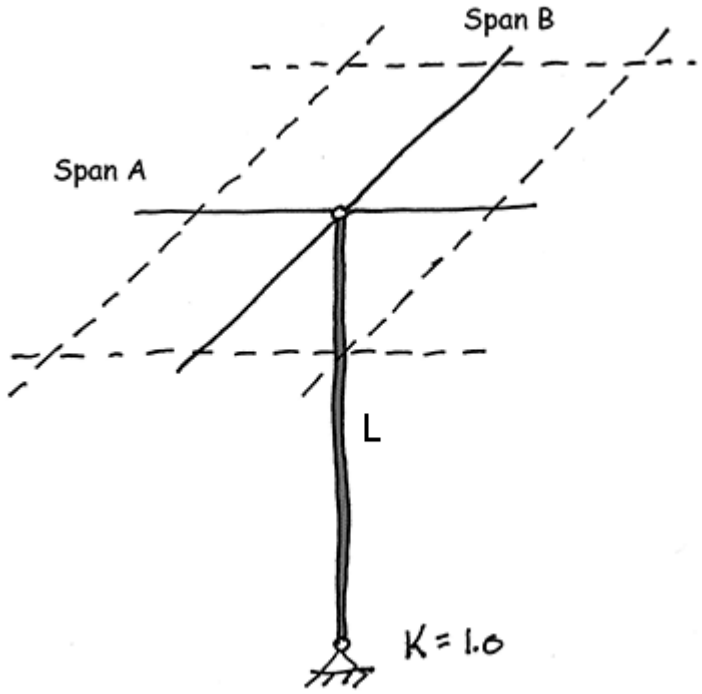
- Problem:

6. Steel Column Analysis

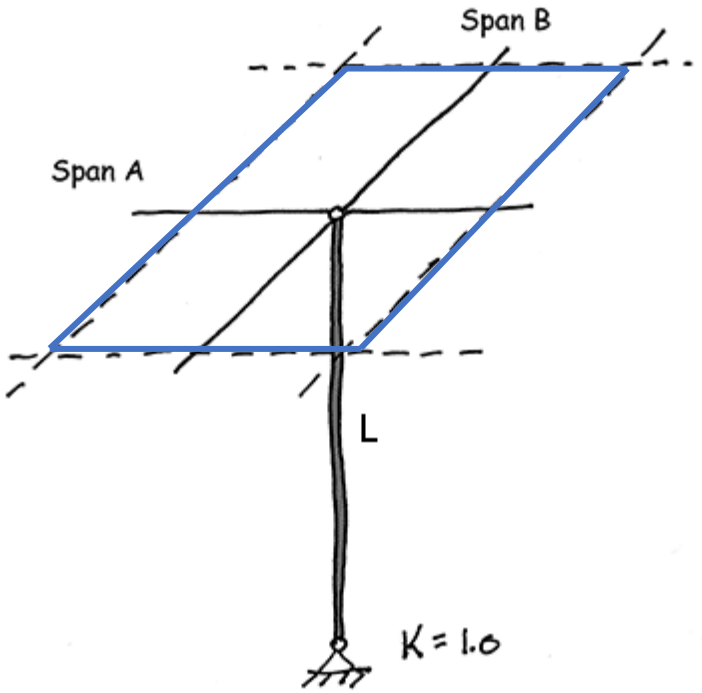
For the given axially loaded steel W-section, determine the maximum floor live load capacity, P LL. Assume the column is pinned top and bottom: K = 1.0, and there is no intermediate bracing. Use AISC-LRFD steel equations to determine phi Pn and the load. E = 29000 ksi.

DATASET: 1 -2- -3-

W-section	W8X35
Fy	50 KSI
Span A	34 FT
Span B	46 FT
Height L	17 FT
Floor Dead Load	18 PSF



Provide the solution for the assignment – **HW6**



#	Question	Your Response	
1	Total unfactored floor dead load on the column		KIPS
2	Controlling slenderness ratio		
3	Transition slenderness value, 4.71(E/Fy)^.5		
4	Euler stress, Fe		KSI
5	Critical stress, Fcr		KSI
6	Nominal strength, Pn		KIPS
7	Factored nominal strength, phi Pn		KIPS
8	UN-factored live load on column (actual total LL)		KIPS
9	Actual unfactored floor live load		PSF

Provide the solution for the assignment – **HW6**

Tributary Area: Span A x Span B = 34 x 46 = 1564 ft²

Dead load: 18 psf

Total floor dead load: $18 \times 1564 = 28152 \times \frac{1}{1000} = 28.152$ kips

Q1

□ Slenderness ratio: $\lambda = \frac{KL}{r}$

W8x35 → Table 1-1a

$r_x = 3.51''$

$r_y = 2.03''$

$A_g = 10.3\ in^2$

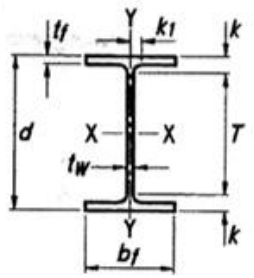


Table 1-1 (continued)
W-Shapes
Dimensions

Shape	Area, A	Depth, d		Web Thickness, t_w		$\frac{t_w}{2}$	Flange Width, b_f		Flange Thickness, t_f		Distance k		Distance k_1	Distance T	Work-able Gage
											k_{des}	k_{det}			
	in.²	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
W8×67	19.7	9.00	9	0.570	9/16	5/16	8.28	8 1/4	0.935	15/16	1.33	1 5/8	15/16	5 3/4	5 1/2
×58	17.1	8.75	8 3/4	0.510	1/2	1/4	8.22	8 1/4	0.810	13/16	1.20	1 1/2	7/8		
×48	14.1	8.50	8 1/2	0.400	3/8	3/16	8.11	8 1/8	0.685	11/16	1.08	1 3/8	13/16		
×40	11.7	8.25	8 1/4	0.360	3/8	3/16	8.07	8 1/8	0.560	9/16	0.954	1 1/4	13/16		
×35	10.3	8.12	8 1/8	0.310	5/16	3/16	8.02	8	0.495	1/2	0.889	1 3/16	13/16		
×31[1]	9.13	8.00	8	0.285	5/16	3/16	8.00	8	0.435	7/16	0.829	1 1/8	3/4		

Table 1-1 (continued)
W-Shapes
Properties

W8-W4

Nominal Wt.	Compact Section Criteria $\frac{b_f}{2t_f}$	Compact Section Criteria $\frac{h}{t_w}$	Axis X-X I	Axis X-X S	Axis X-X r	Axis X-X Z	Axis Y-Y I	Axis Y-Y S	Axis Y-Y r	Axis Y-Y Z	r_{ts}	h_o	Torsional Properties J	Torsional Properties C_w
lb/ft			in.⁴	in.³	in.	in.³	in.⁴	in.³	in.	in.³	in.	in.	in.⁴	in.⁶
67	4.43	11.1	272	60.4	3.72	70.1	88.6	21.4	2.12	32.7	2.43	8.07	5.05	1440
58	5.07	12.4	228	52.0	3.65	59.8	75.1	18.3	2.10	27.9	2.39	7.94	3.33	1180
48	5.92	15.9	184	43.2	3.61	49.0	60.9	15.0	2.08	22.9	2.35	7.82	1.96	931
40	7.21	17.6	146	35.5	3.53	39.8	49.1	12.2	2.04	18.5	2.31	7.69	1.12	726
35	8.10	20.5	127	31.2	3.51	34.7	42.6	10.6	2.03	16.1	2.28	7.63	0.769	619
31	9.19	22.3	110	27.5	3.47	30.4	37.1	9.27	2.02	14.1	2.26	7.57	0.536	530

Provide the solution for the assignment – **HW6**

Effective lenght factor

$$\lambda_u = \frac{KL}{r_u} = \frac{1 \times 17 \times 12 \text{ in}}{3.51 \text{ in}} = 58.1196 < 200$$

$$\lambda_y = \frac{KL}{r_y} = \frac{1 \times 17 \times 12}{2.03} = 100.49 < 200$$

Q2

maximum is governing the desig

- Transition slenderness value: (short or long column?)

$$4.71\sqrt{\frac{E}{F_y}} = 4.71\sqrt{\frac{29000 \text{ ksi}}{50 \text{ ksi}}} = 113.43$$

Q3

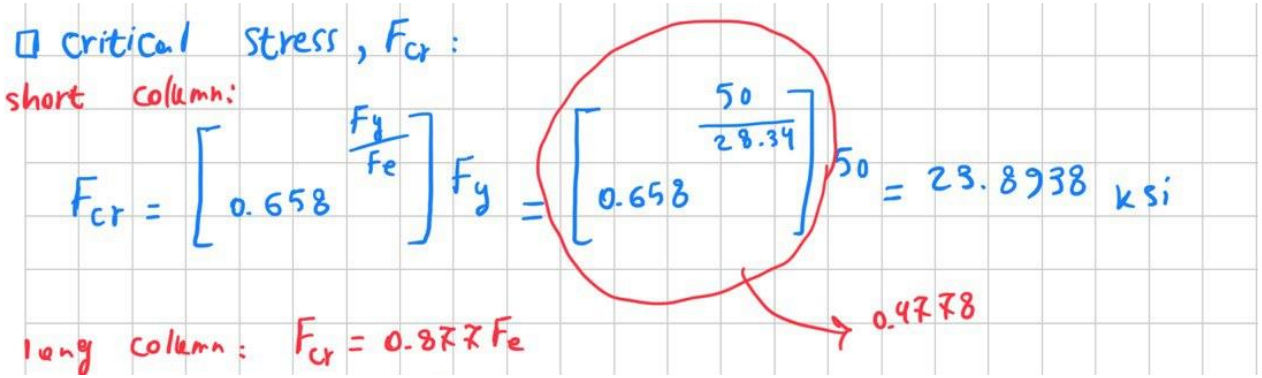
Transition slenderness value

- Euler stress, F_e: $\frac{\pi^2 E}{\left(\frac{KL}{r}\right)^2} = \frac{(3.1415)^2 \, 29000 \text{ ksi}}{(100.49)^2} = 28.3417 \text{ ksi}$

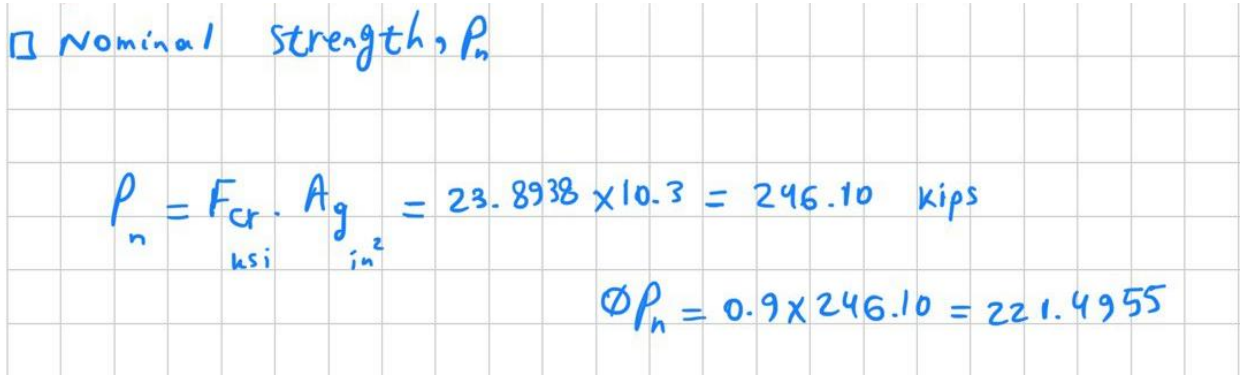
Q4

Provide the solution for the assignment – **HW6**

It is a short column:



Q5



Q6

Q7

Provide the solution for the assignment – **HW6**

$P_u \leq \phi P_n$

$P_u = 1.2 P_D + 1.6 P_L \leq 221.4955 \longrightarrow P_L = 117.32 \text{ kips}$

$P_D = 28.152$

Q8

Actual unfactored floor live load:

$$\frac{P_L}{\text{Tributary Area}} = \frac{117.32 \times 1000 \text{ lb}}{34 \times 46 \text{ in}^2} = 75.012 \text{ psf}$$

Q9

Lab: Steel Column

Description

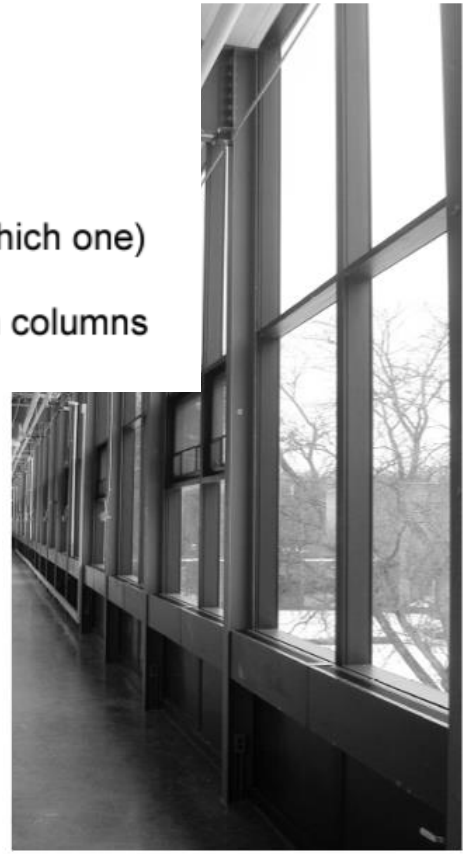
This project gives the opportunity to identify steel sections and determine their properties and strength using the AISC tables.

Goals

To identify a steel section based on dimensions.
To determine the sectional properties using AISC table
To determine the load capacity based on AISC column table.

Procedure

1. Measure the steel column section shown below. (your GSI will tell you which one)
2. Based on the sectional dimensions find the shape in the steel table.
3. Use the column table and the given height to find the load capacity. Both columns are A-36 steel (Fy = 36 ksi).



L= 15 ft. – 4 in.

or

L = 13 ft. 4 in.

Thank you.
Any questions?

Please feel free to ask questions.

Contact: Mohsenv@umich.edu