

**CE 3202 Fall 2010 Exam 1**

Name \_\_\_\_\_

Closed Book; Closed Notes

3"x5" Note Card Allowed; Calculator Allowed

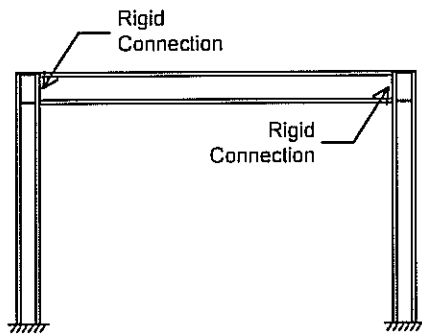
100 points are possible

Answer all questions to the best of your ability. State any assumptions you feel are necessary. Attach extra sheets, if used. **Show your work!**

**Problem 1.**

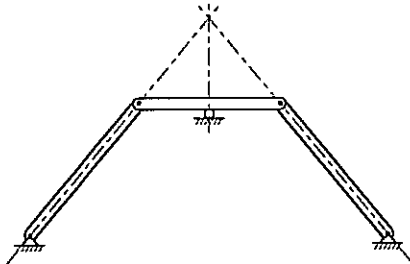
For each structure shown, state if the structure is unstable, stable-determinate, or stable-indeterminate (if stable-indeterminate, state the degree of indeterminacy). Defend your answers! Hint: 2 of these structures are designed to trick you. (15 points)

(a) Frame structure (members carry internal shears, moments and axial loads). Base reactions are fixed-end type connections:



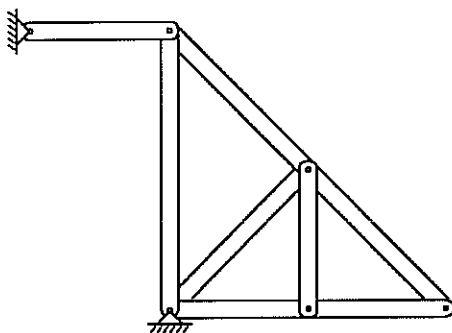
(a)

(b) All members are truss bars (axial load only):



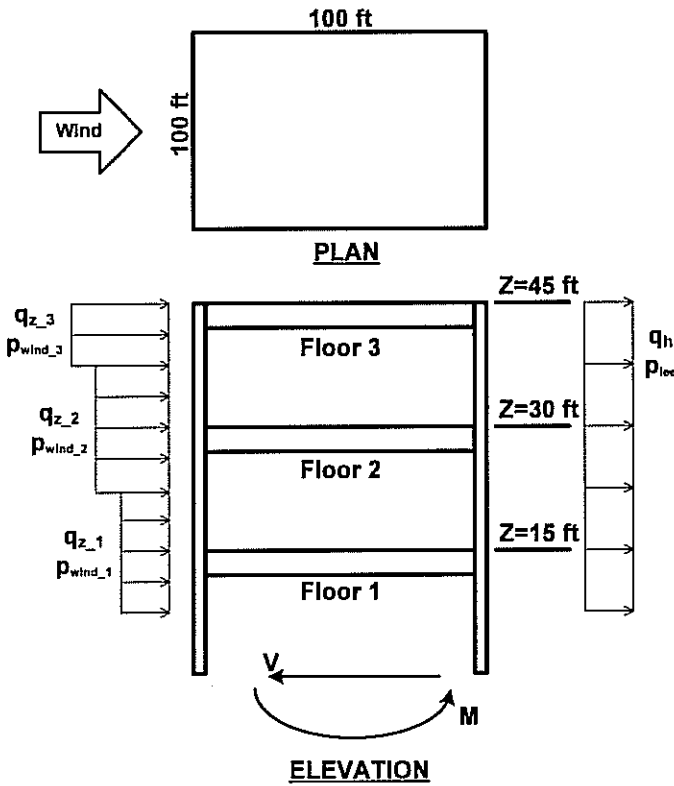
(b)

(c) All members are truss bars (axial load only):



(c)

**Problem 2.** Wind loads.

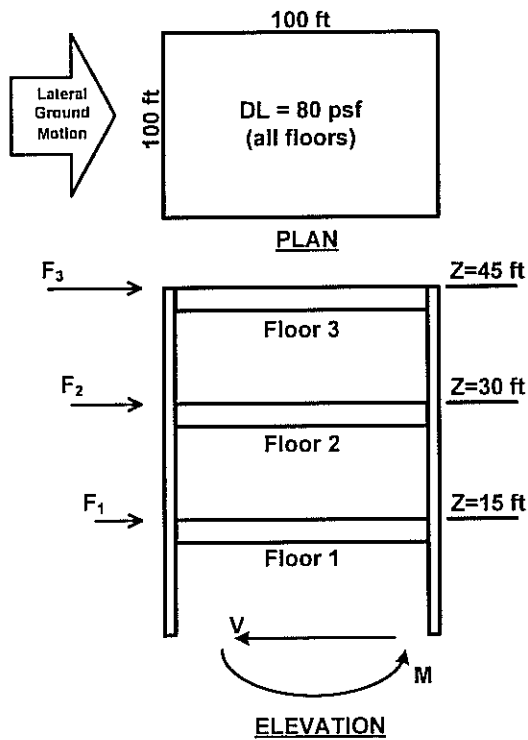


Apartment Building  
 Steel Frame Structure  
 $V = 90$  mph  
 Exposure B  
 Flat Ground  
 (Do not use the simplified procedure.)

- (a) For the structure shown above, find the pressure coefficients  $q_z$  (at each floor) and  $q_h$ . Take  $z_1 = 15$  ft,  $z_2 = 30$  ft, and  $z_3 = 45$  ft. Use the appropriate value for  $h$ . (20 points)

(b) Using the  $q_z$  and  $q_h$  values you calculated in part (a), find the design windward and leeward wind pressures,  $p_{wind,1}$ ,  $p_{wind,2}$ ,  $p_{wind,3}$ , and  $p_{lee}$ . (10 points)

**Problem 3.** Seismic Loads. For the following problems, assume Seismic Design Category B has been determined.



Apartment Building  
Steel Frame Structure  
Site Class D  
Seismic Design Category B  
 $S_{DS} = 0.12$   
 $S_{D1} = 0.05$

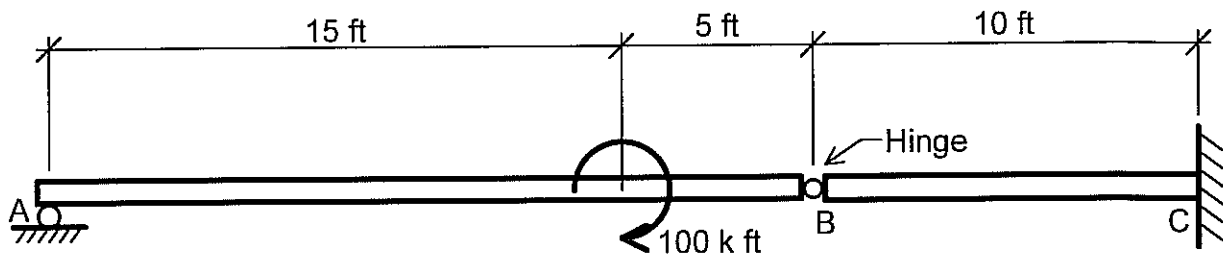
- (a) For the above structure, find the design seismically induced base shear,  $V$ . Be sure to check minimum and maximum values. (20 points).

(b) Using your answer from part (a), find the design seismic equivalent static forces applied to each floor,  $F_1$ ,  $F_2$ , and  $F_3$ . (10 points).

**Problem 4.** For the beam depicted below, draw the shear and moment diagram.

Hint: you should really draw two free-body diagrams to solve for the reactions.

Hint: When you sum moments around a point, be sure to include any concentrated moments that appear on your free-body diagram. (25 points)



**Useful Tables From ASCE 7-05 for CE3202**

**Live Load**

**Table 4-2**

Live Load Element Factor ( $K_{LL}$ )	Importance Category	Occupancy Category
Interior Columns	4	I
Exterior Columns without cantilever slabs	4	I
Edge Columns with cantilever slabs	3	I
Corner Columns with cantilever slabs	2	I
Edge Beams without cantilever slabs	2	I
Interior Beams	2	I
Other members:		
Edge beams with cantilever slabs		I
Cantilever Beams		I
Slabs		I
Members without provisions for continuous shear transfer normal to their span		I

**Snow Load**

**Table 7-4**

Importance Factor (I)	Occupancy Category
I	0.80
II	1.00
III	1.10
IV	1.20

**Thermal Factor (C<sub>t</sub>)**

**Table 7-3**

Heated Buildings	1.0
Unheated Structures	1.2

**Exposure Factor (C<sub>e</sub>)**

**Table 7-2**

Windy Site	0.7
Non-windy Site	1.0
Sheltered Site	1.3

**Slope Factor (C<sub>s</sub>)**

**Figure 7-2**

Flat roof	1.0
-----------	-----

**All Loads**

**Table 1-1**

Occupancy Category	Importance Factor (I)
Structures representing low risk to human life e.g., agricultural facilities some temporary facilities minor storage facilities	I
Structures not in categories I, III, or IV	II
Buildings representing substantial hazard to human life (i.e., gathering places) e.g., schools, day-care centers, auditoriums, jails, nursing homes	III
Buildings representing substantial economic impact or disruption if damaged e.g., power generation stations, water and sewage treatment facilities, telecom	IV
Buildings designated as essential facilities e.g., hospitals, fire, rescue, and police stations, emergency shelters, designated emergency response stations, and national defense facilities	IV

**Wind Load**

**Table 6-1**

Importance Factor (I)	Exposure Category
I	Urban Centers
II	Suburban and wooded areas
III	Open terrain, some obstructions
IV	Beachfront property

**Velocity Pressure Exposure Coefficient (K<sub>z</sub>) for MWFRS**

**Table 6-3**

Height above grade (z)	Exposure A	Exposure B	Exposure C	Exposure D
0-15	0.70	0.57	0.85	All
20	0.70	0.62	0.90	1.03
25	0.70	0.66	0.94	1.08
30	0.70	0.70	0.98	1.12
40	0.76	1.04	1.22	1.16
50	0.81	1.09	1.27	1.21
60	0.85	1.13	1.31	1.25
70	0.89	1.17	1.34	1.29
80	0.93	1.21	1.38	1.33
90	0.96	1.24	1.40	1.36
100	0.99	1.26	1.43	1.39
120	1.04	1.31	1.48	1.44
140	1.09	1.36	1.52	1.48
160	1.13	1.39	1.55	1.51
180	1.17	1.43	1.58	1.54
200	1.20	1.46	1.61	1.57
250	1.28	1.53	1.68	1.64
300	1.35	1.59	1.73	1.69
350	1.41	1.64	1.78	1.74
400	1.47	1.69	1.82	1.78
450	1.52	1.73	1.86	1.82
500	1.56	1.77	1.89	1.85

**Topographical Factor (K<sub>zt</sub>)**

**Figure 6-1**

Flat Ground	1
-------------	---

**Gust Factor (G)**

**Table 6-4**

Rigid Structures	0.85
Buildings	0.85

**External Pressure Coefficient (C<sub>p</sub>)**

**Figure 6-6**

Surface	L/B	C <sub>p</sub>	Use With
Windward Wall	All	0.8	q <sub>w</sub>
Leeward Wall	2	-0.5	q <sub>w</sub>
Side Wall	≥ 4	-0.2	q <sub>w</sub>
	All	-0.7	q <sub>w</sub>

(Positive values point into structure, negative values point away)  
(Linear interpolation of C<sub>p</sub> allowed)

**Seismic Load**

**Table 11.5-1**

Importance Factor (I)	Occupancy Category
I	1.00
II	1.00
III	1.25
IV	1.50

**Site Coefficient, Short-Period (F<sub>s</sub>)**

**Table 11.4-1**

Site Class	Mapped (MCE) Spectral Response Acceleration Parameter S <sub>s</sub> ≤ 0.25	S <sub>s</sub> = 0.5	S <sub>s</sub> = 0.75	S <sub>s</sub> = 1.0	S <sub>s</sub> ≥ 1.25
A	0.80	0.80	0.80	0.80	0.80
B	1.00	1.00	1.00	1.00	1.00
C	1.20	1.20	1.10	1.00	1.00
D	1.60	1.40	1.20	1.10	1.00
E	2.50	1.70	1.30	0.99	0.90
F				Site Specific	

**Site Coefficient, 1s-Period (F<sub>1</sub>)**

**Table 11.4-2**

Site Class	Mapped (MCE) Spectral Response Acceleration Parameter S <sub>1</sub> ≤ 0.1	S <sub>1</sub> = 0.2	S <sub>1</sub> = 0.3	S <sub>1</sub> = 0.4	S <sub>1</sub> ≥ 0.5
A	0.80	0.80	0.80	0.80	0.80
B	1.00	1.00	1.00	1.00	1.00
C	1.70	1.60	1.50	1.40	1.30
D	2.40	2.00	1.80	1.60	1.50
E	3.50	3.20	2.80	2.40	2.40
F				Site Specific	

**Design Category, Based on Short-Period Response Acceleration Parameter**

**Table 11.6-1**

value of S <sub>ps</sub>	Occupancy Category
S <sub>ps</sub> < 0.167	A
0.167 ≤ S <sub>ps</sub> < 0.333	B
0.333 ≤ S <sub>ps</sub> < 0.50	C
0.50 ≤ S <sub>ps</sub>	D

**Design Category, Based on 1s-Period Response Acceleration Parameter**

**Table 11.6-2**

value of S <sub>1p</sub>	Occupancy Category
S <sub>1p</sub> < 0.067	A
0.067 ≤ S <sub>1p</sub> < 0.133	B
0.133 ≤ S <sub>1p</sub> < 0.20	C
0.20 ≤ S <sub>1p</sub>	D