

CEMM 301: BEHAVIOR AND DESIGN OF METAL STRUCTURES  
FALL 04 PROJECT

The project is the structural design of a twelve story building. You may work individually or in groups of two. Refer to the drawings passed out in class.

Service Loads:		Concrete slab on steel deck	75 psf
Weight of exterior walls (supported at each floor)	25 psf	Allowance for beams and girders	5 psf
Horizontal wind load on walls	20 psf	Allowance for partitions	15 psf
		<u>Allowance for ceilings, mech. &amp; misc.</u>	<u>5 psf</u>
		Uniform Dead Load on floors and roof	100 psf
Weight of columns may be ignored.		Uniform Live Load on floors and roof	50 psf

Uniform live loads are applied at each floor either to the whole surface, or to the left half, or to the right half, where the halves are separated by line (B). The floors extend 12" beyond the column center lines at the perimeter. Horizontal wind loads are resisted by walls spanning from floor to floor, and distributed by floors to the frames resisting lateral loads. Wind loads in the longitudinal and transverse directions are not simultaneous. All joints are pinned except at (B, 2), (B, 3), (B, 5) and (B, 6) where rigid beam-column connections resist lateral loads and furnish stability in the transverse direction. All the other columns lean on these four in the transverse connection. In the longitudinal direction, all the columns are braced by vertical diagonal bracing (VDB) on lined (A) and (C) between (3) and (4). The VDB also resists longitudinal wind load. The top of all beams and girders in a floor or roof lie in the same horizontal plane at the bottom of the concrete slab. Beams with prefix B are continuously supported at the top flange. Girders with prefix G are braced at 10 ft o.c. by beams. There is no column bracing between floors, only at the level of floors (and roof). Beams and columns shall be W shapes, Gr 50. VDB shall be 2L with LLBB, Gr.50. Plates shall be A36 Steel.

Analyses should be done separately for dead, live and wind loads. The results should include reactions, bar force, shear, and end moments for each member. For design, the results of analysis are factored and combined to produce the greatest effect on each member. Members with adequate resistance shall be selected. If deflection is excessive for the original selection, make a new selection with enough stiffness for satisfactory deflection. Lateral deflection shall not exceed one half inch per storey. Vertical live load deflection shall not exceed the span/360. Submit all your calculations organized in the specified format. Sketch your design and identify the selected shapes for each member. For connections, sketch details showing the location of bolts and size and location of welds. Complete the last two columns of the Assignment Schedule for your results.

ASSIGNMENT SCHEDULE

Part	Due Date	Description	Mark or Location	Start on Page	Assigned Storeys	Selected Shape
1	11/17	Complete separate wind, dead, & live load analysis for longitudinal braced frames and transverse rigid frames.	frames (A), (C) (2), (3), (5), (6)	1.1.1 1.2.1	ALL	NA
2	11/17	Design floor beams B1, B2, G1 and check deflections	Beam B1 Beam B2 Beam G1	2.1.1 2.2.1 2.3.1	ALL	
3	11/22	Design VDB with bolted connections in your assigned storeys.	VDB	3.1.1		
4	11/22	Design columns in your assigned storeys.	Column at (A,1) Column at (A,2) Column at (A,4) Column at (B,1)	4.1.1 4.1.2 4.1.3 4.1.4		
5	11/22	Design column base plate for column (B,4)	Base PL at (B,4)	5.1.1	Basement	
6	11/29	Design column at (B,2) and beams B3 and calculate drift in your assigned storeys.	Column at (B,2) Beam B3	6.1.1 6.2.1		
7	11/29	Design connections at ends of B1 and G2, and the moment connection for B3 at Column line (B) in your assigned storeys	Girder G2 Beam B1 Beam B3 at (B)	7.1.1 7.2.1 7.3.1		Detail G2 Detail B1 Detail B3
8	12/03	Design alternative composite floor beams B1 and G1	Composite B1 Composite G1	8.1.1 8.2.1	ALL	

STRUCTURAL GENERAL NOTES	
Rolled Shapes A992 Grade 50, Fu = 65 ksi. Plates A36	
Bolts (ASTM A325, 3/4" Diameter in standard holes , Type N, slip critical at VDB and moment connections	
Welding Electrodes E70xx.	
Connections shall be welded in shop and bolted in field.	