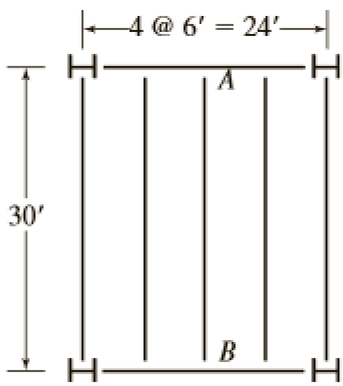
The slab below has a factored distributed load of 210 psf. Assume the self-weight of the structural system is included. Design beam *A*-*B* including details for a 4 in concrete slab.

- Your design may be EITHER composite steel OR concrete. Clearly state at the top of your solution which material you will use.
- Before you begin, outline all required checks.
- Your design should be efficient (avoid significant over design).
- If you are stuck, make an assumption to move you forward. Clearly state ALL assumptions.
- Use normal weight concrete with f'_c = 4 ksi.

You are welcome to do the problem in metric if you prefer:
1 lb = 4.448 N
1 in = 25.2 cm



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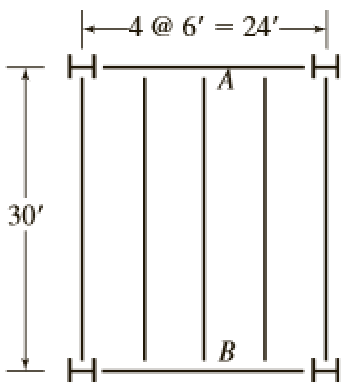


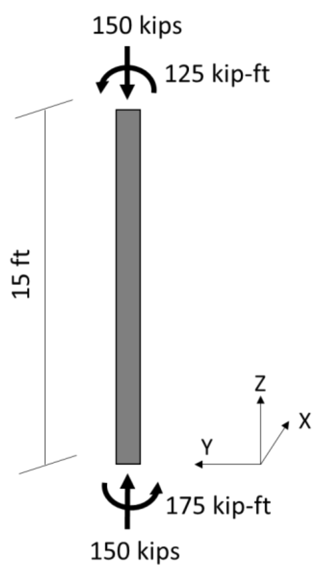
A 15’ column is in an upper story of a frame that is sideway inhibited in both directions. The controlling factored load combination is shown below with seismic causing bending about the X-axis. There is no moment about the Y-axis.

1) You should do this problem with *either* steel *or* concrete. Do not do both! Circle the material you will use here.

2) List the design checks that are necessary for this column.

3) Concrete: Design a cross section for this column including longitudinal and transverse rebar. Use f'_c = 4 ksi for the concrete and F_y = 60 ksi for the rebar. Show work.
   Steel: Select an appropriate W cross section with A992 steel. Show work.

4) The column must be spliced in this story, but you intend to use the same column section above and below the splice. (a) Show where on the elevation of the column you will locate the splice and describe why you would locate it there. (b) Draw a comprehensive sketch of the splice, labeling important details. No calculations are necessary.



UC Berkeley | Preliminary Exam
Civil and Environmental Engineering | **Structural Design** | Fall 2019
SEMM

A two-story building is to be constructed. In the N-S direction, the lateral load resisting system consists of concrete shear walls (R = 6). In the E-W direction, the lateral load resisting system consists of concentrically braced frames (R = 6). Assume the lateral systems are **fixed** at the base. The loads (including the structural frame) are:
2nd floor: Dead load of 65 psf; Live load of 50 psf
Roof: Dead load of 60 psf; Live load 30 psf
Cladding: 20 psf (Dead)

The earthquake design response spectrum parameters for the location, already including site amplification factors, are: $S_{DS} = 1.5$ g, $S_{D1} = 0.6$ g. You can estimate period with $T = 0.02\, h^{0.75}$

(a) You are responsible for the design of *either* the concrete shear walls *or* steel braced frames. Underline the system you will design. Note: you are *not* expected to design any component of the gravity frame.

(b) For the system of your choice, what are the deformation-controlled action(s) and force-controlled action(s)?

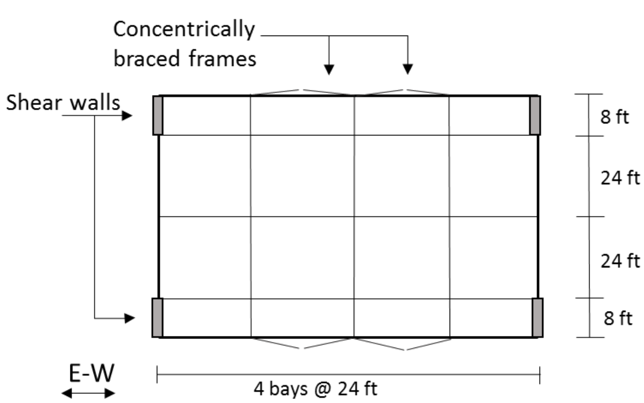
(c) Outline all the steps and checks you would make in designing your system in the order in which you would complete them.

(d) Determine the external forces on your lateral system.

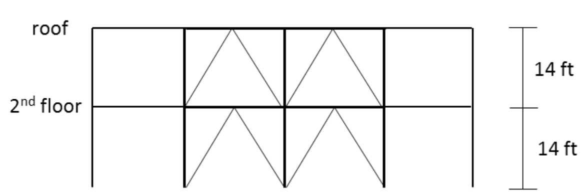
(e) Compete only one of the following:
For the concrete shear walls: for ONE wall, design the thickness of the wall and all necessary reinforcement. Show the design in a neat sketch. You do not need to design anchorage reinforcement.

For the steel concentrically braced frame: (i) Select square HSS braces for each floor. Use nominal dimensions for calculations and the Euler buckling load in lieu of the code formulae. (ii) What are the range of design forces on the columns of the braced frame?

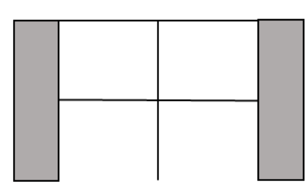
Clearly label all steps and state all assumptions made.



PLAN



E-W ELEVATION



N-S ELEVATION