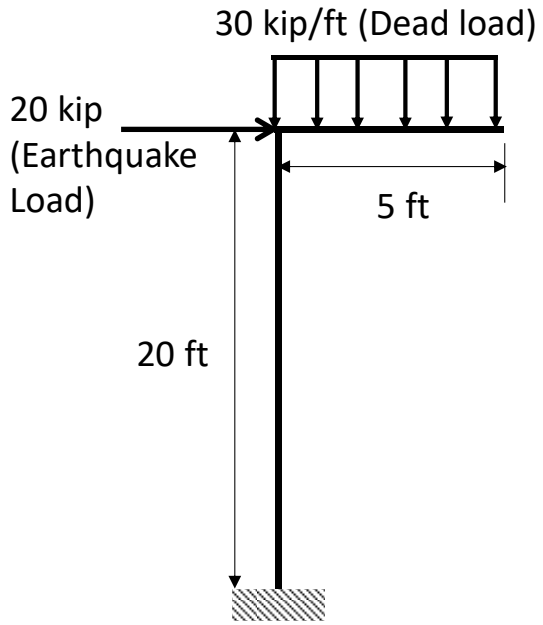
UNIVERSITY OF CALIFORNIA, BERKELEY Dept. of Civil and Environmental Engineering
Spring Semester 2017 Structural Engineering, Mechanics and Materials

Ph.D. Preliminary Examination: Design

Consider the frame shown below subjected to dead load and earthquake loading. Ignore the self-weight and select your material (steel or reinforced concrete) as you prefer making use of the information given below. All loads are unfactored. Use factored load combinations in your design. According to your chosen material, design the column either as a R/C column or a steel column. For the concrete case use a reinforced concrete square section. For the steel case, use a box section. The beam design is not part of this problem. You do not need to consider buckling in the column design. Justify any assumptions you may make.

After designing the column, compute the horizontal deflection at the column under the given unfactored (service) forces assume *linear elastic response* in your calculation. The horizontal deflection should be limited to 1/1000 of the column height because of the presence of important drift-sensitive nonstructural components. If the calculated deflection is larger than this limit, comment (without calculations) on how the deflection can be reduced.



STEEL	CONCRETE
Steel: Fy=36 ksi, Fu=58 ksi	Steel rebars: Fy=60 ksi; Concrete: f'c=4,000 psi

Student's Name (Please Print) _____

University of California at Berkeley
Department of Civil and Environmental Engineering

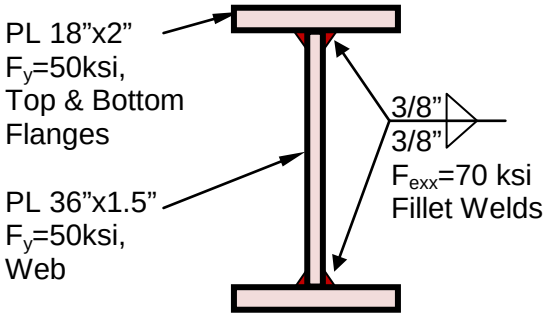
FALL 2016
SEMM

Doctoral Preliminary Examination: Design

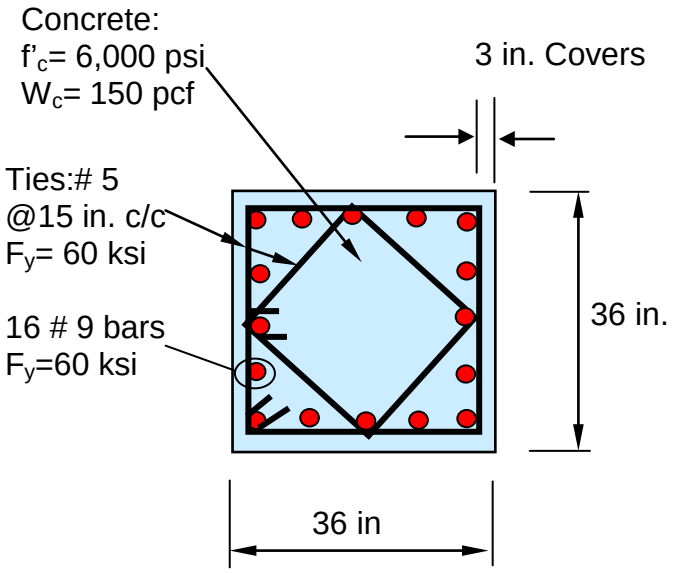
Important Note: All the information you need to do the problem below is provided. If you need any information that is not provided, you need to use a value and explain your reason for using the value. No questions can be asked during the exam.

a. Consider all failure modes of the R/C column and steel girder and calculate the maximum factored load P_u for the structure shown.

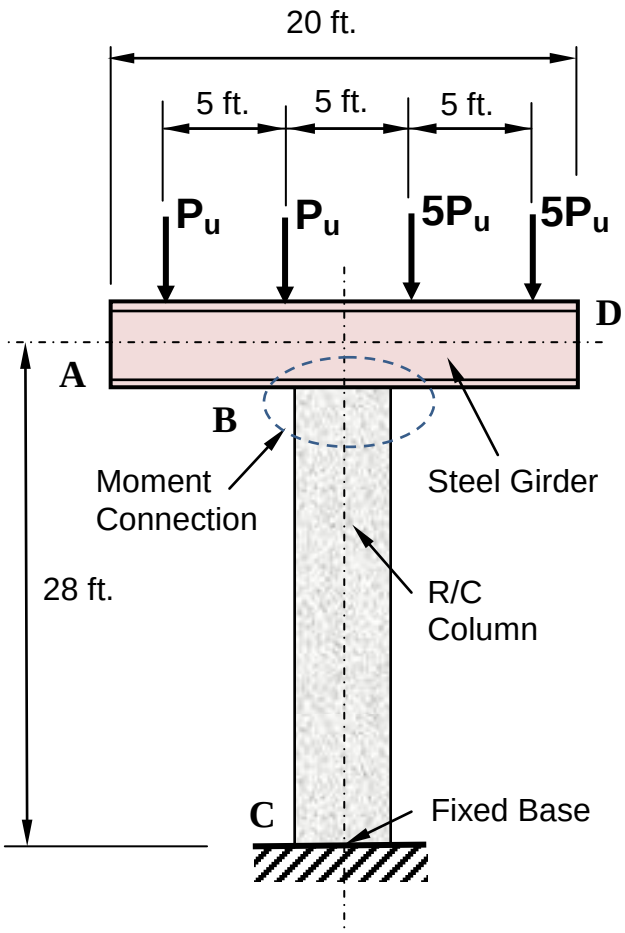
b. Using the value of the P_u calculated in part "a" design the moment connection at B between the steel girder and the R/C column. Show the calculations and detail of the connection on a neat sketch.



CROSS SECTION OF THE STEEL GIRDER



CROSS SECTION OF THE R/C COLUMN



THE STRUCTURE

University of California, Berkeley
Department of Civil and Environmental Engineering
Structural Engineering, Mechanics and Materials

PRELIMINARY EXAMINATIONS- FALL 2015

DESIGN Question

Consider the propped shear wall shown in the figure. The wall is subjected to earthquake lateral forces (E) as shown. The Dead Load (DL) and Live Load (LL) of each floor supported by the shear wall are also given. All loads given (i.e. E, DL and LL) are service loads (not factored).

You are required to do only the following:

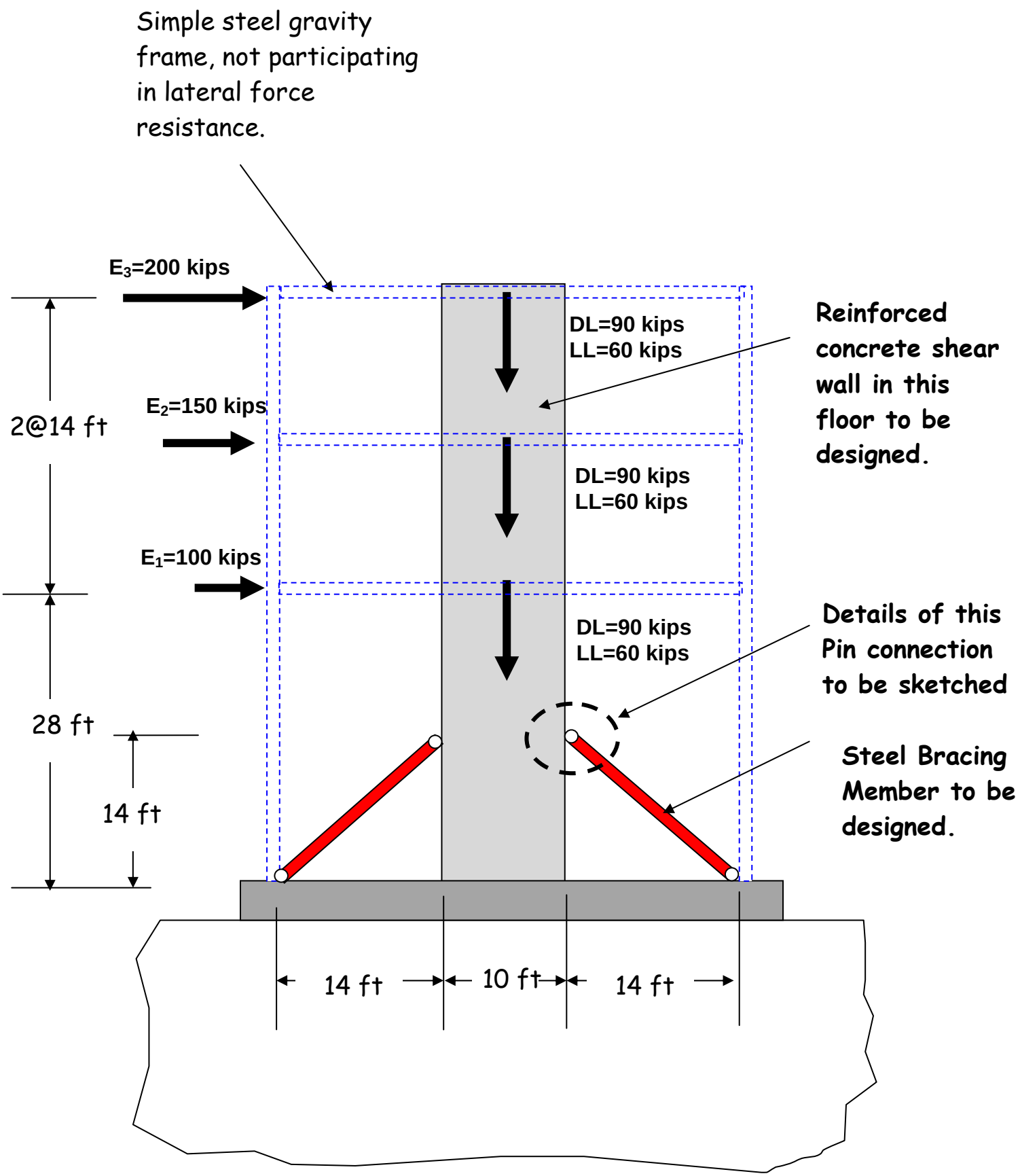
1. Design the necessary thickness of the reinforced concrete shear wall as well as all the necessary reinforcement for this wall to resist the applied loads. Make reasonable assumptions about all parameters of design, and material properties and explain all your assumptions and why you made those assumptions.

2. Design the steel pipe bracing (both braces will have the same pipe section). Both ends of the braces are pin-connected to the concrete wall and concrete foundation. Again make all assumptions you need in your design and explain the basis for your assumptions.

3. Draw a clear sketch showing the details of the pin connection of the steel tube bracing to the reinforced concrete shear wall.

4. List failure modes of the pin-connection in Item 3 above that you would check if you had enough time to do the actual design of the pin connection.

All of the information you need for this problem are given. Still, if you feel you need a piece of information that is not given, make a reasonable assumption and continue the problem. No questions can be asked during the exam. You can use approximate equations if you do not remember the exact equations, but, you have to explain the approximation and how that approximation might affect your design. A portion of the grade will be assigned to how reasonable your assumptions were and how well you have explained the justification of your assumptions.


Simple steel gravity frame, not participating in lateral force resistance.
E3=200 kips
E2=150 kips
E1=100 kips
DL=90 kips
LL=60 kips
DL=90 kips
LL=60 kips
DL=90 kips
LL=60 kips
Reinforced concrete shear wall in this floor to be designed.
Details of this Pin connection to be sketched
Steel Bracing Member to be designed.
2@14 ft
28 ft
14 ft
14 ft
10 ft
14 ft

Student's Name (Please Print) (Last:) _____(First:)_____

Structural Engineering Mechanics and Materials
Department of Civil and Environmental Engineering, University of California at Berkeley
Spring Semester 2015

Preliminary Examination- Design Question

Important Note: All the information needed to do this problem are given below. If you still think there is an item that you need and is not given, or an equation that you need to use but do not remember, please make an assumption, explain your assumption and use your assumed value or equation and continue your solution. No questions can be asked or answered during this exam.

Problem:

Consider the gable frame shown below subjected to gravity, wind and crane loads. Ignore the self weight and select your material as you see fit and explain why you selected a particular steel or concrete material. All loads are unfactored loads. Use factored load combinations in your design.

Design the Column AB as a R/C column. Beam design is not part of this problem. For concrete case use a reinforced concrete square section. Then design the column as a steel box column. For steel case use a welded square steel box section made of four plates with the same thickness.