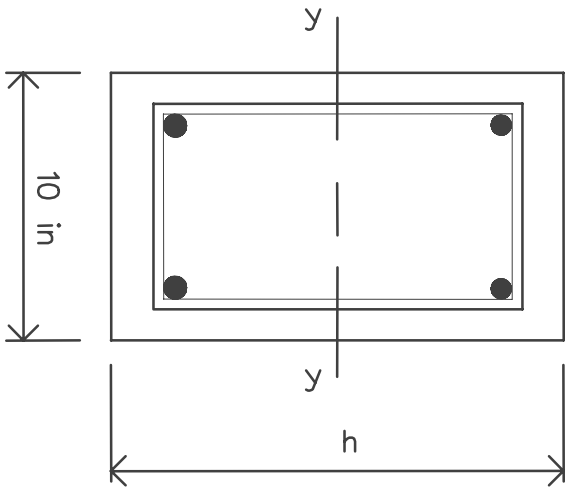
1) (30 Points) Analysis of a short column and tie selection

f'_c = 3000 psi, f_y = 60,000 psi, Interior conditions

a) Using the ACI interaction curves, design a short tied column to carry loads of P_u = 380 kips and M_u = 90 ft-kips. Bending around the y-y axis.
b) Determine the load P_b, moment M_b and the corresponding e_b for balanced failure.
c) Determine the minimum required tie size, and the required tie spacing.



2) (25 points) Wall footing.

f'_c = 3000 psi, f_y = 60,000 psi

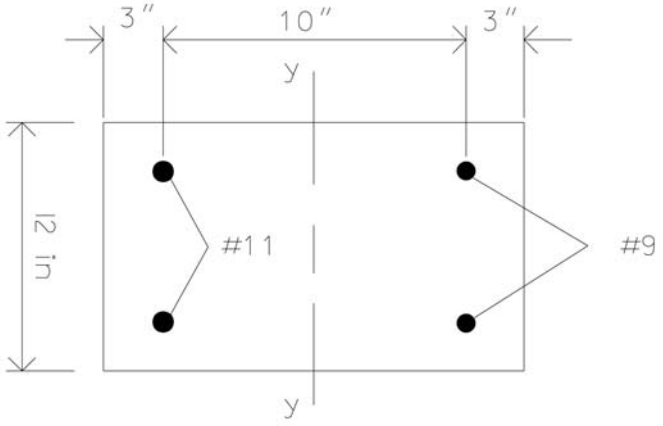
A continuous strip footing is to be located concentrically under a 12 inch thick wall that delivers service loads D 25,000 lb/ft and L = 15,000 lb/ft to the top of the footing. The bottom of the footing will be 4 feet below the final ground surface. The soil has a density of 120 pcf and allowable bearing capacity of 8000 pcf.

a) Determine the required width of the footing,
b) The required effective and total depths, of the footing, based on shear,
c) And, the required flexural steel area.

3) (25 Points) Short Column Analysis

f'_c = 4000 psi
f_y = 60,000 psi

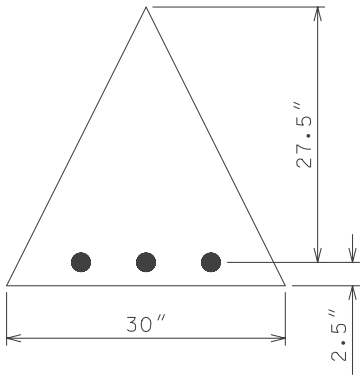
a) Determine whether the column cross-section can safely carry an axial load of P_u = 300 kips and M_u = 180 ft-kips, bending around its y-y axis.
b) In which direction of bending, around the y-y axis, can the column handle the largest axial and bending loads? Why?



4) (20 Points) Flexural Steel Design

f'_c = 4000 psi
f_y = 60,000 psi
Interior conditions

a) Determine the area of flexural steel required by the ACI Code if the triangular cross section must carry a moment M_u = 145 ft-kips.



5) (20 Points) Flexural Steel Design

f'_c = 4000 psi
f_y = 60,000 psi
Interior conditions

a) Design a rectangular reinforced concrete beam to resist a total design moment M_u of 133 ft-kips. (This includes the moment due to beam weight.) Architectural considerations require that the width (b) be 11 ½" and the overall depth (h) be 23".
b) Sketch your design.

6) (20 Points) Flexural Steel Design

f'_c = 3000 psi
f_y = 60,000 psi
Interior conditions

The floor beam shown is on a simple span of 16 ft. The beam supports non-structural elements likely to be damaged by large deflections. The service loads are 0.6 kip/ft dead load (does not include the beam weight) and 1.40 kips/ft live load. Assume that the live load is 60% sustained for 6-month periods. (Neglect shear calculations)

a) Check the beam for deflections.
b) If the beam is unsatisfactory, redesign it so that it meets both flexural strength and deflection requirements.