CMCE New York City College of Technology
Construction Management & Civil Engineering Technology

CMCE 2415 Elements of Structural Design - Concrete
Assignment 1: Free Beam Design

Purpose: To apply techniques learned to the design of a rectangular reinforced concrete beam for moment.

Directions:
The proposed building is a two-story commercial office building. At this stage as a professional engineer, you should design main girder (beam) at roof for just one span, according the information provided in the following:

Design Criteria:

- Roof area is 60'x80'.
- In 60' direction, there are 4 columns, which have divided the width of the roof to 3 equal spans.
- In 80' direction, there is just one span (No column in between).
- ALL CONCRETE CONSTRUCTION SHALL BE NORMAL WEIGHT STONE AGGREGATE HAVING A MINIMUM COMPRESSIVE STRENGTH, f'C = 4000 PSI AT 28 DAYS.
- ALL REINFORCING SHALL BE NEW, DEFORMED BILLET STEEL CONFORMING TO ASTM A615 GRADE 60 WITH A MINIMUM YIELD OF 60,000 PSI.
- Assume that each span is separate from others, and simply supported.
- You can ignore the width of columns, in order to find the L of span.
- Roof Loads: (The loads listed below are SERVICE loads. Be sure to use appropriate factors).

- Roof live load, "Lr".....55 psf

- Roof Dead Loads:

  i. Mechanical, electrical & lighting.....15 psf

  ii. 3⁄4" acoustical hung ceiling (below roof framing).....10 psf

  iii. Roof insulation, membrane.....15 psf

  iv. Concrete weight……..……...88 psf

Hints:

- The total loads of beam after applying appropriate factors should be divided by two for each main girder.
- There are 3 equal spans in each girder, so the design load of the desired beam is 1/3 of the load of its girder.

Submission: Each student is required to submit the following:

- Design the flexural reinforcing for b=14".
- Redesign the beam by changing the beam width to 16" and compare two designs. Use the free beam design method.
- Cover Sheet – include your name, course number and name, title of assignment and. The cover is to be typed on white 8.5"x 11" paper.
- Calculations – are to be done by hand on 8.5" x 11" engineering paper. Please provide a final sketch of your design (ex: beam height, width, reinforcement, and cover).

Due: This project is DUE on Oct 18th 2012. NO LATE!