

Plates

Problem 1.

If $L_B = 1.8 \times L_A$, determine:

- What should be the ratio of the moment of inertia of the two beams in order to take the same load ($P_B = P_A$), if they are made of the same material?
- What should be the ratio of the moment of inertia of the two beams in order for the shorter beam to take 4 times the load of the long beam ($4P_B = P_A$), if they are made of the same material?
- In order to make a better use of the material, both beams should have the same maximum stresses. What should be the ratio of the moment of inertia of two beams so they are stressed equally ($f_B = f_A$), if they are made of A36 steel?

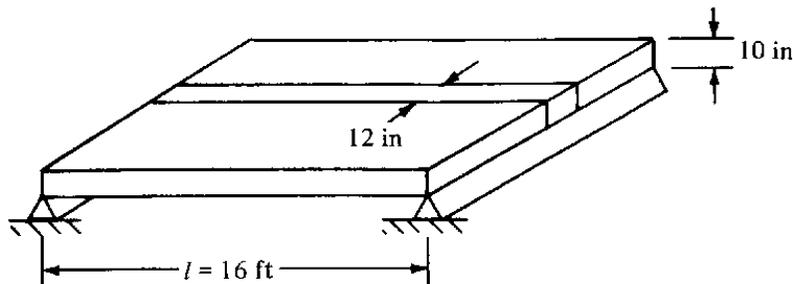
Assume that both beams have the same end conditions.

Problem 2.

Design the reinforcement of a one-way reinforced concrete plate with the following characteristics:

Length: 16 ft, thickness: 10 inches (effective depth 7.5 inches), width: 10 ft, concrete 3 ksi, steel 40 ksi, uniform live load: 50 psf. Consider the dead load as well.

Hint: design it as a beam for flexure and also consider temperature/shrinkage steel in both directions.

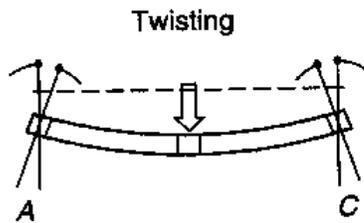
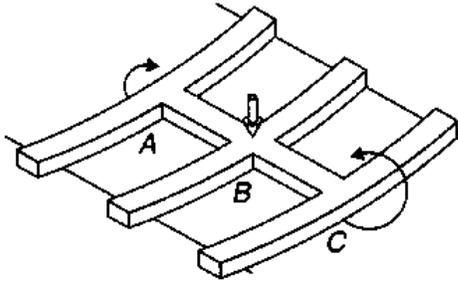


Problem 3.

Analyze the structure below that measures in plan 20 ft by 20 ft. Assume that the beams are W8x18 and they are rigidly connected. Beams A, B and C are simply supported. The load is 20 kips.

- Determine the deflections and rotations at all points, as well as the bending moment diagram.
- Then, modify the section of the transverse beam to W16x40 (much stiffer) to study the deflections and bending moments.
- Finally, reduce the section of the transverse beam to W4x13 (much softer) to study the deflections and bending moments. How do they change compared to the results of the previous two questions? Why are they different?

- d. For all the questions, examine the effect of the dead weight of the steel structure. Does it make a significant difference in the results?



Problem 4.

Design a reinforced concrete square flat plate for a residential building, 18'x18'. What is the required depth of the slab and what is its weight?