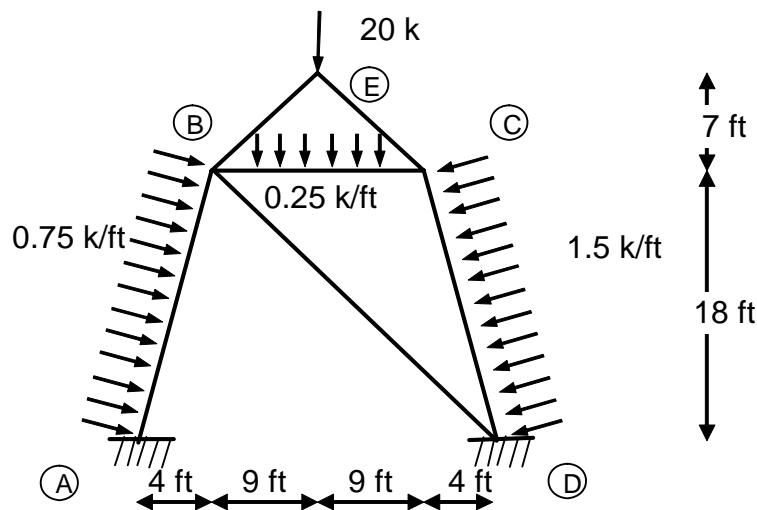


(Due Dec. 7th, in class or at 4:30 in More 233)

You may work in groups of two to complete this assignment. Turn in only one assignment per group. Place the names of both group members on the assignment.

Problem 1. Consider the tunnel structure shown below. Frame members AB, BC and CD resist soil pressure, which for simplicity, will be treated as a uniform load on each member. The loads differ, because of the potential earthquakes that might occur at the site. These frame members are W16x26 steel sections with $E = 29,000$ ksi, $I = 301$ in⁴, depth = 15.69 in. and $A = 7.68$ in².

Members BE and CE are truss members that support a 30-kip downward load to joint E. Both members have $E = 29,000$ ksi, $I = 0$ in⁴ and $A = 4$ in². Truss member BD was added to the structure to stiffen it. It has the same cross-sectional properties as Members BE and CE.



Neglect the weight of the members, and assume that the sections will not buckle. Note that, in practice, bracing might be needed to prevent some members from buckling.

- Using the direct stiffness method (as discussed in the class spreadsheet example), compute the displacement and rotations of the joints.
- Using the sign convention discussed in class, draw the axial load diagram for all the members. Show the diagrams on a sketch of the structure.
- Using the sign convention discussed in class, draw the shear diagram for the frame members (AB, BC, CD).
- Using the sign convention discussed in class, draw the bending moment diagram for the frame members (AB, BC, CD).
- Neatly sketch the deflected shape for the structure.

PROBLEM 2. The owners would prefer that brace BD be removed to allow more room for traffic in the tunnel. Repeat Problem 1 with member BD removed from the structure. In other words, set $A=0$ for that member in your spreadsheet, and repeat Problem 1.

PROBLEM 3. Identify in which ways, the calculated axial force, shear and bending moment diagrams, as well as the deflected shapes, differ significantly between problems 1 and 2.