

Homework #1

Due: Wed, Feb 19, 2003

1) A cable must support five point loads weighing 100 kN each. Draw the force polygon and determine the shape of the cable if the horizontal component of cable force is 300 kN. (Use the load line below, where 1 cm = 100 kN.) Now draw a new force polygon with the horizontal force component of 1200 kN and determine the shape of the cable based on the new force polygon. What do you notice about the geometry of the cable in each case? How does the sag of the cable change in relation to the horizontal component of force in the cable?

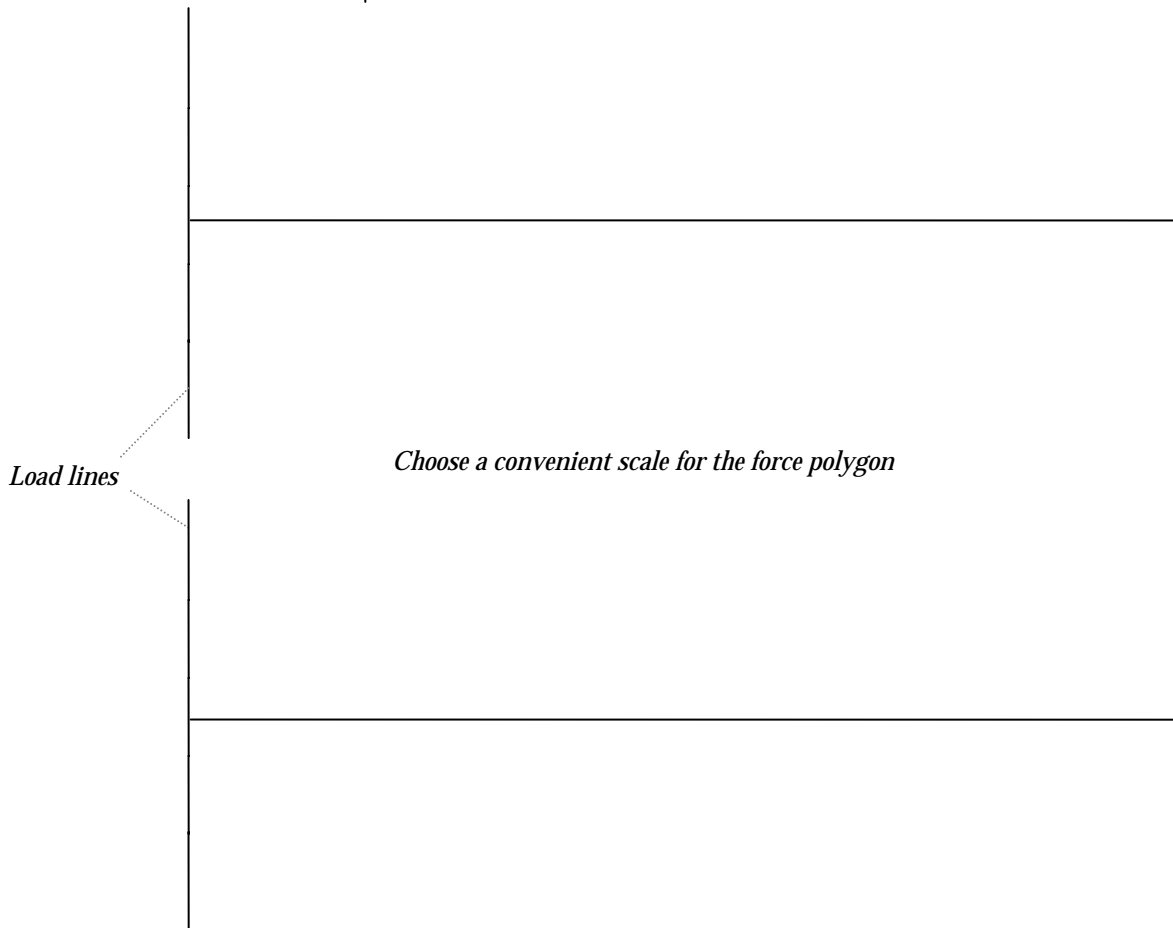
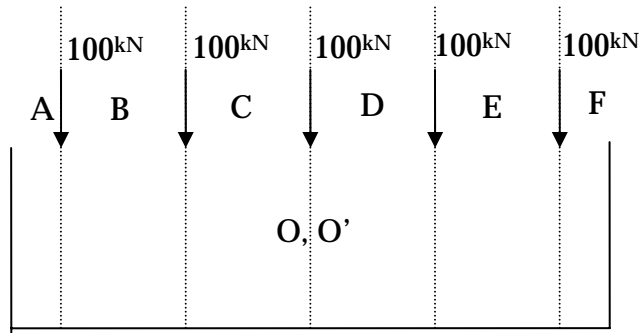


Figure 1.

2) As the structural guru in Gehry's office, you must propose a system for carrying column loads over a truck loading zone in the basement of a new building. The inclined columns carry the weight of five stories above and this load must be transferred over an open space as illustrated in Figure 2. Each column carries an axial load of 400 kips and is inclined at a slope of 4:1 as shown.

- Label the problem using Bow's notation to facilitate a graphical solution.
- On a separate piece of paper, draw the load line for the problem using the loads given in Figure 2. (You may choose to draw the force polygon at a convenient scale.)
- Using graphic statics, propose a structural solution in axial compression for the problem which does not interfere with the zone marked by a dashed line in Figure 2. Your arch must be supported on the granite foundation beneath the building and should be horizontal at the crown of the arch. Sketch your design on Figure 2. (Note: you may wish to experiment with several trial pole locations before deciding on the final form.)
- Based on the force polygon for this problem, which element of the arch carries the highest load? Using concrete with an allowable stress of 3,000 psi (3 kips/in²), what is the minimum required cross-sectional area? (Recall that stress is force/area.)
- Based on the results of (d), propose a suitable cross-section for this part of your arch.
- In terms of construction, name one advantage and one disadvantage to your proposed system.

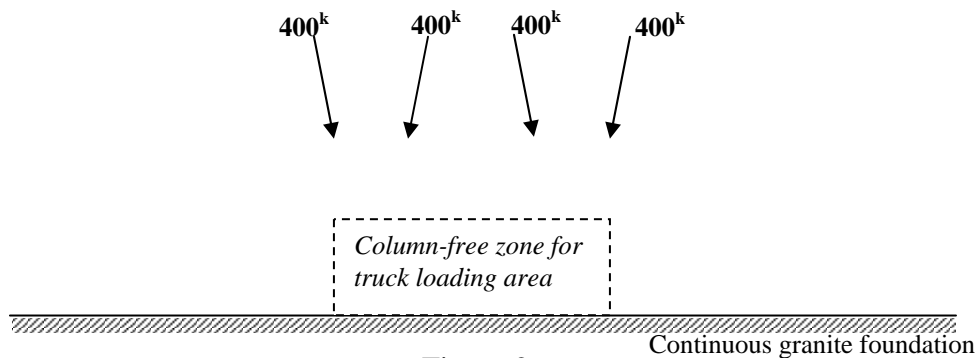


Figure 2