ENCE 353 Homework 5

Due date: October 23, 2013.

Question 1: 10 points

Figure 1 shows an elevation view of a pre-fabricated steel building frame that is subject to a variety of snow and wind loadings.

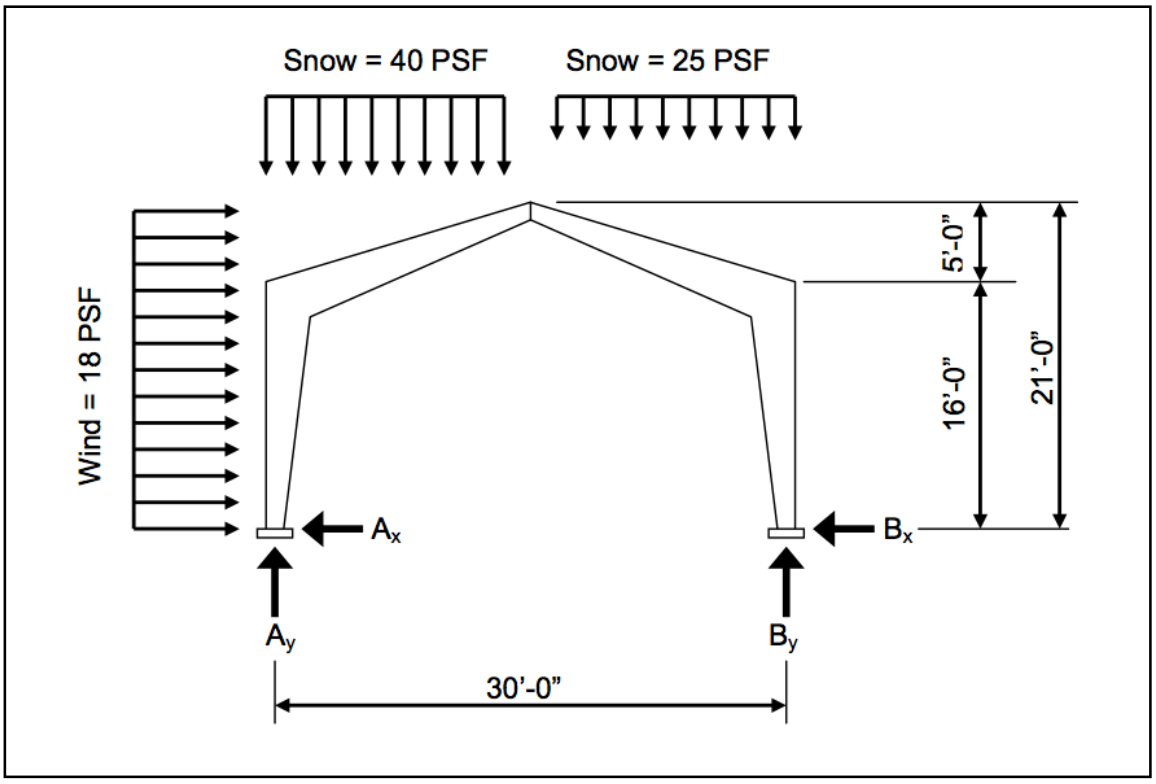

Figure 1: Elevation view of pre-fabricated steel building frame subject to snow and wind loadings.

Assuming that the frames are spaced at 20 ft centers, and that the foundation-level supports and roof apex are pinned (i.e., the frame can be modeled as a three-pinned arch), compute the vertical and horizontal reactions at the base supports.

Question 2: 10 points

The cable structure shown in Figure 2 carries a uniform load w_o N/m along its entire length.

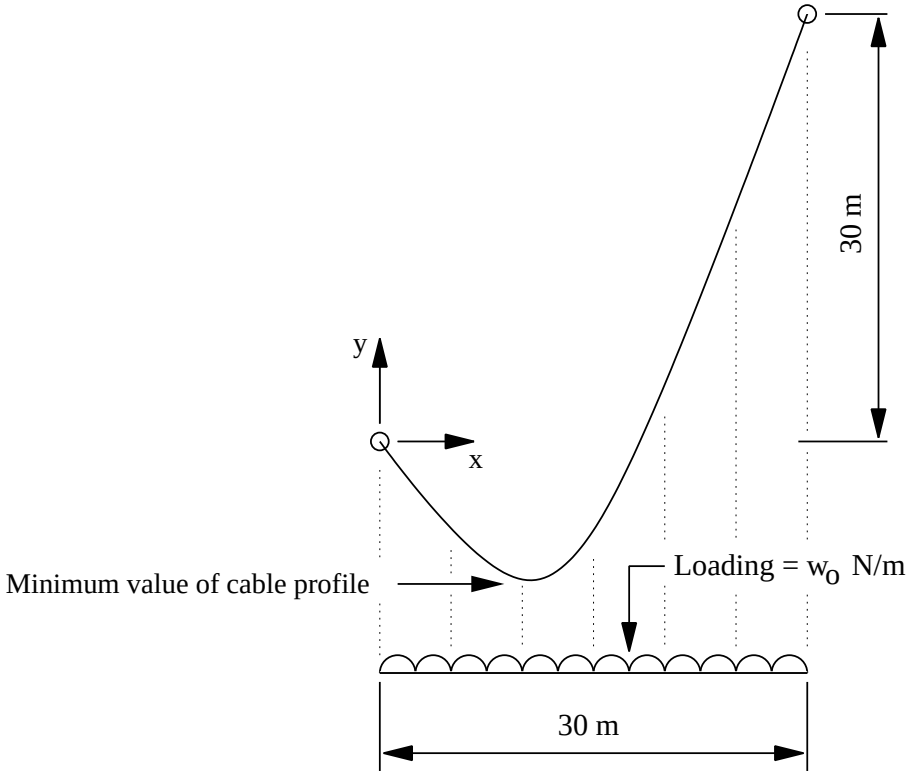

Figure 2: Elevation view of a pedestrian swing bridge.

[2a] Starting from first principles (i.e., the differential equation), show that cable profile is given by the equation

$$y(x) = \frac{w_o x^2}{2H} + \left(1 - \frac{15 w_o}{H}\right) x. \tag{1}$$

Now let us assume that the minumum value of the cable profile occurs at x = 10.

[2b] Show that the horizontal cable force is:

$$H = 5 w_o. \tag{2}$$

[2c] Derive a simple expression for the maximum tensile force in the cable.

Question 3: 10 points

An inclined pedestrian walkway is supported by two identical cables and a system of closely space hangers. The cable towers are 40 m apart with one 4 m higher than the other. One end of the walkway is 5 m below the cables at the high tower and 3 m below the cables at the low tower.

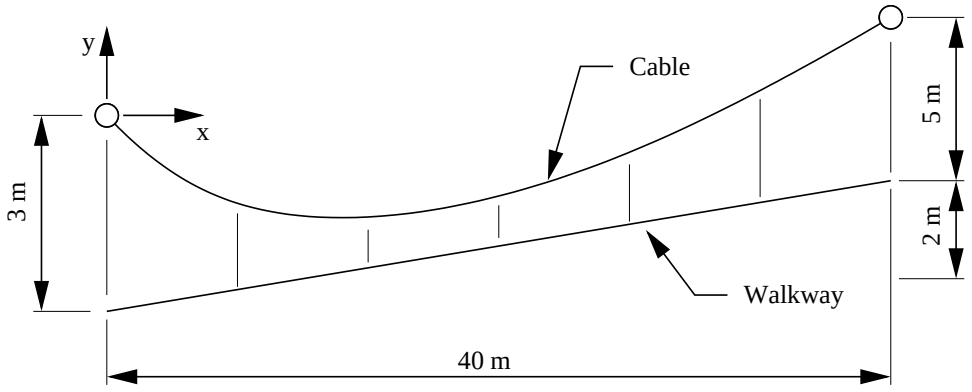

Figure 3: Schematic of walkway dimension (not to scale).

If the smallest possible hanger is 1 m long, and the walkway weighs 5 kN/m, determine:

1. H, the horizontal component of force in the cable?

2. The maximum force in the cable?

3. The length of the cable?