

Algebra/Geometry: Utility Facility Representative

Idaho Power

Job Description: Design and layout overhead and underground power lines.

Problem:

Determine the downward force (V) exerted on the pole by a down guy holding 3 conductors and determine the tension on the guy wire.

$$V \text{ (Vertical Force)} = \frac{\text{\#of conductors} \times T}{\tan \beta}$$

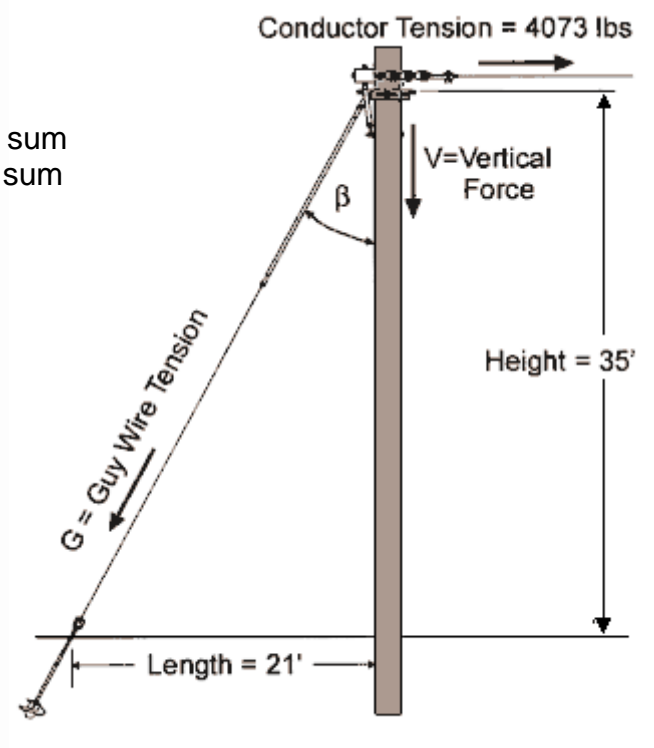
$$G \text{ (Guy Wire Tension)} = \frac{\text{\# of conductors} \times T}{\sin \beta}$$

T = Tension of each conductor = 4,073 lbs

H = Height of attachment = 35 ft

L = Length of anchor lead = 21 ft

Because this is a static system, the sum of the horizontal forces = 0 and the sum of the vertical forces = 0.



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See problem for details.

Solution:

Step one:

Determine β :

$$\tan \beta = \frac{\text{opposite}}{\text{adjacent}} = \frac{21'}{35'} = 0.6$$

$$\beta = \tan^{-1}(0.6) = 31^\circ$$

Step two:

Determine the guy wire tension G

We can get G by summing the horizontal forces.

ΣF (horizontal direction) = 0 because the system is static.

$$-G \sin \beta + 3(4073 \text{ lbs}) = 0$$

$$G = \frac{3 \times 4073 \text{ lbs}}{\sin \beta} = \frac{12219}{\sin 31^\circ}$$

$$G = 23,750 \text{ lbs}$$

Step three:

Determine the vertical force V :

We can get the compression force on the pole by summing the forces in the vertical direction.

ΣF (vertical direction) = 0 because the system is static.

$$-G \cos \beta + V = 0$$

$$V = G \cos \beta = 23,750 \text{ lbs} * \cos 31^\circ = 20,358 \text{ lbs}$$

