

### Material properties:

$$E := 14503 \text{ ksi}$$

$$A := 0.155 \text{ in}^2$$

### Geometry:

$$L_x := 16.4 \text{ ft}$$

$$H_o := 1.64 \text{ ft}$$

### Loading:

$$P_y := 2.25 \text{ kips}$$

### Design:

$$L_i := \sqrt{L_x^2 + H_o^2} \quad L_i = 16.48 \text{ ft}$$

$$R_h := \frac{L_x}{H_o} \cdot \frac{P_y}{2} \quad R_h = 11.25 \text{ kips}$$

$$R_y := \frac{P_y}{2} \quad R_y = 1.125 \text{ kips}$$

$$\text{Axial Force: } P := \sqrt{R_h^2 + R_y^2} \quad P = 11.31 \text{ kips}$$

$$\Delta := \frac{P \cdot L_i}{A \cdot E} \quad \Delta = 0.995 \text{ in}$$

$$L_2 := L_i - \Delta \quad L_2 = 16.399 \text{ ft}$$

Therefore, the struts will snap through

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$$\theta_o := \operatorname{atan}\left(\frac{H_o}{L_x}\right) \quad \theta_o = 0.09967 \quad \tan(\theta_o) = 0.100000$$

$$\theta_e := \operatorname{atan}\left(\frac{H_e}{L_x}\right)$$

$$R_{he} := \frac{P_y}{2} \cdot \frac{L_x}{H_e}$$

$$\text{Axial Force: } P_e := \sqrt{R_{he}^2 + R_y^2} \quad R_{he} := \sqrt{P_e^2 - R_y^2}$$

$$\Delta_e := \frac{P_e \cdot L_i}{A \cdot E} \quad P_e := \frac{\Delta_e \cdot A \cdot E}{L_i}$$

$$L_e := L_i + \Delta_e \quad \Delta_e := L_e - L_i$$

$$L_e := \sqrt{L_x^2 + H_e^2}$$

$$H_e := \frac{P_y}{2} \cdot \frac{L_x}{R_{he}}$$

$$H_e := \frac{P_y}{2} \cdot \frac{L_x}{\sqrt{P_e^2 - R_y^2}}$$

$$H_e := \frac{P_y}{2} \cdot \frac{L_x}{\sqrt{\left(\frac{\Delta_e \cdot A \cdot E}{L_i}\right)^2 - R_y^2}}$$

$$H_e := \frac{P_y}{2} \cdot \frac{L_x}{\sqrt{\left[\frac{\left[\left(\sqrt{L_x^2 + H_e^2}\right) - L_i\right] \cdot A \cdot E}{L_i}\right]^2 - R_y^2}}$$

$$\text{Given} \quad x - \left[ \frac{P_y}{2} \cdot \frac{L_x}{\sqrt{\left[ \frac{\left( \sqrt{L_x^2 + x^2} - L_i \right) \cdot A \cdot E}{L_i} \right]^2 - R_y^2}} \right] = 0 \text{ in} \quad H_e := \text{Find}(x)$$

$$H_e = 2.18 \text{ ft}$$

$$\theta_e := \text{atan}\left(\frac{H_e}{L_x}\right) \quad \theta_e = 0.1322$$

$$R_{he} := \frac{P_y}{2} \cdot \frac{L_x}{H_e} \quad R_{he} = 8.46 \text{ kips}$$

$$\text{Axial Force: } P_e := \sqrt{R_{he}^2 + R_y^2} \quad P_e = 8.53 \text{ kips} \quad R_{he} := \sqrt{P_e^2 - R_y^2}$$

$$\Delta_e := \frac{P_e \cdot L_i}{A \cdot E} \quad \Delta_e = 0.06 \text{ ft} \quad P_e := \frac{\Delta_e \cdot A \cdot E}{L_i} \quad P_e = 8.53 \text{ kips}$$

$$L_e := L_i + \Delta_e \quad L_e = 16.54 \text{ ft} \quad \Delta_e := L_e - L_i \quad \Delta_e = 0.06 \text{ ft}$$

$$L_e := \sqrt{L_x^2 + H_e^2} \quad L_e = 16.54 \text{ ft}$$

$$H_e := \frac{P_y}{2} \cdot \frac{L_x}{R_{he}} \quad H_e = 2.18 \text{ ft}$$

$$H_e := \frac{P_y}{2} \cdot \frac{L_x}{\sqrt{P_e^2 - R_y^2}} \quad H_e = 2.18 \text{ ft}$$

$$H_e := \frac{P_y}{2} \cdot \frac{L_x}{\sqrt{\left( \frac{\Delta_e \cdot A \cdot E}{L_i} \right)^2 - R_y^2}} \quad H_e = 2.18 \text{ ft}$$

$$\frac{P_e}{A} = 55.06 \text{ ksi}$$

$$\Delta_{\text{final}} := H_e + H_o \quad \Delta_{\text{final}} = 3.82 \text{ ft}$$