CCA Structures

Project 3

Example Calculations

Note: Your model will have different dimensions than this example tower. Use straws, string, hot glue, epoxy resin, rockite, etc.

STEP NO. 1

Draw a sketch of your cantilever structure and indicate all dimensions (similar to sketch shown above).
\[ \sum M_A = 0 \]
\[ 0 = +R_{Bx}(3') - 10\text{ lbs}(31.5') \]
\[ R_{Bx} = \frac{315 \text{ in-lbs}}{3 \text{ in}} = 39.375 \text{ lbs} \]

\[ \sum F_x = 0 \]
\[ 0 = -R_{Ax} + 39.375 \text{ lbs} \]
\[ R_{Ax} = 39.375 \text{ lbs} \quad (\text{pos. away from orig. point}) \]

**STEP NO. 9**

*DRAW SIDE ELEVATION, AND CALCULATE THE REACTIONS AS SHOWN (R_{Ax} \& R_{Bx}) USE THE EQUATION OF EQUILIBRIUM*

\[ T = \frac{39.375 \text{ lbs}}{3} = 13.125 \text{ lbs} \]

*TENSION*
STEP 3:
DIVIDE REACTIONS FROM STEP 2 INTO THE MEMBERS ON YOUR TOP AND BOTTOM ELEVATIONS AS SHOWN.

13,125 lbs \times \frac{10}{1} \rightarrow \text{MEMBER SLOPE}

IF YOUR MEMBERS ARE SLOPING CALCULATE THE FORCE IN YOUR MEMBER.

USE SIMILAR TRIANGLES

\[
H = \sqrt{10^2 + 1^2} = \sqrt{101} \\
H = 10.05
\]
**STEP FOUR:**

**CALCULATE SHEAR IN SIDE DIAGONALS:**

\[
\frac{13.125\, \text{lb}}{F} = \frac{10}{10.05}
\]

\[
F = 13.125\, \text{lb} \times \left(\frac{10.05}{10}\right)
\]

\[
F = 13.125\, \text{lb} \times (1.005)
\]

\[
F = 13.191\, \text{lb}
\]

- Steeper angle would have a greater effect.

**HALF OF 10 lb TO EACH SIDE**
Your slope may be different.
FROM SIMILAR TRIANGLES

\[ \frac{1}{2.5 \text{lb}} = \frac{\sqrt{2}}{F_2} \]

\[ F_2 = 2.5 \text{lb} \sqrt{2} \]

\[ F_2 = 2.5 \times (1.414) \]

\[ F_2 = 3.535 \text{ lb} \]