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ARCH 324 - Structures 2, Winter 2009

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A) FIND THE STRESS AT THE ENDS OF THE BEAM:
- NO MOMENT AT ENDS OF THE BEAM
- ONLY AXIAL FORCES DUE TO CABLES

\[ \Sigma_{\text{AXIAL}} = \frac{f_a}{A} = \frac{53.7\text{ k}}{10\text{ in}^2} = 5.37\text{ ksi} \text{ COMPRESSION} \]

\[ f_a = f_h \quad \frac{f_u}{f_h} = \frac{8}{16} \implies f_u = \frac{1}{2} f_h \]

\[ 60^2 = f_h^2 + f_u^2 \]

\[ f_u = 53.7 \text{ k}, \quad f_v = 26.9 \]

B) FIND THE STRESS IN THE TOP FIBERS OF THE BEAM:

\[ M_{\text{DIST}} = \frac{W L}{8} = \frac{96(32)}{8} = 384\text{ k-ft} \]

\[ M_{\text{POINT}} = \frac{PL}{4} = \frac{53.7(32)}{4} = 429.6\text{ k-ft} \]

\[ M_{\text{DIST}} - M_{\text{POINT}} = 384 - 429.6 = -45.6\text{ k-ft} \]

\[ f_b = \frac{M}{S} = \frac{-457200}{48.6} = -11.259\text{ ksi} \]

\[ f_{\text{TOTAL}} = f_b + f_{\text{AXIAL}} = -11.259 + 5.37 = -5.88\text{ ksi} \text{ TENSION IN TOP FIBERS} \]
c) FIND THE TRUSS CENTERLINE DEFLECTION:

\[ \Delta_{\text{point load}} = \frac{PL^3}{48EI} = \frac{(53.7 \times 1000)(32 \times 12)^3}{(48)(29,000,000)(340)} = 6.43 \text{ in } \uparrow \]

\[ \Delta_{\text{dist. load}} = \frac{5WL^3}{384EI} = \frac{5(96 \times 1000)(32 \times 12)^3}{(384)(29,000,000)(340)} = 7.18 \text{ in } \downarrow \]

\[ \Delta_{\text{total}} = 6.43 - 7.18 = -0.75 \text{ in} \quad \text{DEFLECTION IN THE DOWN DIRECTION} \]