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ARCH 324 - Structures 2, Winter 2009

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Problem 12-2 II

Reactions:
\[ \Sigma M_{R_1} = 0 = 28w(8) - R_2(18) \]
\[ R_2 = 12.44w \]

\[ \Sigma M_{R_2} = 0 = R_1(18) - 28w(10) \]
\[ R_1 = 15.56w \]

\[ \Sigma F_V = 0 \checkmark \]

Transformed Section:
\[ h = \frac{4S}{Ew} = \frac{30}{2} = 15 \]

\[ S = 7.5'' \quad 6'' \quad 7.5'' \]

\[ (1) \text{ Steel} \quad (2) \text{ Wood} \quad (3) \text{ Stone} \]

\[ P_{fr} = \frac{21(10)^2}{12} = 1750 \text{ in}^4 \]
STRAIN COMPATIBILITY:

ASSUME WOOD CONTROLS — CHECK STEEL

\[ E_W = \frac{1.8}{2000} = 0.0009 \quad f_s = E_E = 10000(2000) = 27 \text{ KSI} > 22 \text{ KSI} \]

\[ E_s = \frac{22}{10000} = 0.0027 \quad f_w = E_E = 10000(2000) = 1.4667 < 1.8 \text{ KSI} \]

\[ \therefore \text{ MAX STRAIN OK} \]

FIND MAX ALLOWABLE MOMENTS FOR EACH

\[ f = \frac{M_e}{I}, \quad M = \frac{f I}{E} \]

FOR WOOD

\[ 1.46(1750) / 5 = 513.3 \text{ K}\cdot\text{in} = 42.78 \text{ K}\cdot\text{in} \]

FOR STEEL

\[ 22(1750) / 5 = 513.3 \text{ K}\cdot\text{in} = 42.78 \text{ K}\cdot\text{in} \]

\[ \therefore \text{ MOMENTS AGREE} \]

FIND W:

\[ M = 42.78 = 27.70w \]

\[ w = 1.54 \text{ K}/\text{l} = 48.25 \text{ K TOTAL} \]