ARCH 324 - Structures 2, Winter 2009

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GENERAL EQUATION:

\[ M_B = \frac{3}{L_1 + L_2} \left[ E I \theta_1 + E I \theta_2 \right] \]

\[ M_B = \frac{3}{20 + 30} \times \left[ \frac{P L^2}{10} + \frac{W L^2}{24} \right] = \frac{3}{50} \times \left[ \frac{56(20)^2}{10} + \frac{56(30)^2}{24} \right] \]

\[ M_B = 210 \text{ k-ft} \]

REACTIONS BY SUPERPOSITION:

WITH LOADS:

\[ \begin{align*}
\text{With load:} & \quad 56 \\
\text{At B:} & \quad 28 \\
\end{align*} \]

\[ \begin{align*}
\text{Total:} & \quad 17.5 \uparrow \\
\text{At A:} & \quad 73.5 \\
\end{align*} \]

WITH MOMENT:

\[ \begin{align*}
\text{With moment:} & \quad 210 \uparrow + 210 \uparrow \\
\text{At B:} & \quad 7.0 \uparrow + 7.0 \uparrow \\
\text{Total:} & \quad 21 \uparrow \\
\text{At C:} & \quad 21 \uparrow \\
\end{align*} \]
**PART (A)**

\[ f = 24^{-k} = \frac{M}{S} = \frac{210 \times 12}{S} \quad \therefore S = 105 \]

\[ \therefore \text{USE W24\times55} \quad S_a = 114 > 105 \quad \checkmark \text{OK} \]

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**PART (B)**

\[ M_{span_1} = \frac{PL}{4} = \frac{56(20)}{40} = 280^{\text{in}} \quad \leftarrow \text{CONTROLS} \]

\[ M_{span_2} = \frac{WL}{8} = \frac{56(30)}{8} = 210^{\text{in}} \quad \leftarrow \text{CONTROLS} \]

\[ f = 24 = \frac{280 \times 12}{S} \quad ; \quad S = 140 \]

\[ \therefore \text{USE W21\times68} \quad S_a = 140 \]