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**GIVEN:**

- 6.5' 6.5'
- 5" SLAB
- BEAMS
- 13' 13'
- 60'

**FRAMING PLAN**

D.L + L.L = 200 psf

**EFFECTIVE WIDTH = 90''**

**SECTION**

\[ n = \frac{1}{9} \left[ \frac{E_c}{E_s} \right] \]

- f_{steel} = 24 ksi
- f_{concrete} = 1.35 ksi

**LOADING DIAGRAM.**

\[ W = 156k \]

\[ 2 \omega = 200 \text{ psf} \times 13' = 2600 \text{ psf} \]

\[ l = 60' \]

\[ W = \omega l = 2600 \text{ psf} \times 60' \]

\[ W = 156k \]
2) DETERMINE MOST ECONOMICAL SECTION
(W SHAPE) TO CARRY LOAD

WITHOUT COMPOSITE ACTION

\[ \text{FOR A SIMPLY SUPPORTED} \]
\[ \text{UNIFORMLY LOADED BEAM,} \]

\[ \text{MAX. BENDING MOMENT,} \]
\[ M = \frac{Wl}{8} = \frac{156k \times 60'}{8} \]
\[ \therefore M = 1170k' \]

\[ \text{THUS,} \]
\[ S = \frac{M}{f} = \frac{1170k' \times 12''}{24 ksi} \]
\[ \therefore S = 585 \text{ in}^3 \]

\[ \text{FROM TABLE D-35, FOR } S_x = 585 \text{ in}^3, \]
\[ \text{SECTIONS APPROPRIATE ARE,} \]
\[ W \ 30 \times 191 \quad 598 \text{ in}^3 \]
\[ W \ 33 \times 201 \quad 684 \text{ in}^3 \]
\[ \rightarrow W \ 36 \times 182^* \quad 623 \text{ in}^3 \]

\[ \therefore \text{W 36X182}^* \text{ IS USED.} \]

3) TRANSFORMED SECTION

\[ h = \frac{1}{4} = \frac{E_c}{E_s} \]

\[ \therefore \text{TRANSFORMING THE CONCRETE TO} \]
\[ \text{AN EQUIVALENT AREA OF STEEL BY} \]
\[ \text{REDUCING THE WIDTH WE GET,} \]
4. LOCATION OF NEUTRAL AXIS
   (USING D-28)

   $\bar{x} = \frac{\sum Ax}{\sum A}$

   \[
   \begin{array}{c|c|c}
   A & x & Ax \\ 
   \hline
   50 & 2.5 & 125 \\
   39.7 & 22.75 & 904.1675 \\
   \hline
   \sum A & \sum Ax & 1029.1675 \\
   \hline
   \end{array}
   \]

   $\therefore \bar{x} = \frac{\sum Ax}{\sum A} = \frac{1029.1675}{89.7} = 11.47''$ (from top)

5. TRANSFORMED MOMENT OF INERTIA
   (By Parallel Axis Theorem)

   $I_{TR}$

   \[
   \begin{array}{c|c|c}
   & \frac{I_q}{Ad^2} \\
   \hline
   10 & \frac{bd^3}{12} = \frac{10 \cdot 5^3}{12} = 104.17 \\
   \hline
   I & 7800 & 39.7(11.3)^2 = 5073.78 \\
   \hline
   \end{array}
   \]

   $I_a = I_q + Ad^2$

   $I_a = 104.17 + 4023 = 4127.17$

   $I = 7800 + 5073.78 = 12873.78$

   $I_{TR} = 17000.99 \times 10^4$
STRESSES

\[
M_C = \frac{f_C}{C/n} I_{TR}
\]

\[
M_C = \frac{1.35(17001)}{11.47(1/9)} = 1800.8 \, k" X
\]

\[
M_S = \frac{f_S}{C} I_{TR}
\]

\[
M_S = \frac{24(17001)}{29.08} \rightarrow \text{CONTROLS}
\]

\[
f_S = 24 \, ksi
\]

\[
f_c = \frac{M_C n}{I_{TR}} = \frac{14031.08(11.47)1/9}{17001}
\]

\[
\therefore f_c = 1.052 \, ksi
\]