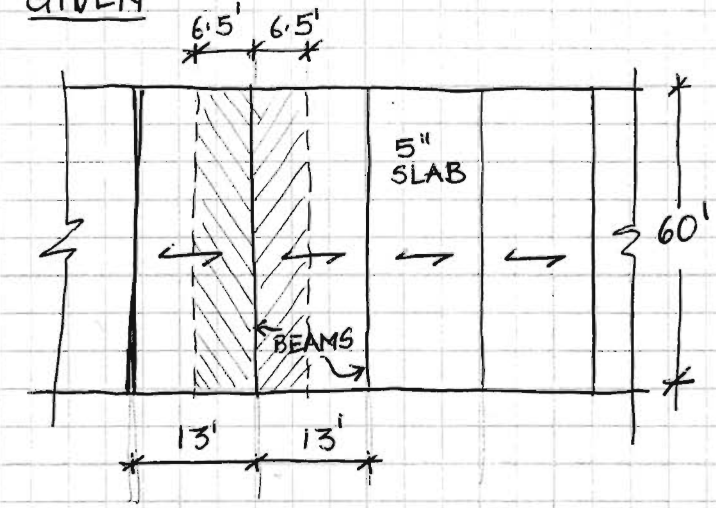
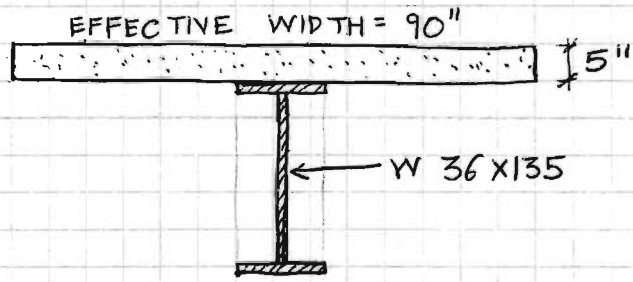
14 - 2 (III)

GIVEN:



FRAMING PLAN

$D.L + L.L = 200$ psf



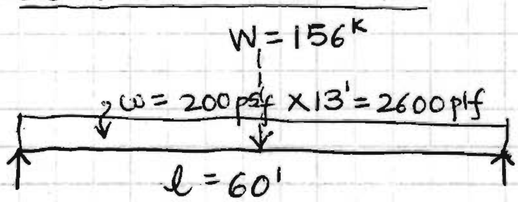
SECTION

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

$f_{steel} = 24$ ksi

$f_{conc} = 1.35$ ksi

① LOADING DIAGRAM.



$W = \omega l = 2600 \text{ plf} \times 60'$

$\therefore W = 156^K$

② DETERMINE MOST ECONOMICAL SEC^n

(W SHAPE) TO CARRY LOAD

WITHOUT COMPOSITE ACTION

∴ FOR A SIMPLY SUPPORTED UNIFORMLY LOADED BEAM,

MAX. BENDING MOMENT,

$$M = \frac{Wl}{8} = \frac{156^{k} \times 60'}{8}$$

$$\therefore M = 1170^{k-'}$$

THUS,

$$S = \frac{M}{f} = \frac{1170^{k-'} \times 12''}{24^{\,ksi}}$$

$$\therefore S = 585 \text{ in}^3$$

FROM TABLE D-35, FOR $S_x = 585 \text{ in}^3$, SECTIONS APPROPRIATE ARE,

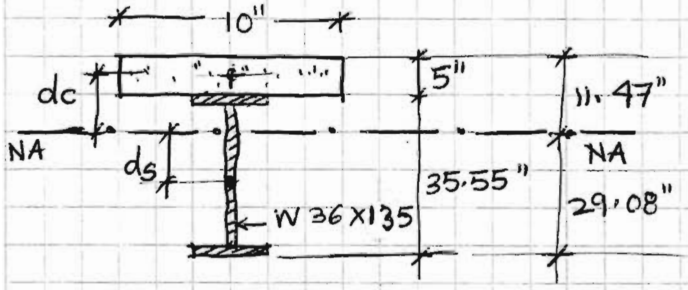
	W 30 X 191	598 in^3
	W 33 X 201	684 in^3
→	W 36 X 182$^{\#}$	623 in^3

THUS 'W 36 X 182' IS USED.

③ TRANSFORMED SECTION

$$n = \frac{1}{9} = \frac{E_c}{E_s}$$

∴ TRANSFORMING THE CONCRETE TO AN EQUIVALENT AREA OF STEEL BY REDUCING THE WIDTH WE GET,



④ LOCATION OF NEUTRAL AXIS
(USING D-28)

ΣAx (using top as base line)

	A	x = Ax
▭	50 in²	2.5" = 125 in³
I	39.7 in²	22.775" = 904.1675 in³

$$\therefore \bar{x} = \frac{\Sigma Ax}{\Sigma A} = \frac{1029.1675}{89.7}$$

$$\therefore \bar{x} = 11.47'' \text{ (from top)}$$

⑤ TRANSFORMED MOMENT OF INERTIA
(By Parallel Axis Theorem)

I_{TR}	Ig	Ad^2
▭ (10 × 5)	$\frac{bd^3}{12} = \frac{10.(5)^3}{12} = 104.17$	$50(11.47-2.5)^2 = 4023$
I	7800	$39.7(11.3)^2 = 5073.78$

$$\therefore I_a = I_g + Ad^2$$

$$I_{a_{\square}} = 104.17 + 4023 = 4127.17$$

$$+ \; I = 7800 + 5073.78 = 12873.78$$

$$\therefore I_{TR} = 17000.99 \text{ in}^4$$

⑥ STRESSES

NOW, $M_c = \dfrac{f_c \; I_{TR}}{c\,n}$

$$M_c = \frac{1.35\,(17001)}{11.47\,(1/9)} = 18008.9^{\,K-''}$$

$$M_s = \frac{f_s \; I_{TR}}{c}$$

$$\therefore M_s = \frac{24\,(17001)}{29.08} = 14031.08^{\,K-''}$$

← CONTROLS

$$\therefore f_s = 24 \text{ ksi}$$

$$f_c = \frac{M\,c\,n}{I_{tr}} = \frac{14031.08\,(11.47)\,1/9}{17001}$$

$$\therefore f_c = 1.052^{\,ksi}$$