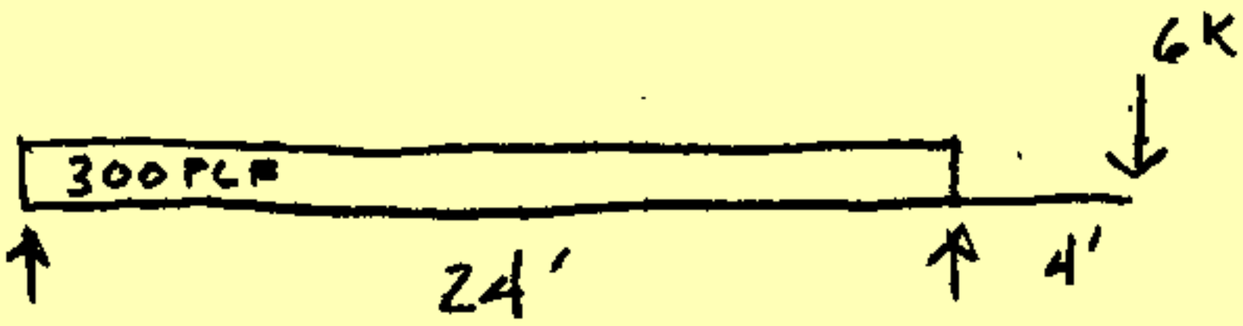
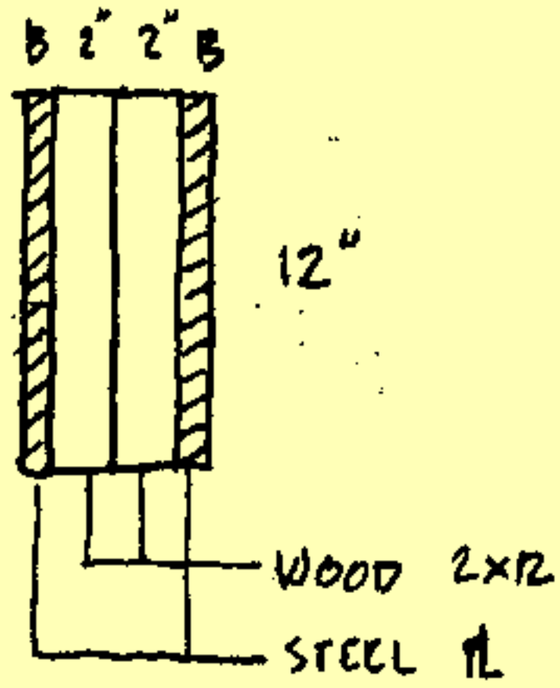
open.michigan





E_{WOOD} 2 000 KSI
E_{STEEL} 30 000 KSI

F_b WOOD 1.5 KSI
F_b STEEL 22.5 KSI

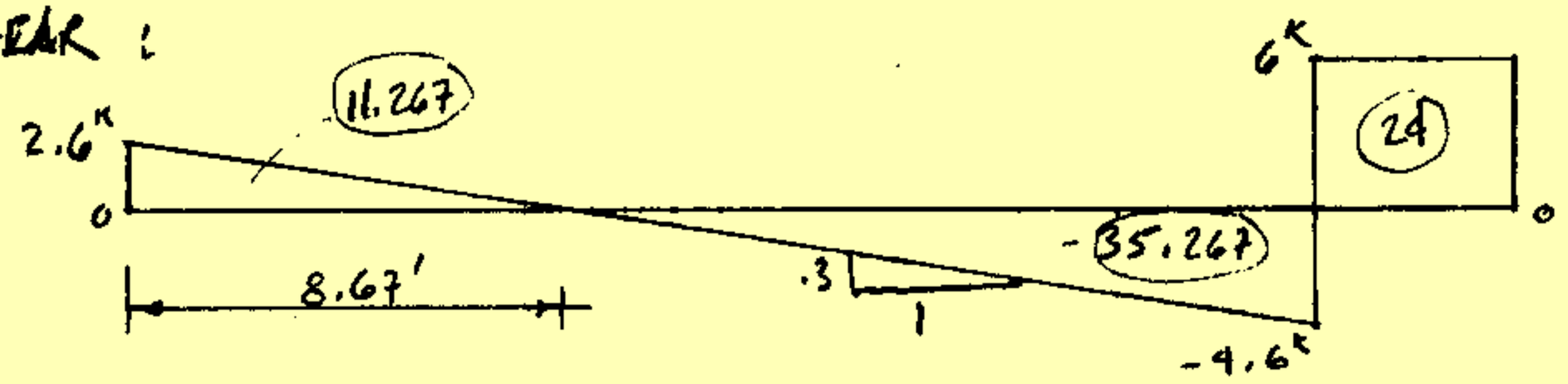
REACTIONS:

$\Sigma M_{R1} = 0 = 7.2(12) - R_2(24) + 6(28)$
$R_2 = 10.6^K$

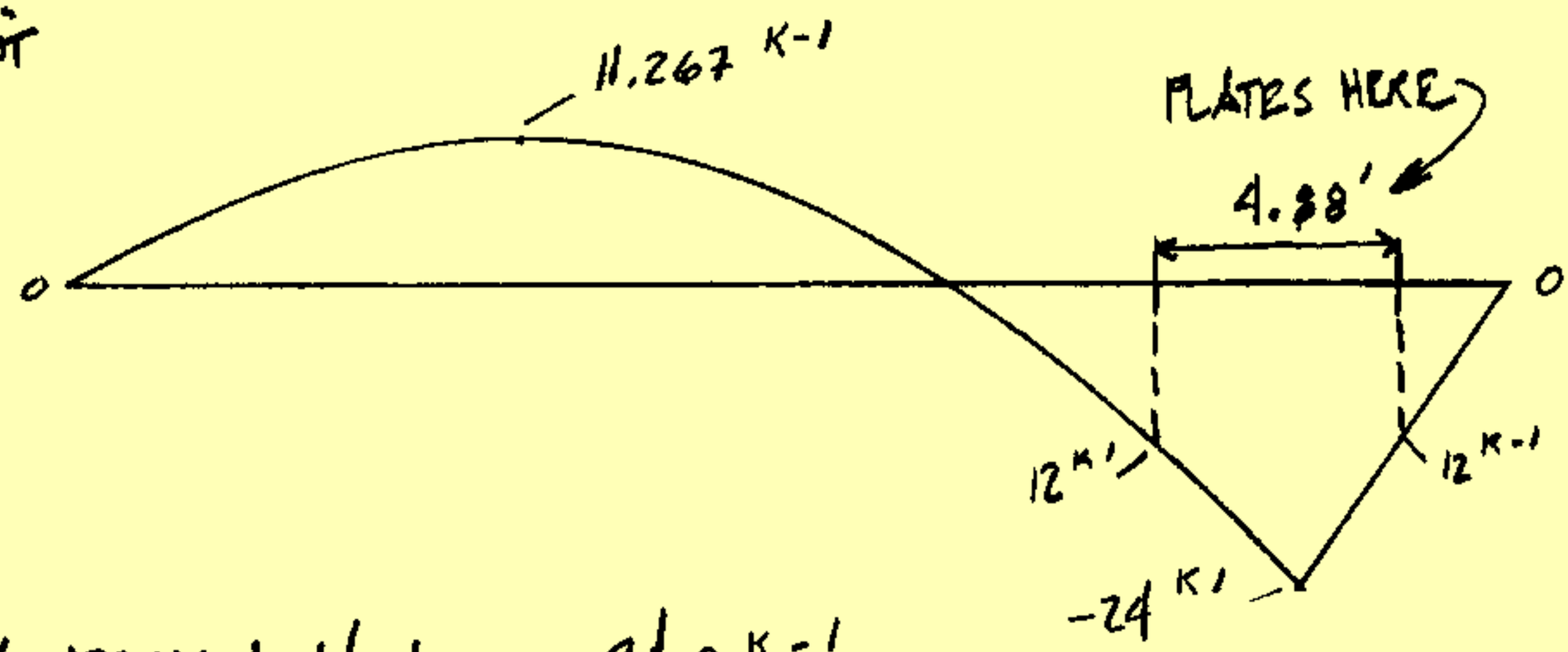
$\Sigma M_{R2} = 0 = R_1(24) - 7.2(12) + 6(4)$
$R_1 = 2.6^K$

CHECK $\Sigma F_V = 10.6 + 2.6 - 7.2 - 6 = 0$ ✓

SHEAR:



MOMENT

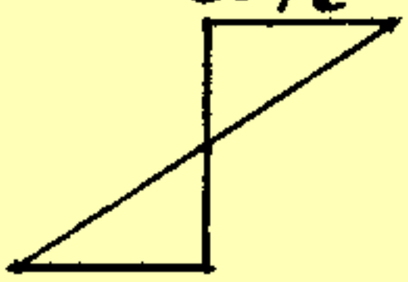


∴ DESIGN MOMENT = 24.0 K-1

STRAIN COMPATABILITY :

ASSUME WOOD CONTROLS STRAIN :

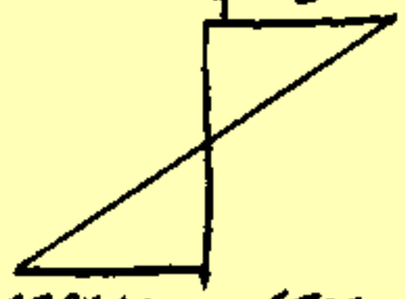
$\epsilon = f/E = 1.5/2000 = 0.00075$



STRAIN IN WOOD

CHECK →

$f = E\epsilon = 30000(.00075) = 22.5 = F_b$



STRESS IN STEEL

∴ STEEL AND WOOD HAVE BALANCED STRAIN AS IS

FIND MOMENT CARRIED BY WOOD :

$$M_{WOOD} = fS = 1.5\left(\frac{4(12)^2}{6}\right) = 144 \text{ K-"}$$
$$= 12 \text{ K-'}$$

FIND MOMENT CARRIED BY STEEL :

$$M_{STEEL} = M_{TOTAL} - M_{WOOD} = 24 - 12 = 12^{K-'}$$

FIND b OF STEEL PLATES : (TWO PLATES)

$$M_s = f_s S = F\left(\frac{bd^2}{6}\right)\times 2 = 22.5\left(\frac{b(12)^2}{6}\right)\times 2 = 12\times 12$$

$$\underline{\underline{b = .133"}}$$

FIND LENGTH OF PLATES (SEE MOMENT DIAGRAM)

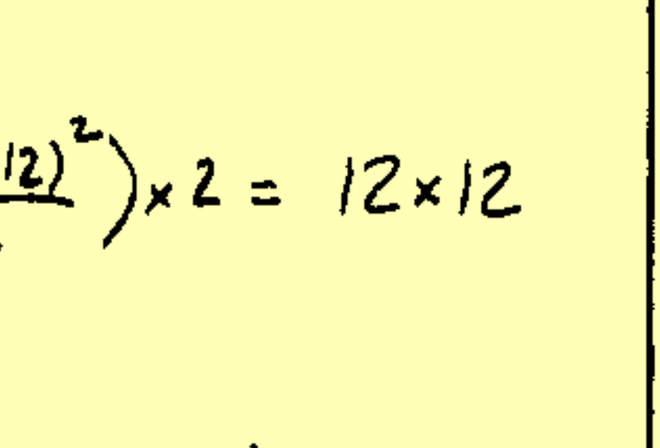
WOOD WILL CARRY $12^{K-'}$ ALONE, THEREFORE FIND PORTION OF MOMENT DIAGRAM > $12^{K-'}$

ON CANTILEVER :

$6 \times l_1 = 12 \qquad l_1 = 2'$

BETWEEN SUPPORTS :

FROM SHEAR DIAGRAM →



$$12 = l_2(4.6 - .3l_2) + \frac{l_2(.3l_2)}{2}$$

$$0 = -0.15l_2^2 + 4.6l_2 - 12$$

$$l_2 = \frac{-4.6 \pm \sqrt{4.6^2 - 4(.15)12}}{-2(.15)} = 2.879'$$

$$L_{TOTAL} = l_1 + l_2$$
$$= 2 + 2.88$$
$$= 4.88'$$

$$\underline{\underline{\quad}}$$