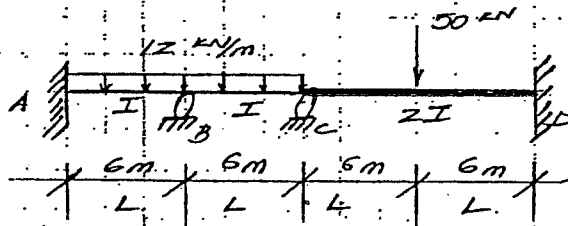


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$E = \text{constant}$

$$F_{AB} = \frac{wL^2}{12} = \frac{12 \times 6^2}{12} = 36 \text{ kN-m}$$

$$F_{BA} = -36 \text{ kN-m}$$

$$F_{BC} = \frac{wL^2}{12} = \frac{12 \times 6^2}{12} = 36 \text{ kN-m}$$

$$F_{CB} = -36 \text{ kN-m}$$

$$F_{CD} = \frac{PL}{8} = \frac{50 \times 5}{8} = 31.25 \text{ kN-m}$$

$$F_{DC} = -31.25 \text{ kN-m}$$

$$K_{AB} = K_1 = \frac{4EI}{L} = \frac{4EI}{6} = \frac{2EI}{3}$$

$$K_{BC} = K_2 = \frac{4EI}{L} = \frac{4EI}{6} = \frac{2EI}{3}$$

$$K_{CD} = K_3 = \frac{4EI}{L} = \frac{4EI}{5}$$

$$M_{AB} = F_{AB} + k_1 \theta_A + \frac{k_2}{2} \theta_B - \frac{3}{2} k_1 \rho_1 = 36 + \frac{k_1}{2} \theta_B$$

$$M_{BA} = F_{BA} + \frac{k_2}{2} \theta_A + k_1 \theta_B - \frac{3}{2} k_1 \rho_1 = -36 + \frac{k_2}{2} \theta_B$$

$$M_{BC} = F_{BC} + k_2 \theta_B + \frac{k_3}{2} \theta_C - \frac{3}{2} k_2 \rho_2 = 36 + k_2 \theta_B + \frac{k_3}{2} \theta_C$$

$$M_{CB} = F_{CB} + \frac{k_3}{2} \theta_B + k_2 \theta_C - \frac{3}{2} k_2 \rho_2 = -36 + \frac{k_3}{2} \theta_B + k_2 \theta_C$$

$$M_{CD} = F_{CD} + K_3 \theta_C + \frac{k_3}{2} \theta_D - \frac{3}{2} k_3 \rho_3 = 31.25 + k_3 \theta_C$$

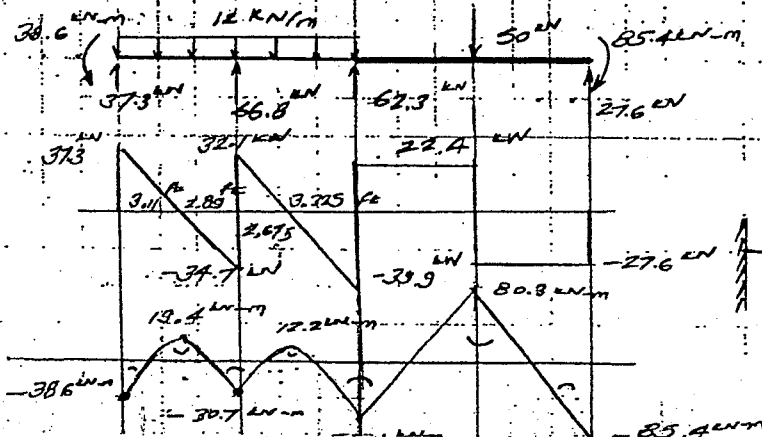
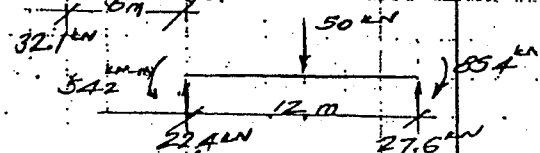
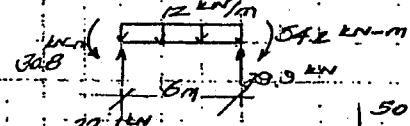
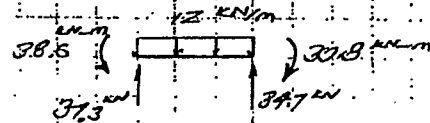
$$M_{DC} = F_{DC} + \frac{k_3}{2} \theta_C + k_3 \theta_D - \frac{3}{2} k_3 \rho_3 = -31.25 + \frac{k_3}{2} \theta_C$$

$$M_{BA} + M_{BC} = 0 \rightarrow \frac{k_2}{2} \theta_B + \frac{k_3}{2} \theta_C = 0$$

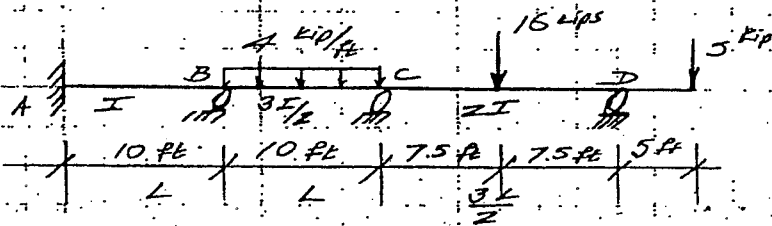
$$M_{CD} + M_{DC} = 0 \rightarrow \frac{k_3}{2} \theta_B + k_3 \theta_C = -31.25$$

$$\rightarrow k_2 \theta_B = 31.25, \quad k_3 \theta_C = -31.25$$

- So, $M_{AB} = 38.6 \text{ kN-m}$
- $M_{BA} = -30.8 \text{ kN-m}$
- $M_{BC} = 30.8 \text{ kN-m}$
- $M_{CB} = -34.2 \text{ kN-m}$
- $M_{CD} = 34.2 \text{ kN-m}$
- $M_{DC} = -27.6 \text{ kN-m}$



2.



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$F_{AB} = 0$
 $F_{BA} = 0$

$F_{BC} = \frac{wL^2}{12} = 33.33 \text{ ft-kip}$
 $F_{CB} = -33.33 \text{ ft-kip}$

$F_{CD} = \frac{3PL}{16} - \frac{1}{2}(25) = 32.5 \text{ ft-kip}$

$K_{AB} = \frac{4EI}{L} = \frac{4EI}{L} = k$

$K_{BC} = \frac{4EI_2}{L_2} = \frac{4E(\frac{3I}{2})}{L} = \frac{6EI}{L} = \frac{3k}{2}$

$K'_{CD} = \frac{3EI_3}{L_3} = \frac{3E(2I)}{\frac{3L}{2}} = \frac{4EI}{L} = k$

$M_{AB} = F_{AB} + K_1\theta_A + \frac{K_1\theta_B}{2} - \frac{3L_1}{2}P_1 = \frac{K_1\theta_B}{2}$

$M_{BA} = F_{BA} + \frac{K_1\theta_A}{2} + K_1\theta_B - \frac{3L_1}{2}P_1 = K_1\theta_B$

$M_{BC} = F_{BC} + K_2\theta_B + \frac{K_2\theta_C}{2} - \frac{3L_2}{2}P_2 = 33.33 + 1.5K_2\theta_B + 0.75K_2\theta_C$

$M_{CB} = F_{CB} + \frac{K_2\theta_B}{2} + K_2\theta_C - \frac{3L_2}{2}P_2 = -33.33 + 0.75K_2\theta_B + 1.5K_2\theta_C$

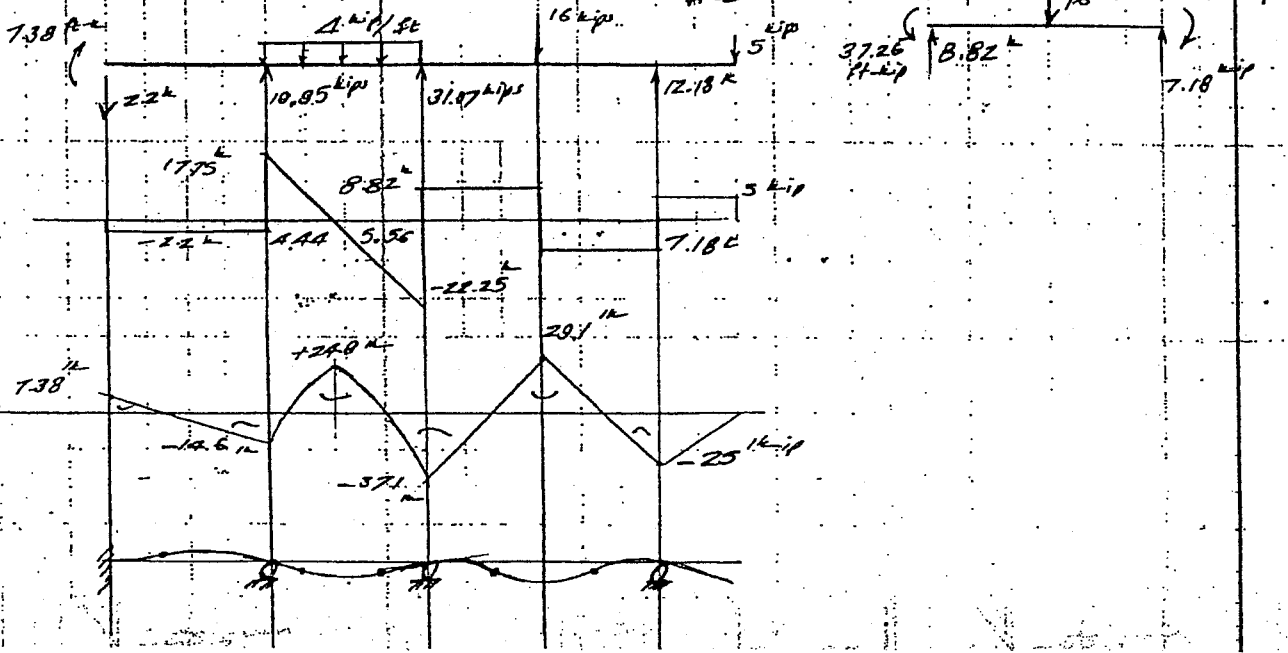
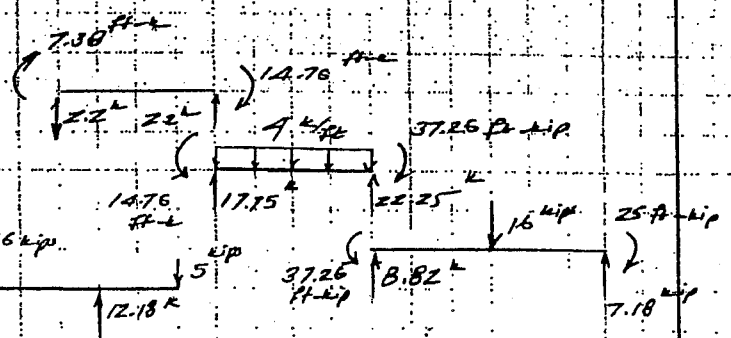
$M_{CD} = F_{CD} + K_3\theta_C - K_3'P_3 = 32.5 + K_3\theta_C$

$M_{BA} + M_{BC} = 0 \Rightarrow 2.5K_2\theta_B + 0.75K_2\theta_C = -33.33$

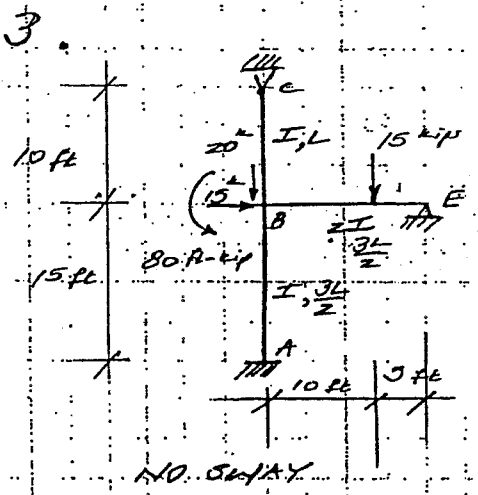
$M_{CB} + M_{CD} = 0 \Rightarrow 0.75K_2\theta_B + 2.5K_2\theta_C = 0.83$

$\Rightarrow K_2\theta_B = 14.76, K_2\theta_C = 14.76$

$M_{AB} = 7.38 \text{ ft-kip}$
 $M_{BA} = -14.76 \text{ ft-kip}$
 $M_{BC} = 14.76 \text{ ft-kip}$
 $M_{CB} = -37.26 \text{ ft-kip}$
 $M_{CD} = 37.26 \text{ ft-kip}$



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$$K_{AB} = K_1 = \frac{4EI}{L_1} = \frac{4EI}{\frac{3L}{2}} = \frac{8EI}{3L} = k$$

$$K'_{BC} = K'_2 = \frac{3EI}{L_2} = \frac{3EI}{L} = \frac{9}{8}k$$

$$K'_{BE} = K'_3 = \frac{3EI}{L_3} = \frac{3E(2I)}{\frac{3L}{2}} = \frac{4EI}{L} = \frac{3k}{2}$$

$$F_{AB} = 0$$

$$F_{BA} = 0$$

$$F'_{BC} = 0$$

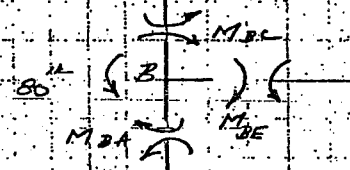
$$F'_{BE} = \frac{Pab}{2L} \left(1 + \frac{b}{L}\right) = \frac{15 \times 10 \times 5}{2 \times 15} \left(1 + \frac{5}{15}\right) = 33.33$$

$$M_{AB} = F_{AB} + K_1 \theta_A + \frac{K_1}{2} \theta_B - \frac{3}{2} K_1 \rho_1 = \frac{K}{2} \theta_B$$

$$M_{BA} = F_{BA} + \frac{K}{2} \theta_A + K \theta_B - \frac{3}{2} K_1 \rho_1 = K \theta_B$$

$$M_{BC} = F'_{BC} + K'_2 \theta_B - K'_2 \rho_2 = \frac{9}{8} K \theta_B$$

$$M_{BE} = F_{BE} + K'_3 \theta_B - K'_3 \rho_3 = 33.33 + \frac{3}{2} K \theta_B$$

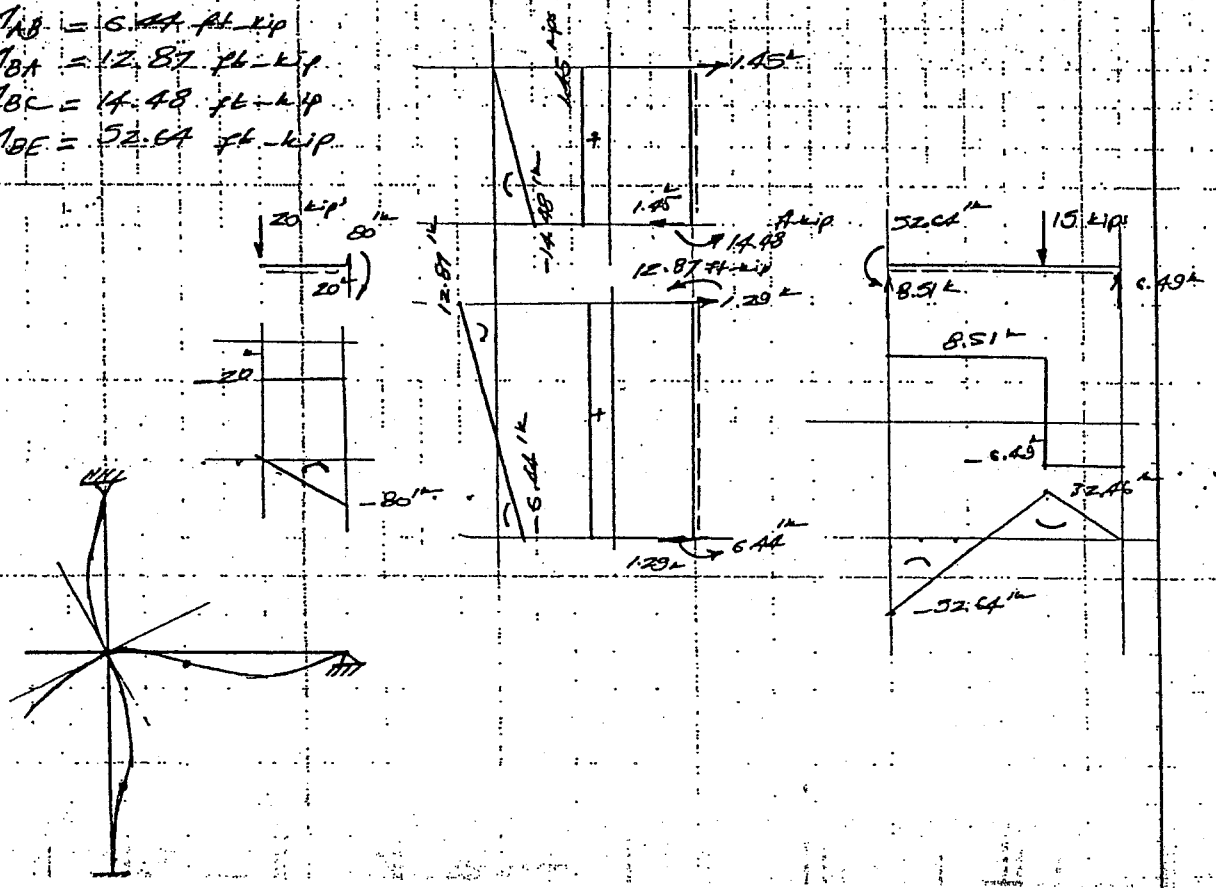


at B: $M_{BA} + M_{BC} + M_{BE} = 80$

$$\rightarrow K \theta_B + \frac{9}{8} K \theta_B + 33.33 + \frac{3}{2} K \theta_B = 80$$

$$\rightarrow K \theta_B = 12.87$$

- So $M_{AB} = 6.44 \text{ ft-kip}$
- $M_{BA} = 12.87 \text{ ft-kip}$
- $M_{BC} = 14.48 \text{ ft-kip}$
- $M_{BE} = 52.67 \text{ ft-kip}$



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