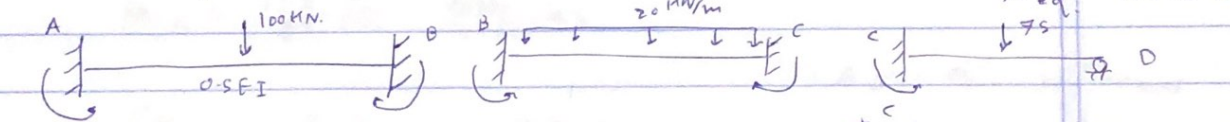
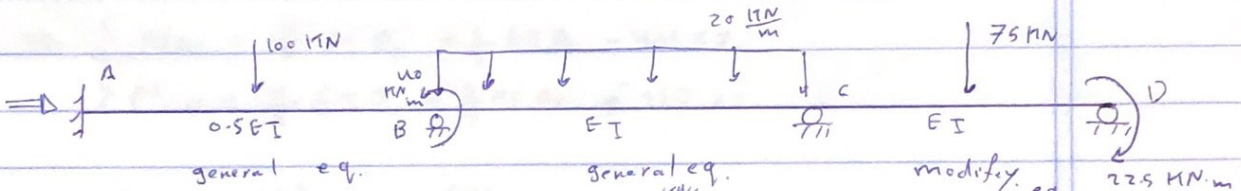
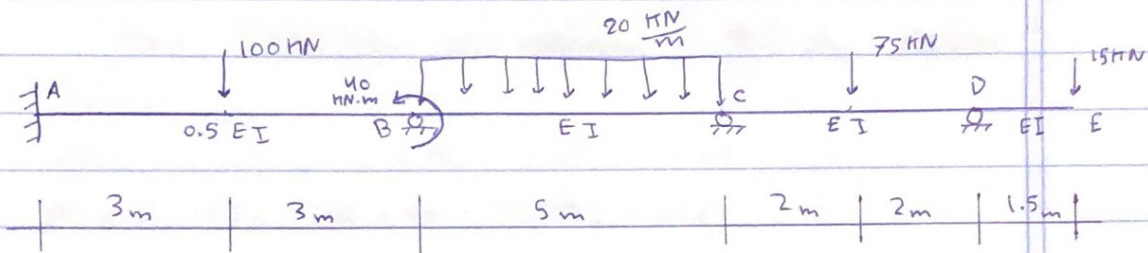


- Assignment: Slope-deflection equations.

- Mohamad Moayad ShannaK - 1181401.

- The Support Settle: A (5mm ↓), B (2mm ↓), C (7mm ↓)

- steel ( $E = 200 \text{ GPa}$ ),  $I = 1.5 \times 10^3 \text{ m}^4$ .



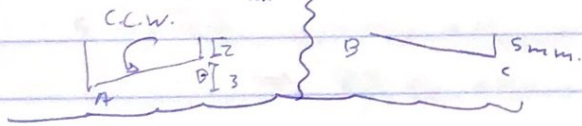
$$FEM_{AB} = -PL/8 = -75 \text{ kN.m} \quad FEM_{BC} = \frac{-WL^2}{12} = -41.67 \text{ kN.m}$$

$$FEM_{BA} = PL/8 = 75 \text{ kN.m} \quad FEM_{CB} = 41.67 \text{ kN.m}$$

$$FEM_{CD} = \frac{-3PL}{16} + 11.25$$

$$FEM_{CD} = -45 \text{ kN.m}$$

$$\Delta_{AB} = -0.003 \text{ mm} \quad \Delta_{BC} = 0.005 \text{ mm}$$



$$\Delta_{CD} = -0.007 \text{ mm}$$

$$7 \text{ mm} \quad D$$

-END-Moment equations:

$$M_{AB} = \frac{2EI}{6} (2\theta_A + \theta_B - \frac{3\Delta}{L}) + 75$$

$$M_{BA} = \frac{2EI}{6} (2\theta_B + \theta_A - \frac{3\Delta}{6}) + 75$$

$$\Rightarrow \begin{cases} M_{AB} = EI/6 (2\theta_A + \theta_B) = \frac{EI}{6} \theta_B \\ M_{BA} = EI/6 (2\theta_B + \theta_A) + 150 = \frac{EI}{3} \theta_B + 150 \end{cases}$$

$$M_{BC} = \frac{2EI}{5} (2\theta_B + \theta_C - \frac{3\Delta_{BC}}{5}) - 41.67$$

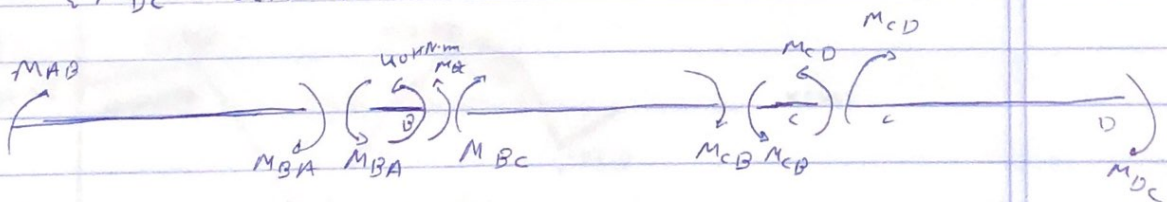
$$M_{CB} = \frac{2EI}{5} (2\theta_C + \theta_B - \frac{3\Delta_{BC}}{5}) + 41.67$$

$$\Rightarrow \begin{cases} M_{BC} = \frac{4}{5} EI \theta_B + \frac{2}{5} EI \theta_C - 41.67 \\ M_{CB} = \frac{4}{5} EI \theta_C + \frac{2}{5} EI \theta_B + 318.33 \end{cases}$$

$$M_{CD} = \frac{3EI}{4} (\theta_C - \frac{\Delta_{CD}}{4}) - 45$$

$\therefore \theta_B, \theta_C$  unknowns.

$$\Rightarrow \begin{cases} M_{CD} = \frac{3}{4} EI \theta_C + 348.75 \\ M_{DC} = 22.5 \text{ kN}\cdot\text{m} \end{cases}$$



$$\sum M_B = 0 \Rightarrow M_{BA} + M_{BC} + 40 = 0$$

$$\Rightarrow \frac{EI}{3} \theta_B + 150 + \frac{4}{5} EI \theta_B + \frac{2}{5} EI \theta_C - 41.67 + 40 = 0$$

$$\Rightarrow \frac{3.4}{3} EI \theta_B + 0.4 EI \theta_C = 21.67$$

$$\sum M_C = 0 \Rightarrow M_{CD} + M_{CB} = 0 \Rightarrow 1.55 EI \theta_C + 0.4 EI \theta_B = -30.42$$

$$EI \begin{pmatrix} \frac{3.4}{3} & 0.4 \\ 0.4 & 1.55 \end{pmatrix} \begin{pmatrix} \theta_B \\ \theta_C \end{pmatrix} = \begin{pmatrix} 21.67 \\ -30.42 \end{pmatrix} \Rightarrow \theta_B = -1.584 \times 10^{-8} \text{ rad} \quad \theta_C = 0.0134 \text{ rad}$$

$$\Rightarrow \theta_B = \frac{213.1}{EI}, \theta_C = \frac{-74.62}{EI}$$

$$\Rightarrow M_{AB} = 35.5167 \text{ KN}\cdot\text{m}$$

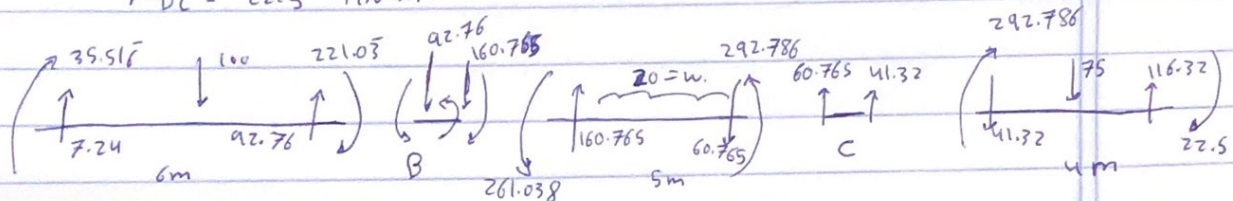
$$M_{BA} = 221.03 \text{ KN}\cdot\text{m}$$

$$M_{BC} = -261.038 \text{ KN}\cdot\text{m}$$

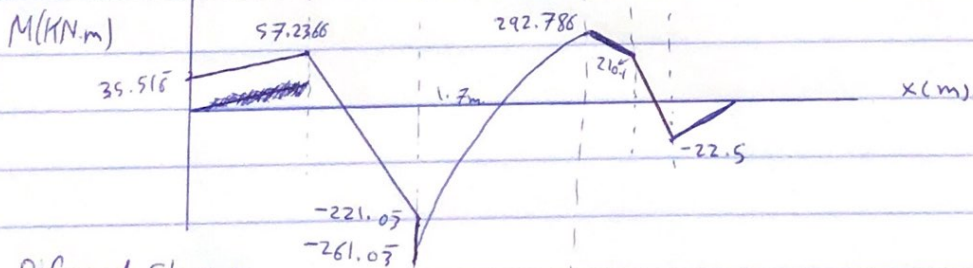
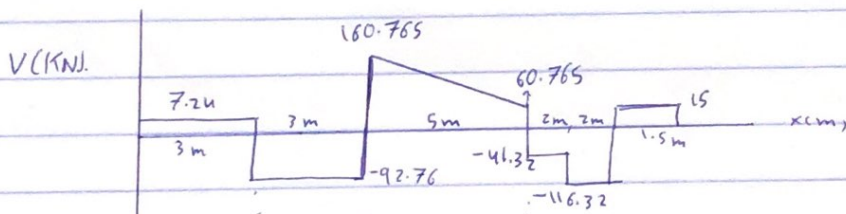
$$M_{CB} = -292.786 \text{ KN}\cdot\text{m}$$

$$M_{CD} = 292.786 \text{ KN}\cdot\text{m}$$

$$M_{DC} = 22.5 \text{ KN}\cdot\text{m}$$



-reactions:  $A_x=0$ ,  $A_y=7.24 \text{ KN}\uparrow$ ,  $M_A=35.5167 \text{ KN}\cdot\text{m}$ ,  $B_y=253.525 \text{ KN}\uparrow$   
 $C_x=102.085 \text{ KN}\downarrow$ ,  $D_y=131.32 \text{ KN}\uparrow$



Deformed Shape

