

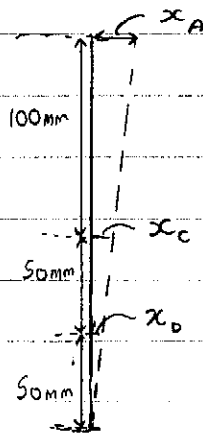
M_F

$$-(P \times 200 \times 10^{-3}) + (F_{CB} \times 100 \times 10^{-3}) - (F_{DE} \times 50 \times 10^{-3}) = 0$$

$$-0.2P + 0.1F_{CB} - 0.05F_{DE} = 0 \Rightarrow 0.05F_{DE} - 0.1F_{CB} = -480$$

$$\delta_{CB} = \frac{F_{CB} L_{CB}}{A_{CB} E} \quad , \quad \delta_{DE} = \frac{F_{DE} L_{DE}}{A_{DE} E}$$

AF - Rigid Bar



Deflection at A = x_A

Deflection at C = x_C

Deflection at D = x_D

Gradient for each is the same

$$\therefore \frac{x_D}{0.05} = \frac{x_C}{0.1} = \frac{x_A}{0.2} \quad \therefore \text{if } \frac{x_D}{0.05} = \frac{x_C}{0.1}$$

$$\delta_{CB} = x_C, \quad \delta_{DE} = x_D$$

$$\text{then } x_C = \frac{0.1x_D}{0.05}$$

$$x_C = \frac{F_{CB} L_{CB}}{A_{CB} E}, \quad x_D = \frac{F_{DE} L_{DE}}{A_{DE} E}$$

$$\therefore \frac{0.1x_D}{0.05} = \frac{F_{CB} L_{CB}}{A_{CB} E} \Rightarrow \frac{2F_{DE} L_{DE}}{A_{DE} E} = \frac{F_{CB} L_{CB}}{A_{CB} E}$$

$$\therefore F_{CB} = \frac{2F_{DE} L_{DE} A_{CB} E}{A_{DE} E L_{CB}}$$

$$\text{If } 0.1 F_{CB} = 0.05 F_{DE} + 480$$

$$\text{then } F_{CB} = 0.5 F_{DE} + 4800$$

$$\Rightarrow 0.5 F_{DE} + 4800 = \frac{2 F_{DE} L_{DE} A_{CB} E}{A_{DE} E L_{CB}}$$

$$0.5 F_{DE} = \frac{2 F_{DE} L_{DE} A_{CB} E}{A_{DE} E L_{CB}} - 4800$$

$$F_{DE} = \frac{4 F_{DE} L_{DE}}{L_{CB}} - 9600$$

$$1 = \frac{4 L_{DE}}{L_{CB}} - \frac{9600}{F_{DE}} \Rightarrow \frac{9600}{F_{DE}} = \frac{4 L_{DE}}{L_{CB}} - 1$$

$$\therefore \frac{F_{DE}}{9600} = \frac{\frac{4 L_{DE}}{L_{CB}} - 1}{1}$$

$$\therefore F_{DE} = \frac{9600}{\frac{4 L_{DE}}{L_{CB}} - 1} = 2400 \text{ N}$$

$$F_{CB} = 0.5 F_{DE} + 4800 = 6000 \text{ N}$$

$$\delta_{CB} = \frac{6000 \times 0.1}{7.2 \times 10^{-5} \times 200 \times 10^9} = 4.167 \times 10^{-5} \text{ m} = 0.04167 \text{ mm} = x_c$$

$$\frac{x_c}{0.1} = \frac{x_A}{0.2} \Rightarrow x_A = \frac{0.2 x_c}{0.1} = 8.33 \times 10^{-5} \text{ m} = 0.083 \text{ mm}$$