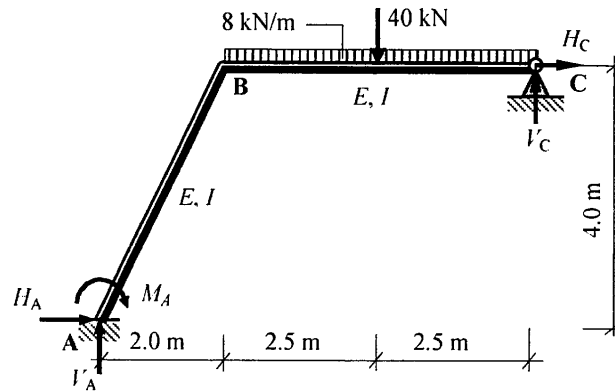


Solution

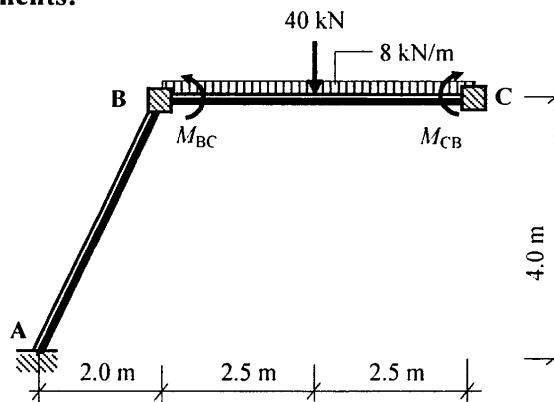
Topic: Moment Distribution – No-Sway Rigid-Jointed Frames

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Fixed-end Moments:



$$\text{Length of member AB} = \sqrt{(2.0^2 + 4.0^2)} = 4.472 \text{ m}$$

Member BC*

$$M_{BC} = -\frac{PL}{8} - \frac{wL^2}{12} = -\frac{40.0 \times 5}{8} - \frac{8.0 \times 5^2}{12} = -41.67 \text{ kNm}$$

$$M_{CB} = +\frac{PL}{8} + \frac{wL^2}{12} = +\frac{40.0 \times 5}{8} + \frac{8.0 \times 5^2}{12} = +41.67 \text{ kNm}$$

* Since support C is pinned, the fixed-end moments are $(M_{BC} - 0.5M_{CB})$ at B and zero at C.

$$(M_{BC} - 0.5M_{CB}) = [-41.67 - (0.5 \times 41.67)] = -62.51 \text{ kNm.}$$

Solution

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Distribution Factors : Joint B

$$k_{BA} = \left(\frac{I}{4.472} \right) = 0.22I$$

$$k_{total} = 0.37I$$

$$DF_{BA} = \frac{k_{BA}}{k_{Total}} = \frac{0.22}{0.37} = 0.59$$

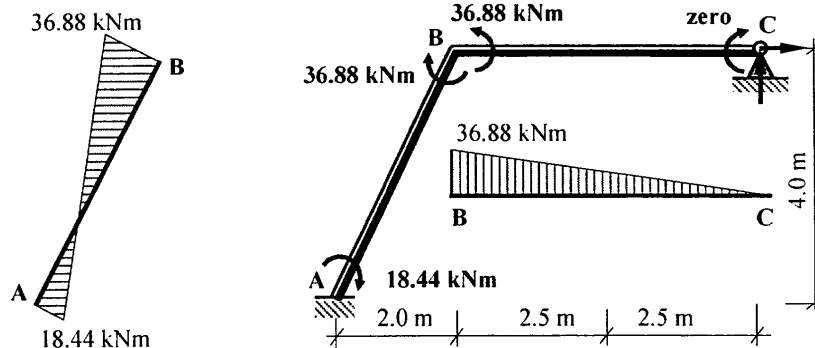
$$k_{BC} = \frac{3}{4} \times \left(\frac{I}{5} \right) = 0.15I$$

$$DF_{BC} = \frac{k_{BC}}{k_{Total}} = \frac{0.15}{0.37} = 0.41$$

Moment Distribution Table:

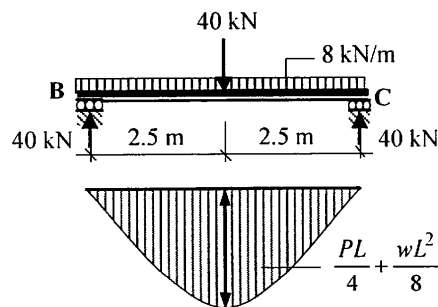
Joint	A	B		C
	AB	BA	BC	CB
Distribution Factors	0	0.59	0.41	1.0
Fixed-end Moments			- 62.51	
Balance		+ 36.88	+ 25.63	
Carry-over	+ 18.44			
Total	+ 18.44	+ 36.88	- 36.88	0

Continuity Moments:



Fixed Bending Moment Diagrams

Free bending moment:



Member BC:

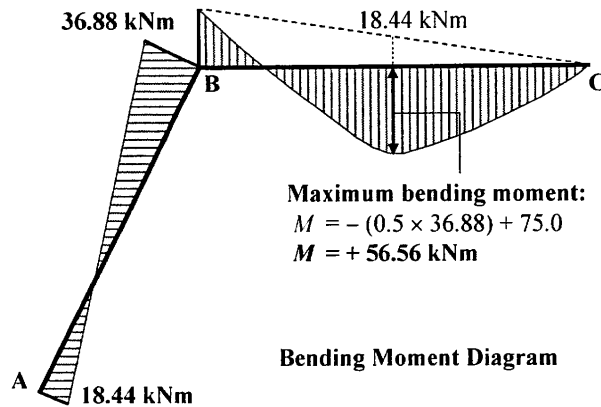
$$\begin{aligned}
 M_{free} &= \frac{PL}{4} + \frac{wL^2}{8} \\
 &= \frac{40 \times 5}{4} + \frac{8.0 \times 5.0^2}{8} \\
 &= 75.0 \text{ kNm}
 \end{aligned}$$

Solution

Topic: Moment Distribution – No-Sway Rigid-Jointed Frames

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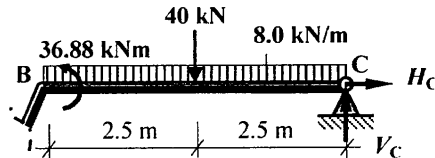


Maximum bending moment:

$$M = -(0.5 \times 36.88) + 75.0$$

$$M = + 56.56 \text{ kNm}$$

Consider Member BC:



$$+ve \curvearrowright \Sigma M_B = 0$$

$$- 36.88 + (40.0 \times 2.5) + (8.0 \times 5.0 \times 2.5) - (V_C \times 5.0) = 0 \quad \therefore V_C = + 32.62 \text{ kN} \uparrow$$

For the complete frame:

$$+ve \curvearrowright \Sigma M_A = 0$$

$$+ 18.44 + (40.0 \times 4.5) + (8.0 \times 5.0 \times 4.5) - (32.62 \times 7.0) + (H_C \times 4.0) = 0$$

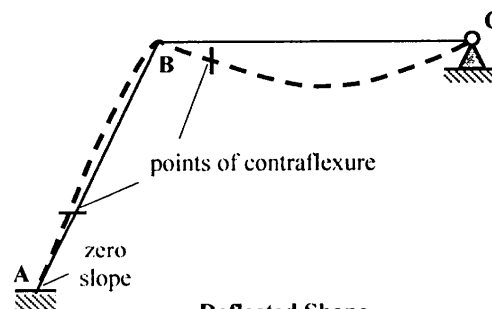
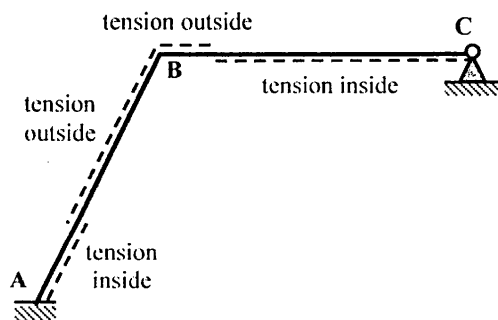
$$\therefore H_C = - 37.53 \text{ kN} \leftarrow$$

$$+ve \uparrow \Sigma F_y = 0$$

$$V_A - 40.0 - (8.0 \times 5.0) + 32.62 = 0 \quad \therefore V_A = + 47.38 \text{ kN} \uparrow$$

$$+ve \rightarrow \Sigma F_x = 0$$

$$H_A - 37.53 = 0 \quad \therefore H_A = + 37.53 \text{ kN} \rightarrow$$



Deflected Shape