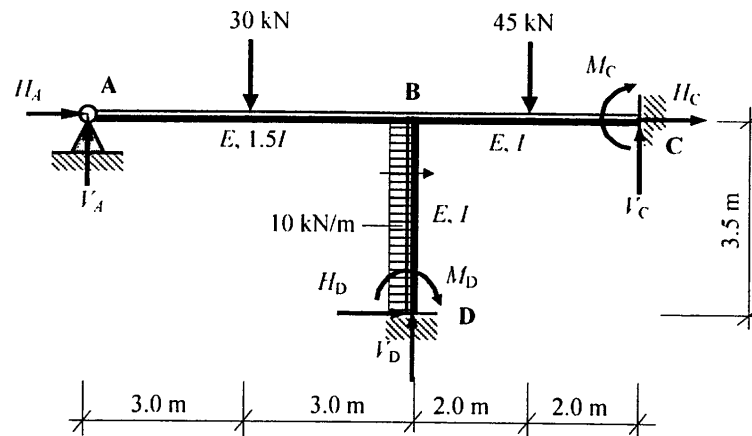
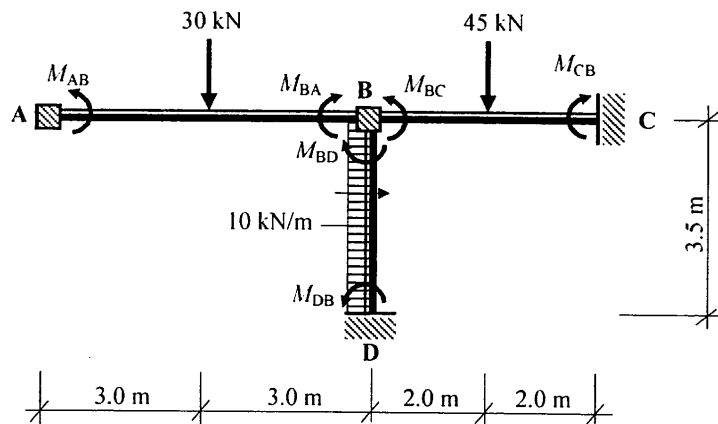


Solution**Topic: Moment Distribution – No-Sway Rigid-Jointed Frames****Problem Number: 5.7****Page No. 1****Fixed-end Moments:**

Member AB*

$$M_{AB} = -\frac{PL}{8} = -\frac{30.0 \times 6}{8} = -22.5 \text{ kNm}$$

$$M_{BA} = +\frac{PL}{8} = +\frac{30.0 \times 6}{8} = +22.5 \text{ kNm}$$

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

$$(M_{BA} - 0.5M_{AB}) = [22.5 + (0.5 \times 22.5)] = +33.75 \text{ kNm.}$$

Solution**Topic: Moment Distribution – No-Sway Rigid-Jointed Frames****Problem Number: 5.7****Page No. 2**

Member BC

$$M_{BC} = -\frac{PL}{8} = -\frac{45.0 \times 4}{8} = -22.5 \text{ kNm}$$

$$M_{CB} = +\frac{PL}{8} = +\frac{45.0 \times 4}{8} = +22.5 \text{ kNm}$$

Member BD

$$M_{BD} = +\frac{wL^2}{12} = +\frac{10.0 \times 3.5^2}{12} = +10.21 \text{ kNm}$$

$$M_{DB} = -\frac{wL^2}{12} = -\frac{10.0 \times 3.5^2}{12} = -10.21 \text{ kNm}$$

Distribution Factors : Joint B

$$k_{BA} = \frac{3}{4} \times \left(\frac{1.5I}{6.0} \right) = 0.19I$$

$$k_{BC} = \left(\frac{I}{4} \right) = 0.25I$$

$$k_{BD} = \left(\frac{I}{3.5} \right) = 0.29I$$

$$k_{\text{total}} = 0.73I$$

$$DF_{BA} = \frac{k_{BA}}{k_{\text{Total}}} = \frac{0.19}{0.73} = 0.26$$

$$DF_{BC} = \frac{k_{BC}}{k_{\text{Total}}} = \frac{0.25}{0.73} = 0.34$$

$$DF_{BD} = \frac{k_{BD}}{k_{\text{Total}}} = \frac{0.29}{0.73} = 0.40$$

Moment Distribution Table:

Joint	A	B			C	D
	AB	BA	BD	BC	CB	DB
Distribution Factors	1.0	0.26	0.40	0.34	0	0
Fixed-end Moments		+ 33.75	+ 10.21	- 22.5	+ 22.5	- 10.21
Balance		- 5.58	- 8.58	- 7.3		
Carry-over					- 3.7	- 4.29
Total	0	+ 28.17	+ 1.63	- 29.8	+ 18.8	- 14.5

Note: the sum of the moments at joint B = zero

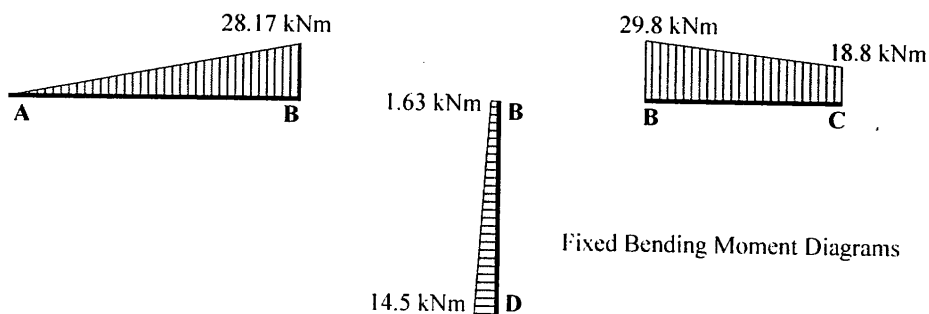
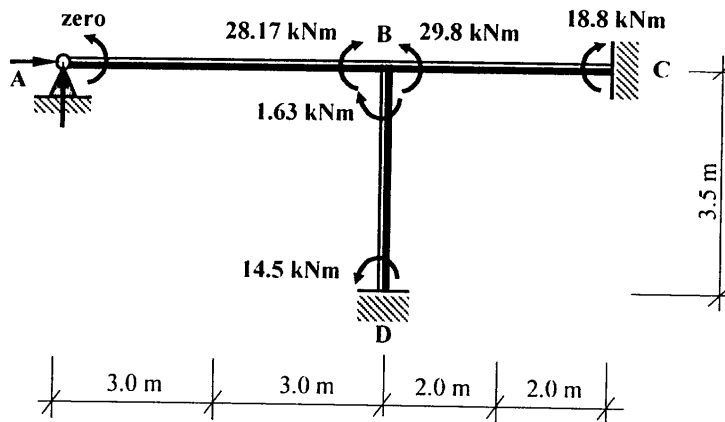
Solution

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

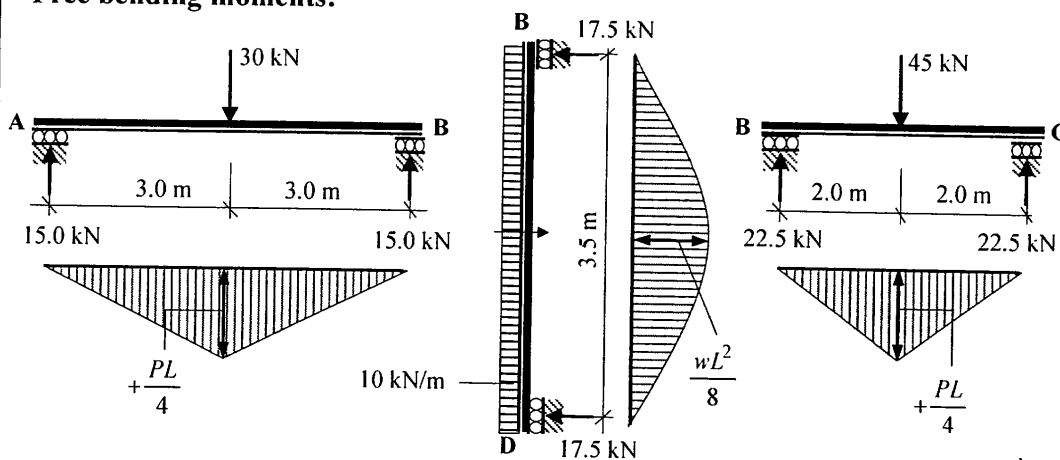
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Continuity Moments:



Free bending moments:



Free Bending Moment Diagrams

Solution

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Member AB:

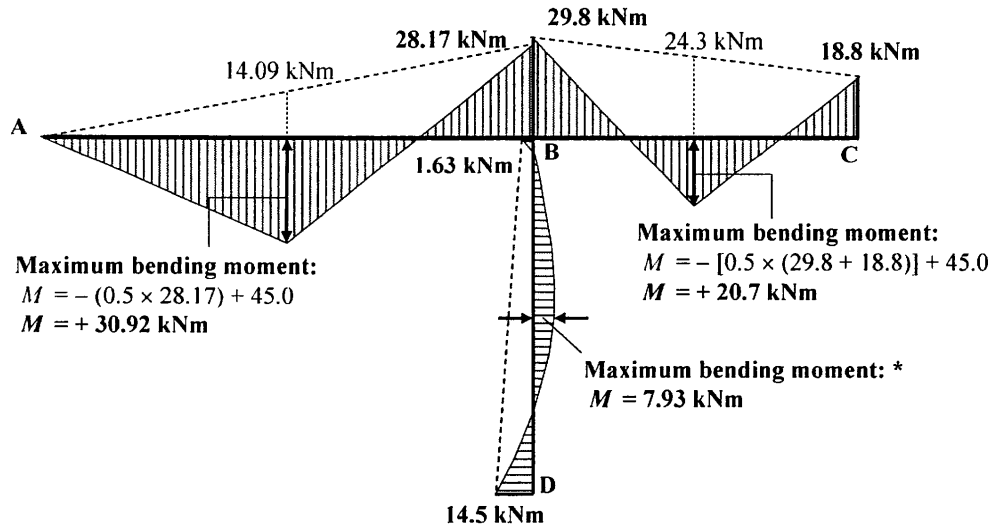
$$M_{\text{free}} = + \frac{PL}{4} = \frac{30.0 \times 6}{4} = 45.0 \text{ kNm}$$

Member BD:

$$M_{\text{free}} = + \frac{wL^2}{8} = \frac{10.0 \times 3.5^2}{8} = 15.31 \text{ kNm}$$

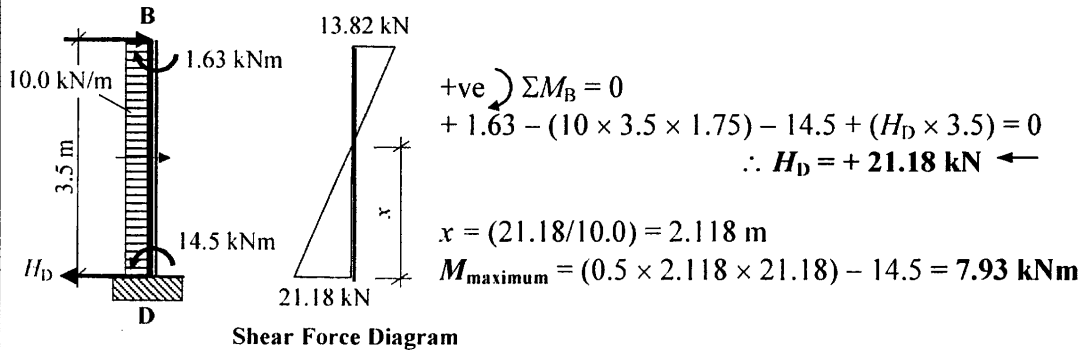
Member BC:

$$M_{\text{free}} = + \frac{PL}{4} = \frac{45.0 \times 4}{4} = 45.0 \text{ kNm}$$



Bending Moment Diagram

* The maximum value along the length of member DB can be found by identifying the point of zero shear as follows:



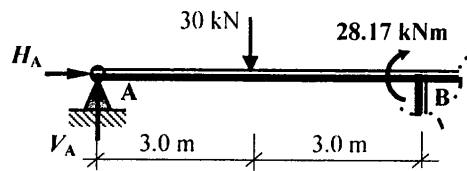
Solution

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Consider Member AB:

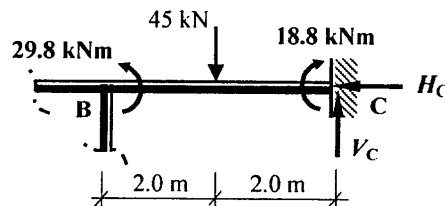


$$+ve \curvearrowright \Sigma M_B = 0$$

$$+ 28.17 - (30.0 \times 3.0) + (V_A \times 6.0) = 0$$

$$\therefore V_A = + 10.31 \text{ kN} \quad \uparrow$$

Consider Member BC:



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

$$- 29.8 + (45.0 \times 2.0) + 18.8 - (V_C \times 4.0) = 0$$

$$\therefore V_C = + 19.75 \text{ kN} \quad \uparrow$$

For the complete frame:

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

$$10.31 - 30.0 - 45.0 + 19.75 + V_D = 0$$

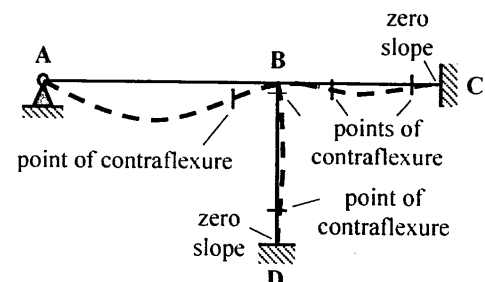
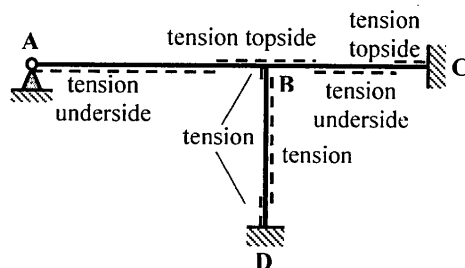
$$\therefore V_D = + 44.94 \text{ kN} \quad \uparrow$$

There is insufficient information from the moment distribution analysis to determine the values of H_A and H_C separately; i.e.

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

$$(10.0 \times 3.5) + H_A + H_D + H_C = 0$$

$$\therefore H_A + H_C = (35.0 - 21.18) = 13.82 \text{ kN}$$



Deflected Shape