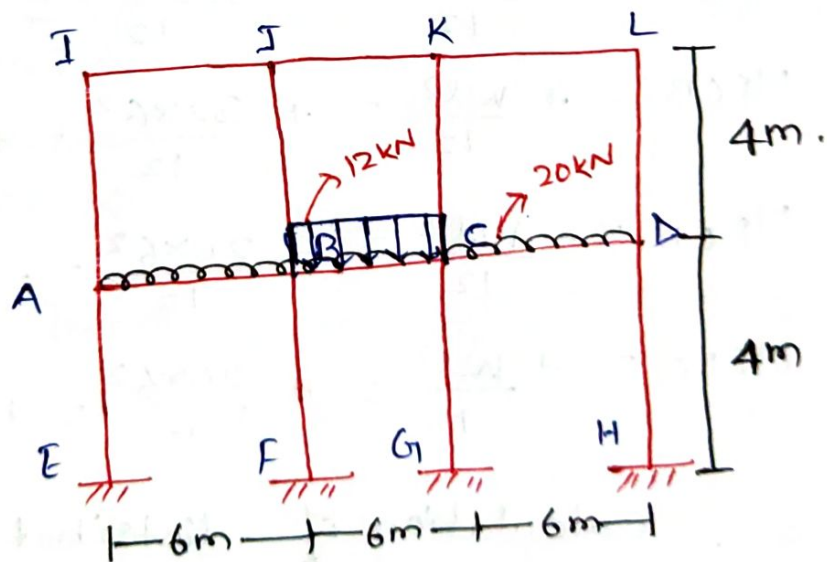


Substitute frame Method. (Vertical loads only)

12

- * This method is also called as two cycle moment distribution method.
- * This method assumes that the moments in the beam of any floor are influenced by the loading on that floor alone.
- * The influence of loading on the lower or upper floor is ignored altogether.
- * The process involves the division of multi-storied structures into smaller frames.

①



Given,

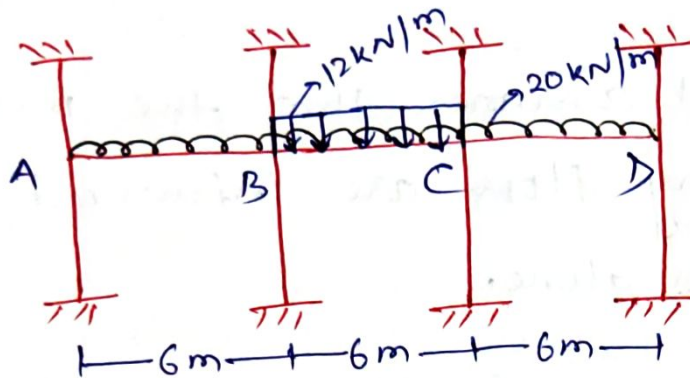
Live load = 12 kN/m [for girder]

Dead load = 20 kN/m

Analyse the above frame by substitute frame method for the span BC.

Solⁿ:-

Step-1: → Convert frame to substitute frame.



Step-2: → Fixed end moments

$$M_{FAB} = -\frac{Wl^2}{12} = -\frac{20 \times 6^2}{12} = -60 \text{ kN-m}$$

$$M_{FBA} = +\frac{Wl^2}{12} = +\frac{20 \times 6^2}{12} = +60 \text{ kN-m}$$

$$M_{FBC} = -\frac{Wl^2}{12} = -\frac{32 \times 6^2}{12} = -96 \text{ kN-m}$$

$$M_{FCB} = +\frac{Wl^2}{12} = +\frac{32 \times 6^2}{12} = +96 \text{ kN-m}$$

$$M_{FCD} = -\frac{Wl^2}{12} = -\frac{20 \times 6^2}{12} = -60 \text{ kN-m}$$

$$M_{FDC} = +\frac{Wl^2}{12} = +\frac{20 \times 6^2}{12} = +60 \text{ kN-m}$$

Step-3:- Calculation of distribution factor.

In this frame we have four joints

A, B, C and D.

Joint	Member	Stiffness	Total Stiffness	D.F
A	AB	$4EI/6$	$2.66EI$	0.25
	AI	$4EI/4$		0.375
	AE	$4EI/4$		0.375
B	BJ	$4EI/4$	$3.33EI$	0.30
	BF	$4EI/4$		0.30
	BC	$4EI/6$		0.20
	BA	$4EI/6$		0.20
C	CK	$4EI/4$	$3.33EI$	0.30
	CG	$4EI/4$		0.30
	CB	$4EI/6$		0.20
	CD	$4EI/6$		0.20
D	DC	$4EI/6$	$2.66EI$	0.25
	DL	$4EI/4$		0.375
	DH	$4EI/4$		0.375

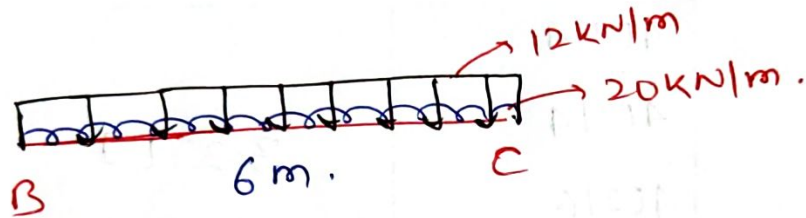
Step-4 :→ Distribution of moment till cycle-2

	A	B	C	D		
D.F	0.25	0.20	0.20	0.20	0.25	
FEM	-60	+60	+96	-60	+60	
	15	+7.2	+7.2	-7.2	-7.2	-15
	3.6	7.5	-3.6	3.6	-7.5	-3.6
	-41.4	74.4	-92.4	92.4	-74.4	41.4

Cycle-1

	A	B	C	D
D.F	0.25	0.20	0.20	0.25
Cycle-1 (Moment)	-41.4	74.4	-92.4	92.4
Cycle-2	10.35	3.6	3.6	-3.6
	1.8	5.18	-1.8	1.8
	-29.25	83.18	-90.6	90.6

NOW,



SO,

Moment @ mid span = BM @ Centre of span BC
 - Moment got after 2nd cycle for span BC

$$= \frac{(20+12) \times 6^2}{8} - 90.6$$

$$= 144 - 90.6$$

$$= 53.4 \text{ kN-m.}$$