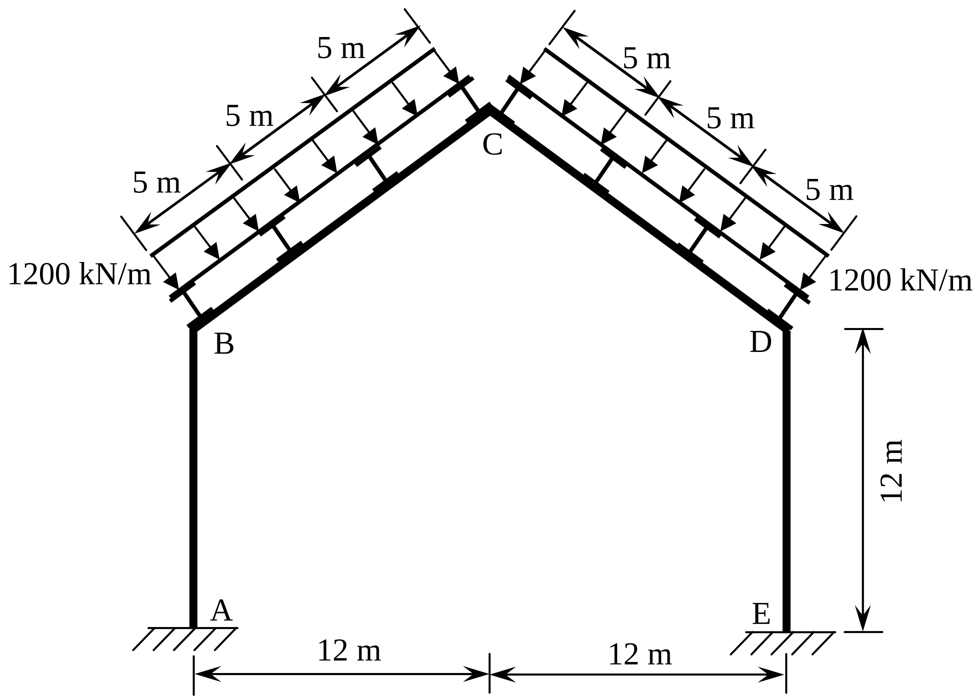
Department of Civil Engineering, IIT Bombay

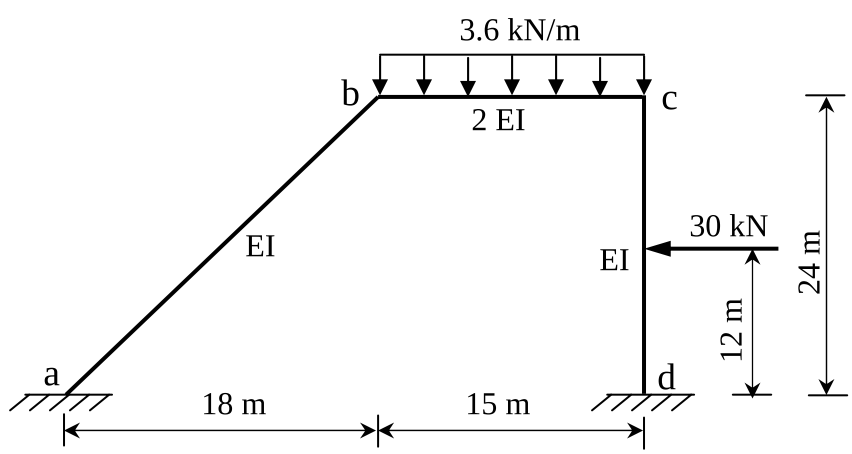
CE317 Structural Mechanics –II Tutorial 4

Use moment distribution method. Draw BMD, SFD, and deflected shape.

P1



P2



Tutorial 4 CE317

P.1 (P1, Tute 2)

jt	a	b	b	c
mem end	ab	ba	bc	cb
rel stiff	k	k	.8k	.8k
df	0	0.555556	0.444444	0
fem			-20000	20000
	5555.556	11111.11	8888.889	4444.444
BMprime	5555.556	11111.11	-11111.1	24444.44
ax	-1388.89	from momt equil of ab, left +ve		
ay	14400	from symm and vertical equil		
r	4292.593	from moment equil of left half structure taken about c, right +ve		
jt	a	b	b	c
mem end	ab	ba	bc	cb
rel stiff	k	k	.8k	.8k
df	0	0.555556	0.444444	0
fem	100	100	-106.667	-106.667
	1.851852	3.703704	2.962963	1.481481
BMdash	101.8519	103.7037	-103.704	-105.185
axprime	-17.1296	from momt equil of ab, left +ve		
ayprime	0	from symm and vertical equil		
rprime	-40.3395	from moment equil of left half structure taken about c, right +ve		
BM	16393.78	22146.39	-22146.4	13251.52

BM=Bmprime+r/(-rprime)*Bmdash

Use symm, so c like a fixed end on a vertical roller
So no distr at c and no co from c
No stiffness reductions due to symm.
k=4I/12

P2 (P2, Tute 1)

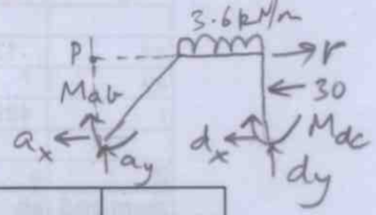
jt	a	b	b	c	c	d	
mem	ab	ba	bc	cb	cd	dc	
stiff	0.133333	0.133333	0.533333	0.533333	0.166667	0.166667	
df	0	0.2	0.8	0.761905	0.238095	0	
fem	0	0	-67.5	67.5	-90	90	
	6.75	13.5	54	27			
			-1.71429	-3.42857	-1.07143	-0.53571	
	0.171429	0.342857	1.371429	0.685714			
			-0.26122	-0.52245	-0.16327	-0.08163	
		0.052245	0.20898				
BMprime	6.921429	13.8951	-13.8951	91.23469	-91.2347	89.38265	
-14.9228	dx	from momt equil of cd, left +ve					
32.15597	dy	from momt equil of bcd about b, so that horz reaction at c doesent intervene (imp), up +ve					
-17.2504	ax	from momt ext-equil about pt above a lying on extension of bc so that horz reaction at c doesent intervene (imp), left +ve					
-2.17321	r	right +ve					

jt	a	b	b	c	c	d	
mem	ab	ba	bc	cb	cd	dc	
stiff	0.133333	0.133333	0.533333	0.533333	0.166667	0.166667	
df	0	0.2	0.8	0.761905	0.238095	0	
fem	-80	-80	384	384	-100	-100	
	-30.4	-60.8	-243.2	-121.6			
			-61.8667	-123.733	-38.6667	-19.3333	
	6.186667	12.37333	49.49333	24.74667			
			-9.4273	-18.8546	-5.89206	-2.94603	
	0.94273	1.88546	7.541841	3.770921			
			-1.43654	-2.87308	-0.89784	-0.44892	
	-0.14365	-0.28731	1.149233	0.574616			
			-0.2189	-0.4378	-0.13681	-0.06841	
		0.04378	0.175121				
BMdash	-103.414	-126.785	126.2101	145.5934	-145.593	-122.797	
11.18292	dxprime	from momt equil of cd, left +ve					
18.12023	dyprime	from momt equil of bcd about b, so that horz reaction at c doesent intervene (imp), up +ve					
23.15786	axprime	from momt ext-equil about pt above a lying on extension of bc so that horz reaction at c doesent intervene (imp), left +ve					
34.34078	rprime	right +ve					
BM	0.377004	5.87171	-5.90807	100.4484	-100.448	81.61164	BM=BMprime+(-r)/rprime*Bmdash

$$d_y = \left[M_{bc} + M_{dc} + d_x \cdot 24 + 30 \cdot 12 + \frac{3 \cdot 6 (15^2)}{2}\right] \cdot \frac{1}{15}$$
$$= 32 \cdot 156$$

$$a_x = -\frac{1}{24}\left[M_{ab} + M_{dc} + d_x \cdot 24 - d_y \cdot 33 + 30 \cdot 12 + 3 \cdot 6 (15)(25 \cdot 5)\right]$$
$$= -17 \cdot 2504$$

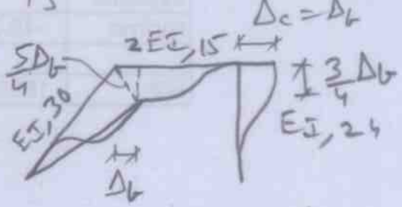
$$r = 30 + a_x + d_x = -2 \cdot 17$$



Fem's: $\frac{6EI\Delta_c}{24^2} = 100$ (Δ_b)

$$\Rightarrow \frac{6(2EI)\Delta}{15^2} = 12EI \frac{\Delta_b}{20} \cdot \frac{1}{15} = 384$$

$$\Rightarrow \frac{6EI \frac{5}{4}\Delta_b}{30^2} = 80$$



similarly for d'_x, a'_x, r'.