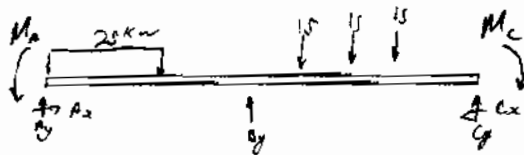


$EI = \text{constant}$

FBD



10
10

$$FEM_{AB} = -\frac{11WL^2}{192} = -\frac{11(25)(6^2)}{192} = -51.563 \text{ kN}\cdot\text{m}$$

$$FEM_{BA} = \frac{5WL^2}{192} = \frac{(5)(25)(6^2)}{192} = 23.438 \text{ kN}\cdot\text{m}$$

$$FEM_{BC} = -\frac{15PL}{48} = -\frac{(15)(15)(8)}{48} = -37.5$$

$$FEM_{CB} = \frac{15PL}{48} = \frac{(15)(15)(8)}{48} = 37.5$$

21
50

PROB. 12-19?

Distribution factors

$DF = k/EK$

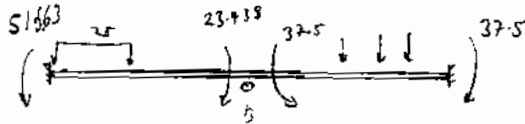
$k = I/L$

$$DF_{AB} = \frac{1/6}{(1/6 + 1/8)} = 0.571$$

$COF = \frac{1}{2}$ For fixed ends
0 for hinge ends

$$DF_{BC} = \frac{1/8}{(1/6 + 1/8)} = 0.429$$

Diagram



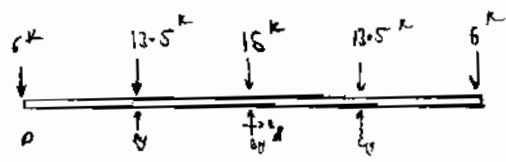
Member End	AB	BA	BC	CB
DF	0	0.571	0.429	0
FEM	-51.563	23.438	-37.5	37.5
Bal Int B	4.015 ←	8.029	6.033 →	3.017
Σ	-47.548			40.517

$$UM = 23.438 + (-37.5) = -14.062$$

$\therefore M_{AB} = \underline{\underline{-47.5 \text{ kN}\cdot\text{m}}}$

$M_{CB} = \underline{\underline{40.5 \text{ kN}\cdot\text{m}}}$

FBD



EI = constant

3° of freedom

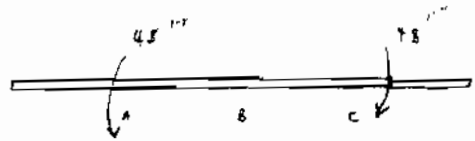
I
10

Due to overhangs

$$FEM_{AD} = 6^k \times 8 = 48^{1-k} \quad \downarrow -$$

$$FEM_{CE} = 6^k \times 8 = 48^{1-k} \quad \downarrow +$$

Redrawn



$$DF = \frac{1}{2} \cdot K = \frac{I}{L}$$

$$DF_{BA} = \frac{1/10}{(1/10 + 1/10)} = 0.5$$

$$DF_{BC} = 0.5 \quad \therefore 48 (0.5) = 24^{1-k}$$

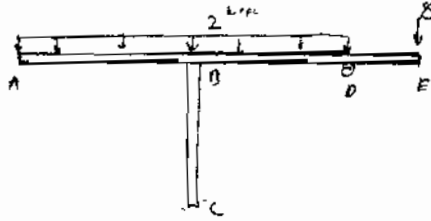
$$M_{AD} = -48^{1-k}$$

$$M_{BC} = 24^{1-k}$$

$$M_{CE} = 48^{1-k}$$

- 3 Moment Diagram

FBD



I constant all out

FEM

$$FEM_{AB} = \frac{-wL^2}{12} = \frac{-2(15^2)}{12} = -37.5 \text{ k-ft} \quad FEM_{BA} = 37.5 \text{ k-ft}$$

$$FEM_{BD} = \frac{-wL^2}{12} = -24 \text{ k-ft} \quad FEM_{DB} = 24 \text{ k-ft}$$

$$FEM_{DE} = 8 \times 8 = 64 \text{ k-ft} \quad FEM_{DC} = 0 = FEM_{CB}$$

Distribution factor $DF = k/EK \quad k = I/L$

$$DF_{BA} = \frac{15^{-1} I/k}{15^{-1} I/k + 12^{-1} I/k} = 0.26$$

$$DF_{BD} = \frac{12^{-1} (3/4)}{\frac{1}{2} 15^{-1} + 12^{-1} + \frac{1}{8} 12^{-1}} = 0.32 \quad DF_{DC} = \frac{12^{-1}}{\frac{1}{4} 15^{-1} + 12^{-1} + \frac{1}{8} 12^{-1}} = 0.42$$

$$DF_{DB} = \frac{12^{-1}}{12^{-1} + 8^{-1}} = 0 \quad DF_{DE} = 0$$

Joint	A	B		D		C	
Member Ends	AB	BA	BC	BD	DB	DE	CB
D.F	1	0.26	0.42	0.32	1	0	0
FEM	-37.5	37.5	0	-24	24	64	0
Balance Joint		-3.86	-4.82	-4.82	-35.2	-52.8	
C/O							

3. End Moments

-3 Moment Diagram.

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS

STANDARD

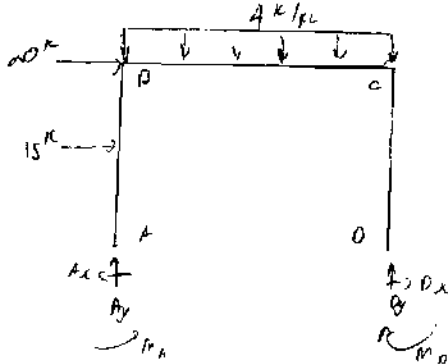
4/0

Prob 12-16

Ass # 13

025/12/25

FSD



$k = \frac{EI}{L}$ for fixed
 $\frac{3EI}{2L}$ for hinge

Distribution factor

$DF = k/EK$

$k = EI/L$

$DF_{DB} = 0 = DF_{CB}$

$DF_{BC} = \frac{15^3}{12^3 + 15^3} = 0.44$

$DF_{BA} = 1 - 0.44 = 0.56$

$DF_{CB} = 0.44$

$DF_{CD} = 0.56$

Part 1 No Side Sway

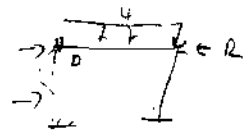
$FEM_{DC} = FEM_{CD} = 0$

$FEM_{BC} = -\frac{wL^2}{12} = -\frac{4(15^2)}{12} = -75 \text{ k-ft}$

$FEM_{CB} = 75 \text{ k-ft}$

$FEM_{AB} = \frac{PL}{8} = \frac{15(12)}{8} = 22.5 \text{ k-ft}$

$FEM_{BA} = -22.5$



Member End	A B	B A	B C	C B	C D	D C
DF	0	0.56	0.44	0.44	0.56	0
FEM	-22.5	22.5	-75	75	0	0
Balanced		+29.19	+23.3	-33	-42	
Carry over	+14.6		-16.5	+11.7		-21
B/C		+9.17	+7.33	-5.18	-1.48	
C/D	+4.59		-2.59	+3.67		-3.24
B/C		+2.44	+1.15	-1.63	-2.03	
C/D	+0.72		-0.82	+0.58		-1.015
B/C		+0.46	+0.36	-0.26	-0.32	
C/D	+0.23		-0.13	+0.18		-0.16
B/C		+0.07	+0.06	-0.08	-0.01	
Final Moments	+2.38	+62.83	+62.83	+50.6	+50.6	+25.39

-1/2 signs

22-141 50 SHEETS
 22-142 100 SHEETS
 22-144 200 SHEETS

STAIN

16/16

Part II side sway

$$FEM_{BC} = FEM_{CB} = 0$$

$$FEM_{AB} = FEM_{BA} = FEM_{DC} = FEM_{CD}$$

$$= -\frac{6EID}{L^2} = -\frac{6EID'}{L^2}$$

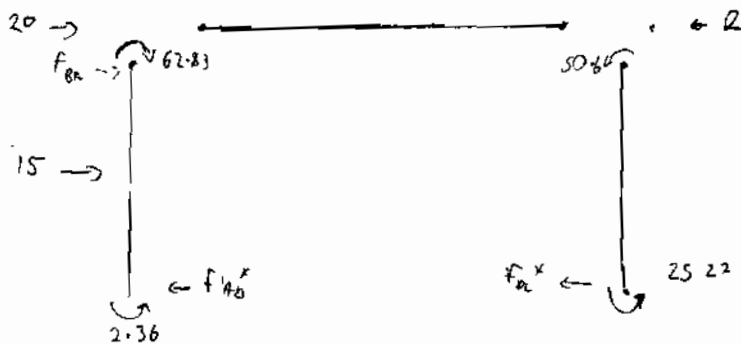
$$\text{Let } -\frac{6EID'}{L^2} = -100 \text{ kNm}$$



Member-End	AB	BA	BC	CB	CD	DC
Distribution Factor	0	0.56	0.44	0.44	0.56	0
FEM	-100	-100	0	0	-100	-100
B/C		+56	+44	+44	+56	
C/O	+28		+22	+22		+28
B/C		-12.32	-9.68	-9.68	-12.32	
C/O	-6.16		-4.84	-4.84		-6.16
B/C		+2.71	+2.13	+2.13	+2.71	
C/O	+1.36		+1.07	+1.07		+1.36
B/C		-0.60	-0.47	-0.47	-0.60	
C/O	-0.30		-0.24	-0.24		-0.30
D/C		+0.13	+0.11	+0.11	0.13	
Final	72.1	+54.1	+54.1	+54.1	+54.1	72.1

-1/2 signs

Solving for Q



$$\sum M_A = F_{BC}(12) - (15 \times 6) \cdot 62.83 - 2.16$$

$$F_{BC} = -2.46 \text{ k} \therefore \leftarrow$$

$$\sum M_B = 0 \quad F_{CD}(12) - 50.6 - 25.3$$

$$F_{CD} = -6.33 \text{ k} \therefore \leftarrow$$

where

$$\sum F_x = 0 = 20 - 2.46 - 6.33 - Q$$

$$Q = 11.22 \text{ k}$$

$$M = M_0 + \left(\frac{R}{Q}\right) M_A$$

-3