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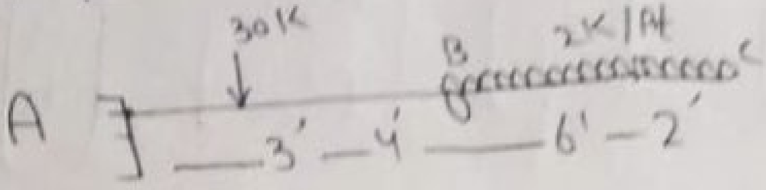
Submitted To : Engr.
Sir aDEED

Subject : Structer II

Date : 25 Sept 2020

Qno # 01



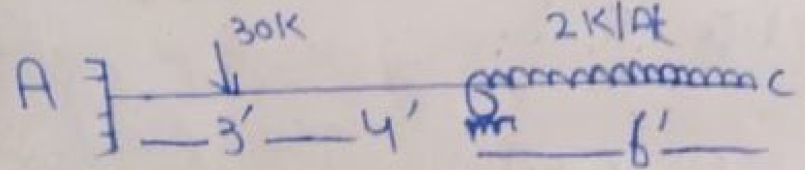
Solution:

Step #01

Determine Kinematic inDeterminacy

$K \cdot I\ 5^{\circ}$

So we have to reduce the extended Portion



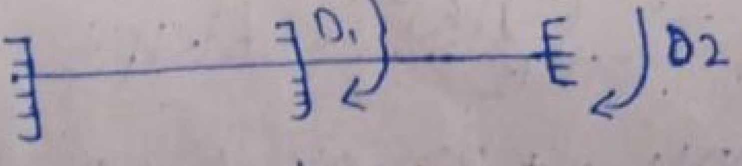
$$\Rightarrow \frac{2(2)}{1} = 4 \text{ K ft}$$

Now

$K \cdot I = 2^{\circ}$

Step #02

Determine Unknown Joint Displacement



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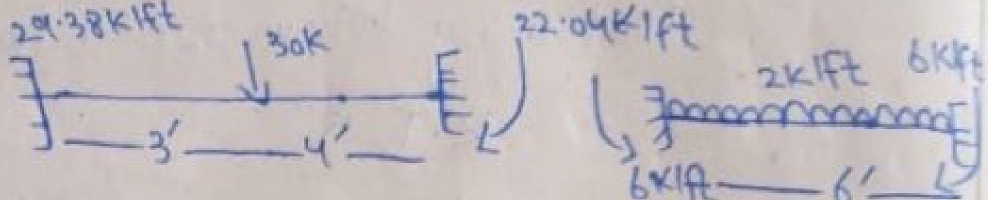
$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} ? \\ ? \end{bmatrix} \quad \begin{pmatrix} AD_1 \\ AD_2 \end{pmatrix} = \begin{bmatrix} 0 \\ 4 \end{bmatrix}$$

Step # 03

Compute [ADL] Matrix



⇒ For Point load (not at mid):-

for left End :-

$$\frac{Pab^2}{L^2} = \frac{(30)(3)(4)^2}{(7)^2} = 29.38 \text{ K/ft}$$

For right End :-

$$\frac{Pa^2b}{L^2} = \frac{(30)(3)^2(4)}{(7)^2} = 22.04 \text{ K/ft}$$

⇒ For UDL

$$\frac{wL^2}{12} \Rightarrow \frac{(2)(6)^2}{12} = 6 \text{ K/ft}$$

$ADL_1 = +22.04 - 6 = 16.04$ K/ft

$ADL_2 = 6$ K/ft

Step4

Compute [S] Matrix

$$S = \begin{bmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{bmatrix}$$

a) $D_1 = 1K$, $D_2 = 0$

$4EI = 0.57$

$\frac{4EI}{6} = 0.67$

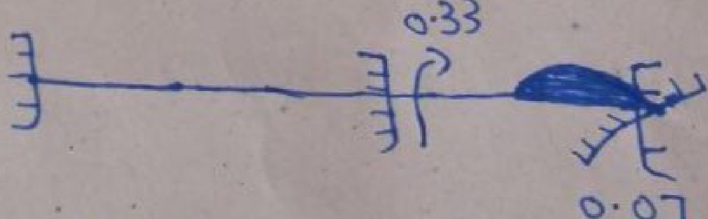
$\frac{2EI}{6} = 0.33$

$\frac{2EI}{7} = 0.28$

$S_{11} = 0.57 + 0.67$
$= 1.24EA$

$S_{21} = 0.33EA$

b) $D_1 = 0$, $D_2 = 1K$



$\frac{4EI}{6} = 0.67$

$\frac{2EI}{6} = 0.33$

$$S = \begin{bmatrix} 1.24 & 0.33 \\ 0.33 & 0.67 \end{bmatrix}$$

Step # 05

Compute $[D]$ matrix

$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{bmatrix}^{-1} \times \begin{bmatrix} AD_1 \\ AD_2 \end{bmatrix} - \begin{bmatrix} ADL_1 \\ ADL_2 \end{bmatrix}$$

$$= \frac{1}{\begin{bmatrix} 1.24 & 0.33 \\ 0.33 & 0.67 \end{bmatrix}} \times \text{Adj } A \times \begin{bmatrix} 0 \\ 4 \end{bmatrix} - \begin{bmatrix} 16.04 \\ 6 \end{bmatrix}$$

$$|S| = (1.24 \times 0.67) - (0.33 \times 0.33)$$

$$= 0.8308 - 0.1089$$

$$|S| = 0.7219$$

$$\text{Adj } A = \begin{bmatrix} 0.67 & -0.33 \\ -0.33 & 1.24 \end{bmatrix}$$

Now

$$\begin{bmatrix} AD_1 - ADL_1 \\ AD_2 - ADL_2 \end{bmatrix} = \begin{bmatrix} 0 - 16.04 \\ 4 - 6 \end{bmatrix} = \begin{bmatrix} 16.04 \\ -2 \end{bmatrix} E$$

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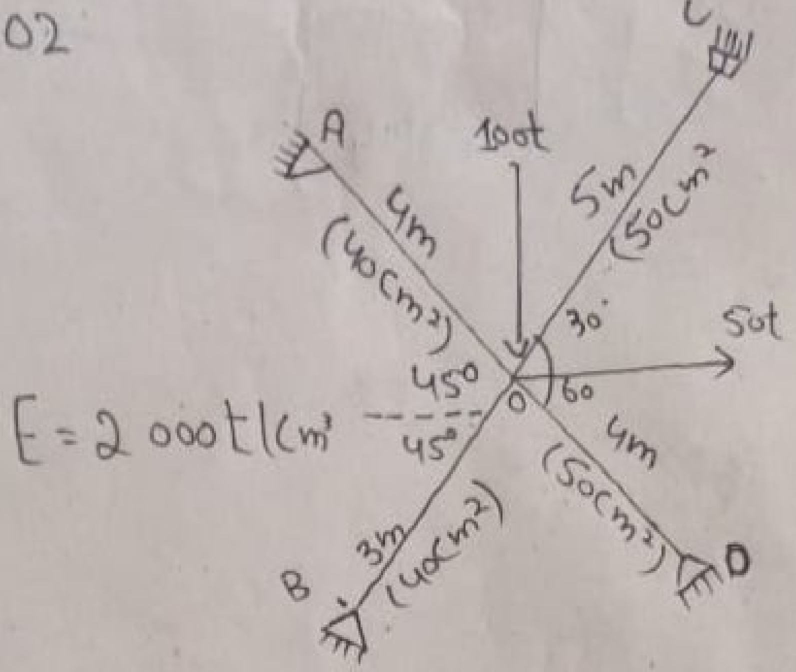
$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} -13.915 \\ 3.894 \end{bmatrix}$$

Qno #02



Solution:-

For A

$$\sin 45^\circ = \frac{p}{h} = \frac{p}{4}$$

$\Rightarrow P = 2.828m$

$$\cos 45^\circ = \frac{b}{4}$$

$\Rightarrow b = 2.828 m$

For B

$$\sin 45^\circ = \frac{p}{3}$$

$$\cos 45 = \frac{b}{h}$$

$\Rightarrow b = 2.12m$

For C

$$\sin 30^\circ = \frac{p}{h=5}$$

$\Rightarrow D \Rightarrow 2.5m$

$\cos 30^\circ = \frac{b}{5}$

$\Rightarrow b = 4.33m$

Now

$EA(A) = 2000 \times 40 = 80{,}000t$

$EA(B) = 2000 \times 40 = 80{,}000t$

Step1

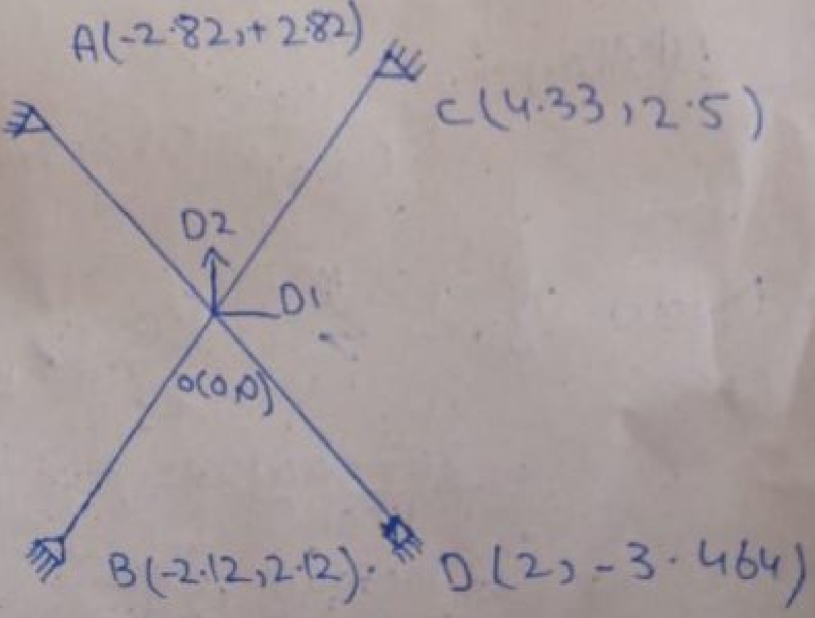
K.I

$K.I = 2j - 8$

$= 2(5) - 8 = 2^\circ$

Step #02

Slect unchown Joint of Displament.



$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} ? \\ ? \end{bmatrix}, \begin{bmatrix} AD_1 \\ AD_1 \end{bmatrix} = \begin{bmatrix} 50 \\ -100 \end{bmatrix}$$

Step#03

$$[AMD]_{4\times 2} \; \& \; [S]_{2\times 2}$$

i) $D_1 = 1$, $D_2 = 0$

$$AMD \; \frac{EA}{L^2}(x_i - x_j)$$

$$AMD_{11} = \frac{80{,}000}{(400)} \times (0+282) = 141$$

$$AMD_{21} = \frac{80{,}000}{(300)^2} \times (0+212) = 188.44$$

$$AMD_{31} = \frac{100{,}000}{(500)^2} \times (0-433) = -173.2$$

$$AMD_{41} = \frac{100{,}000}{(400)^2} \times (0 - 200) = -125$$

Now
$$S_{11} = \sum_{i=1}^{M} \frac{EA}{L^3}(x_i - x_j)^2$$

$$= \frac{80{,}000}{400^3}(282)^2 + \frac{80{,}000}{300^3}(212)^2 + \frac{100{,}000}{500^3}(-433)^2 + \frac{100{,}000}{400^3}(-200)^2$$

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$$\boxed{S_{11}\ 445.063}$$

$$S_{12} = S_{21} = \sum_{12.1}^{m} \frac{EA}{l^2}(xk - xj)\cdot(yk - yj)$$

$$= \frac{80{,}000}{400^3}(282)(-282) + \frac{86{,}000}{300^3}(212)(212) + \frac{100{,}000}{500^3}(-433)(0-250)$$

$$+ \frac{100{,}000}{400^3}(-200)(0+346)$$

$$\boxed{S_{12} = S_{21} = 12.237}$$

ii) $D_1 = 0 \quad D_1 = 1K'$

$$AMD = \frac{EA}{l^3}(yk - yj)$$

$$AMD_{12}\ \frac{80{,}000}{400^2}(-282) = 141$$

$$AMD_2\ \frac{80{,}000}{300}(212) = 188.44$$

$$AMD_{32}\ \frac{100{,}000}{500^2}(-250 = -100$$

$AM_{1)} = \frac{100,000}{400\,2}$ (346 = 216.25

Now $S_{22} = \sum_{i=1}^{n} \frac{EA}{L^3} (Y_K - X_j)^2$

$\frac{80,000}{400^3}(-282)^2 + \frac{80,000}{300^3}(212)^2$

$+ \frac{100,000}{500^3}(-250)^2 + \frac{100,000}{400^3}(346)^2$

$$\boxed{S_{22} = 469.628}$$

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Step # 4

$$[D] = [S]^{-1} \times [AD]$$

$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} 445.063 & 12.237 \\ 12.237 & 469.628 \end{bmatrix}^{-1} \times \begin{bmatrix} 50 \\ -100 \end{bmatrix}$$

$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} 0-1183 \\ -0.216 \end{bmatrix}$$

Step # 05 $[AM]$

$$\begin{bmatrix} AM_1 \\ AM_2 \\ AM_3 \\ AM_4 \end{bmatrix} = \begin{bmatrix} 141 & -141 \\ 188.44 & 188.44 \\ 173.2 & -100 \\ -\cancel{128} & 216.25 \end{bmatrix} \times \begin{bmatrix} 0.1183 \\ -0.216 \end{bmatrix}$$

$$\begin{bmatrix} 14\times.1183 + (-141) \times (0.216 \\ 188.44\times0.1185 + 185.44 \times (-0.216) \\ -173.28\times0.1183 + (-100) \times (-6.210) \\ -125\times0.1183 + 216.25 \times (0.218) \end{bmatrix}$$

$$\begin{bmatrix} AM_1 \\ AM_2 \\ AM_3 \\ AM_4 \end{bmatrix} = \begin{bmatrix} 16.68 & +30.46 \\ 22.29 & -40.70 \\ -20.49 & +21.6 \\ -14.79 & -46.71 \end{bmatrix}$$

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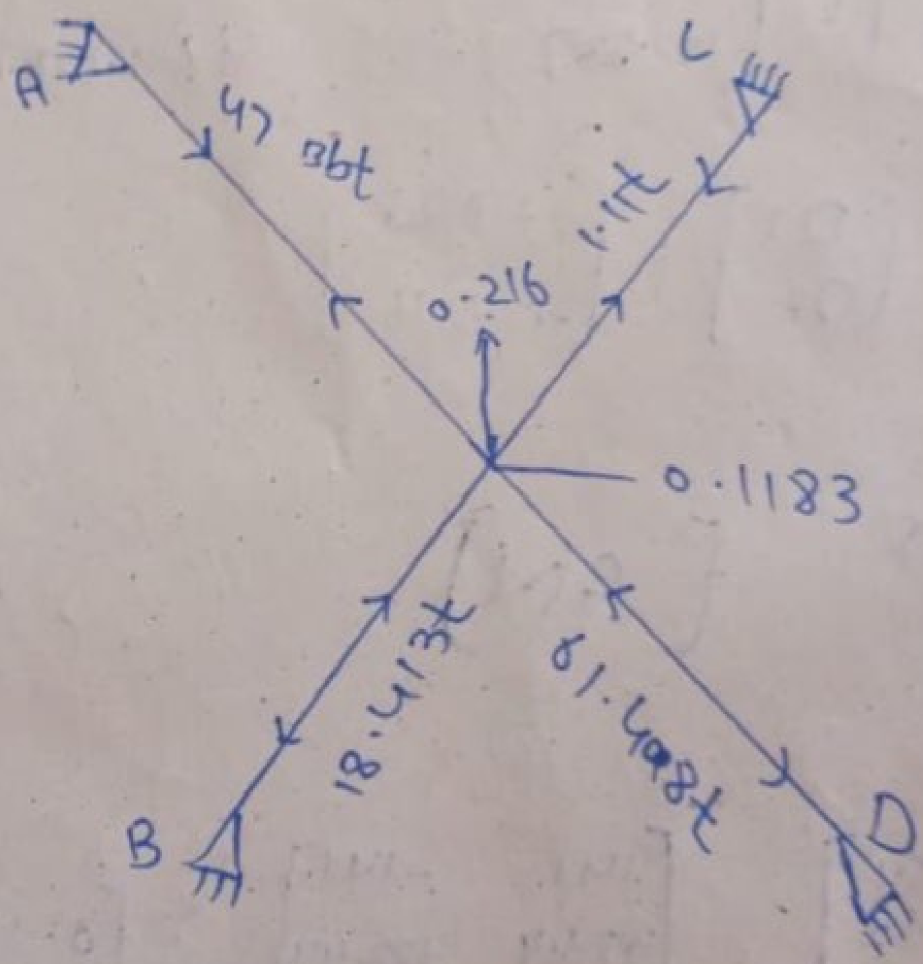
$$\begin{bmatrix} AM_1 \\ AM_2 \\ AM_3 \\ AM_4 \end{bmatrix} = \begin{bmatrix} 47.136t \\ -18.413t \\ 1.11t \\ -61.498t \end{bmatrix}$$



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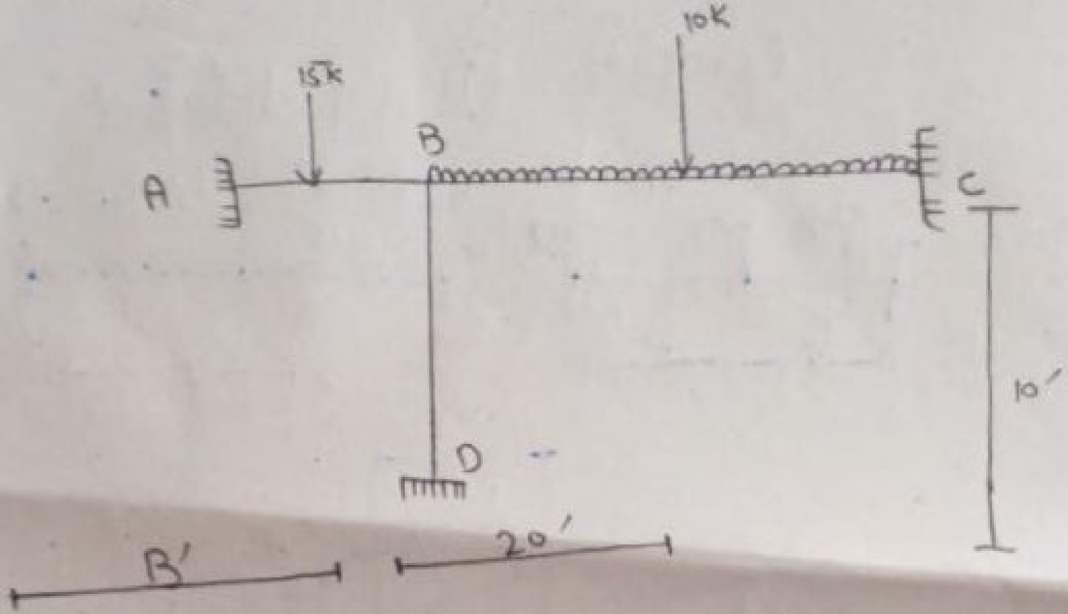
Qno #03



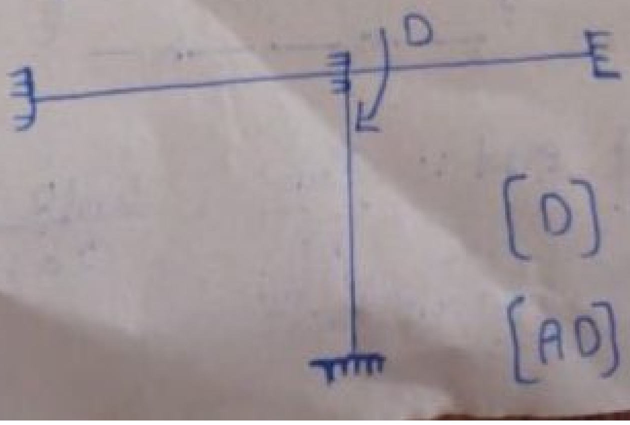
Solution

Step #1

- Determine Kinematic intermi-namey

$K.I = 1^{0}$

Step #2 Determine Unknown Joint Displacement

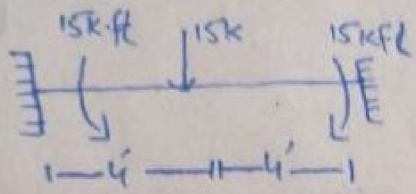


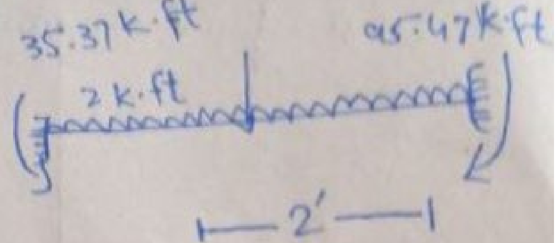
$[D] = [?]$

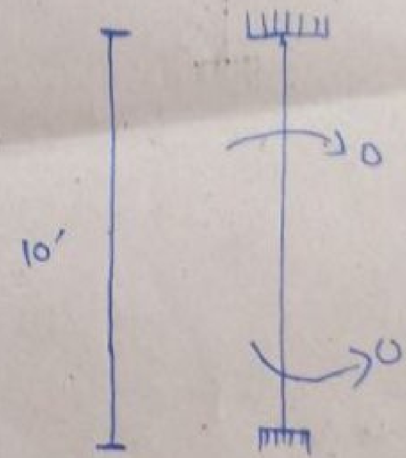
$[AD] \quad [0]$

Step #-03

Compute [ADL] Matrix







= Point load at center :· $\frac{PL}{8} = \frac{(15 \times 8)}{8}$

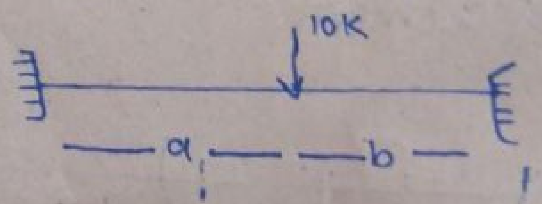
$= 15 \text{ Kip.ft}$

=> Uniformly Distributed load :· $\frac{wL^2}{12} = \frac{2(20)^2}{12}$

$= 66.67 \text{ k.ft}$

=> Point load (Not at mid) :-

Suppose



For Left end :· $\frac{Pab^2}{L^2} = \frac{(10)(12)(8)^2}{(20)^2}$

$= 19.2 \text{ K.ft}$

For right end :- $\frac{Pa^2b}{L^2} = \frac{(10)(12)^2(8)}{(20)^2} =$

28.8k ft

So total Moment at left end :.

19.2 + 66.67 85.87 k.ft

Similarly at right end :-

28.8 + 66.67 = 95.47 K.ft

So [ADL] = -85.87 + 15 = -70.87 kft

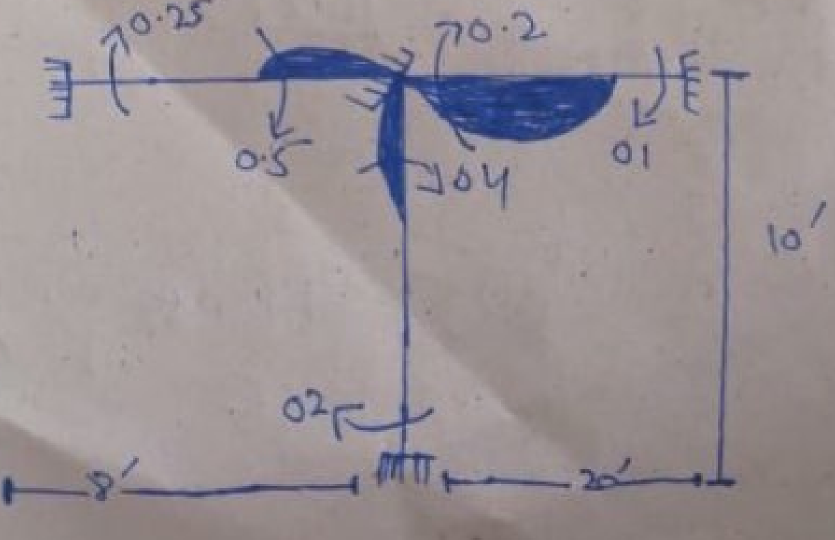
Step # 04

Determine [S] Matrix

[S] = [S 11]

Now

D = 1K



$\Rightarrow \frac{4EI}{8} = 0.5 \quad \frac{2EI}{8} = 0.25 \Rightarrow \frac{4EI}{10} = 0.4$

$= \frac{4EI}{20} = 0.2 \quad \frac{2EI}{20} \; 0.25 \Rightarrow \frac{2EI}{10} = 0.2$

$$[S] = (0.5 + 0.4 + 0.2)EI$$

$$= 1.1 EI$$

$$[S] = 1.1 \, EI$$

Stepe#05

Compute [D] Matrix

$$[D] = [S]^{-1} \times ([AD] - [ADL])$$

$$[D] = \frac{1}{1.1} \times [0] - [-70.81]$$

$$= \frac{70.87}{\cancel{1.1}}$$

$$[D] = [64.42] \; {}^{1}/_{EI}$$