

21/02/2022

P.1

QUESTION:- 1

HILAL AHMAD
ID : 13144

Given

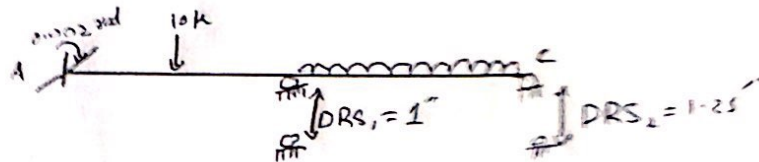
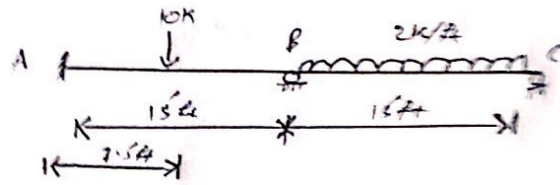
$$E = 30000 \text{ ksi}$$

$$I = 800 \text{ in}^4$$

$$EI = 166666.6 \text{ K-ft}^2$$

SI = 2 degree so two

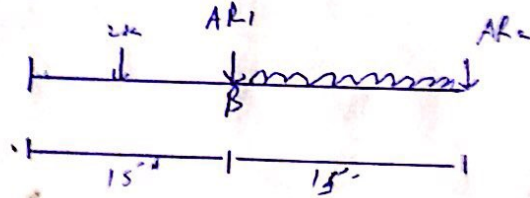
redundant actions should be chosen.



Solution:-

Step #A :-

select redundant action and assign coordinate at these location.



$$[AR]_{2 \times 1} = \begin{bmatrix} AR_1 \\ AR_2 \end{bmatrix}$$

$$[DRS]_{2 \times 1} = \begin{bmatrix} DRS_1 \\ DRS_2 \end{bmatrix}$$

$$= \begin{bmatrix} 1'' \\ 1.25'' \end{bmatrix}$$

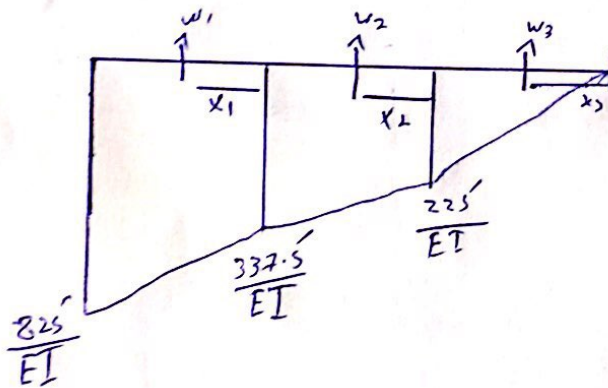
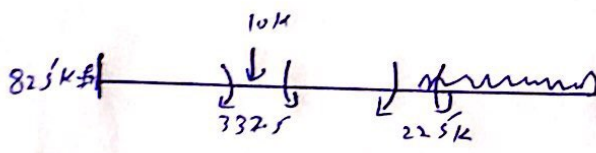
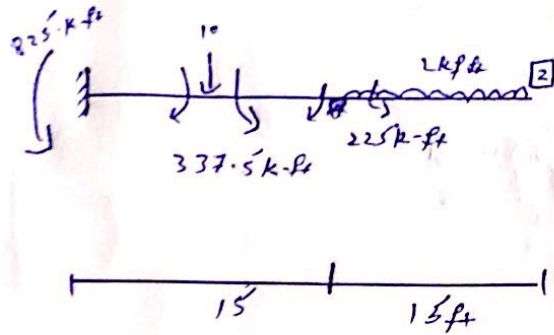
21-8-2019
Q-1

(P.2)

HILAL AHMAD

ID: 13144

compute value of DRL



$$\cancel{DRL} \begin{bmatrix} \cancel{DRL_1} \\ \cancel{DRL_2} \end{bmatrix} =$$

$$w_1 = \frac{1}{2} \left[\frac{82.5 + 337.5}{EI} \right] \times 7.5$$

$$w_1 = \frac{4359.375}{EI} \quad \text{--- (1)}$$

Q.1

(P.3)

$$w_2 = \frac{1}{2} \times \left[\frac{3375' + 225'}{EI} \right] \times 7.5'$$

$$w_2 = \frac{2109.375'}{EI} \quad \text{--- (2)}$$

$$w_3 = \frac{1}{3} \left(\frac{225'}{EI} \right) \times 15'$$

$$w_3 = \frac{1125'}{EI} \quad \text{--- (3)}$$

$$x_1 = \frac{7.5'}{3} \times \left(\frac{3375' + 2(825')}{3375' + 825'} \right) = 4.27'$$

$$x_2 = \frac{7.5'}{3} \times \left(\frac{225' + 2(825')}{225' + 825'} \right) = 4.46'$$

$$x_3 = \frac{3}{4} \times (15') = 11.25'$$

$$DRL_1 = w_1 (x_1 + 7.5') + w_2 (x_2)$$

$$= \left\{ (435'9) (4.27' + (2109) (4.46) \right\} \times \frac{1}{EI}$$

$$= \frac{28022.34}{EI}$$

Q.1

(P.4)

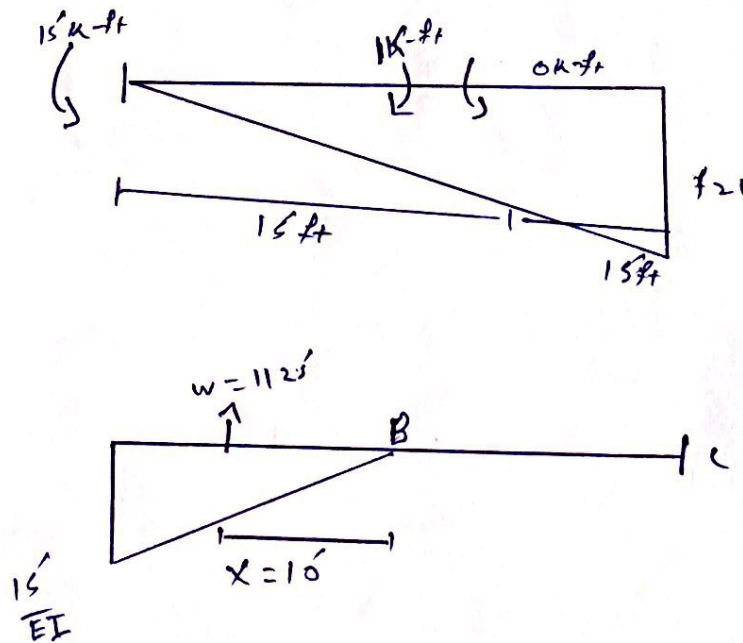
$$DRL_2 = w_1 (x_1 + 22.5') + w_2 (x_2 + 15') + w_3 x_3$$

$$= \frac{1}{EI} \times \left\{ 4359.375' (4.27' + 22.5') + (2109.375' \times (4.46' + 15')) + (1125' \times 11.25') \right\}$$

$$= \frac{170405' \cdot 15'}{EI}$$

$$DRL = \begin{bmatrix} 28022.34 \\ 170405' \cdot 15' \end{bmatrix} \times \frac{1}{EI}$$

FLEXIBILITY



Q.1

(P.S)

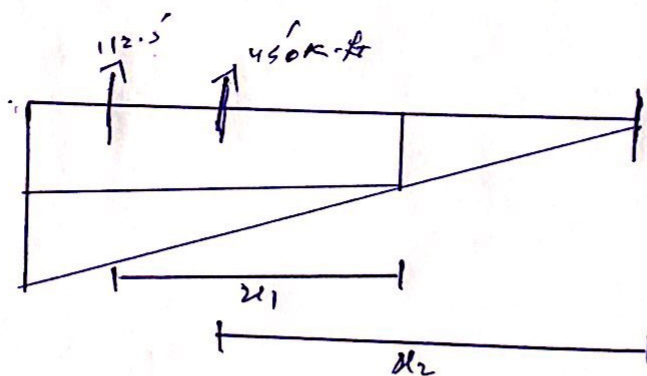
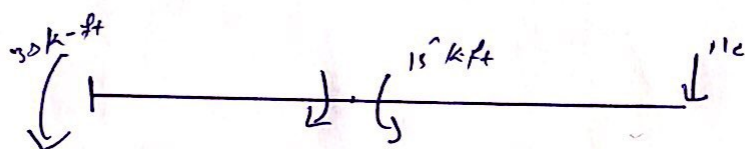
$$w = \frac{15' \times 15'}{2EI} = \frac{112.5'}{EI} \text{ k}$$

$$F_{11} = w(x) \quad F_{21} = (w * (x + 15'))$$

$$= \frac{112.5'}{EI} \times 10 \quad = 112.5' * (10 + 15')$$

$F_{1L} = \frac{112.5'}{EI}$	$F_{2L} = \frac{2812.5'}{EI}$
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P1)



$$w_1 = \frac{1}{2} \left(\frac{15' + 30}{EI} \right) \times 15'$$

$$x_1 = \frac{15'}{3} \left(\frac{15' + 2(30)}{15' + 30} \right) = 8.33'$$

$$w_2 = \frac{1}{2} \left(\frac{30 \times 30}{EI} \right)$$

$$= \frac{450}{EI} \text{ k}$$

Q.1

(P.6)

$$x_2 = \frac{2}{3} \times (30) \\ = 20$$

$$F_{12} = w_1(x_1)$$

$$F_{12} = \frac{337.5'}{EI} \times 8.33$$

$$F_{12} = 2812.5'k$$

$$F_{22} = w_2(x_2)$$

$$F_{22} = 45'0 + 20$$

$$= \frac{9000'k}{EI}$$

$$f = \frac{1}{EI} \begin{bmatrix} 1125' & 2812.5' \\ 2812.5' & 9000' \end{bmatrix}$$

$$DRL = \begin{bmatrix} 0.002 \times 15' \\ 0.002 \times 30 \end{bmatrix}$$

$$DRL = \begin{bmatrix} 0.03' \\ 0.06 \end{bmatrix}$$

$$DRL = \begin{bmatrix} 0.03 + 0.168 \\ 0.06 + 1.02 \end{bmatrix}$$

$$DRL = \begin{bmatrix} 0.198 \\ 1.083 \end{bmatrix}$$

(P.7)

$$DRS = [DRL] + [F] * [AR]$$

$$\begin{bmatrix} AR_1 \\ AR_2 \end{bmatrix} = \begin{bmatrix} F_{11} & F_{12} \\ F_{21} & F_{22} \end{bmatrix}^{-1} \begin{bmatrix} DRS_1 - DRL_1 \\ DRS_2 - DRL_2 \end{bmatrix}$$

$$= \begin{bmatrix} 4 \times 10^{-3} & -1 \times 10^{-3} \\ -1 \times 10^{-3} & 5 \times 10^{-3} \end{bmatrix} \begin{bmatrix} 1 & -0.198 \\ 1.25 & -1.083 \end{bmatrix}$$

$$= \begin{bmatrix} 4 \times 10^{-3} & -1 \times 10^{-3} \\ -1 \times 10^{-3} & 5 \times 10^{-3} \end{bmatrix} \begin{bmatrix} 0.802 \\ 1.67 \end{bmatrix}$$

$$\begin{bmatrix} AR_1 \\ AR_2 \end{bmatrix} = \begin{bmatrix} 677.25 & -211.6 \\ -211.6 & 24.652 \end{bmatrix} * \begin{bmatrix} 0.802 \\ 1.67 \end{bmatrix}$$

$$\begin{bmatrix} AR_1 \\ AR_2 \end{bmatrix} = \begin{bmatrix} 189 \\ -28.36 \end{bmatrix}$$

Q. NO: 2
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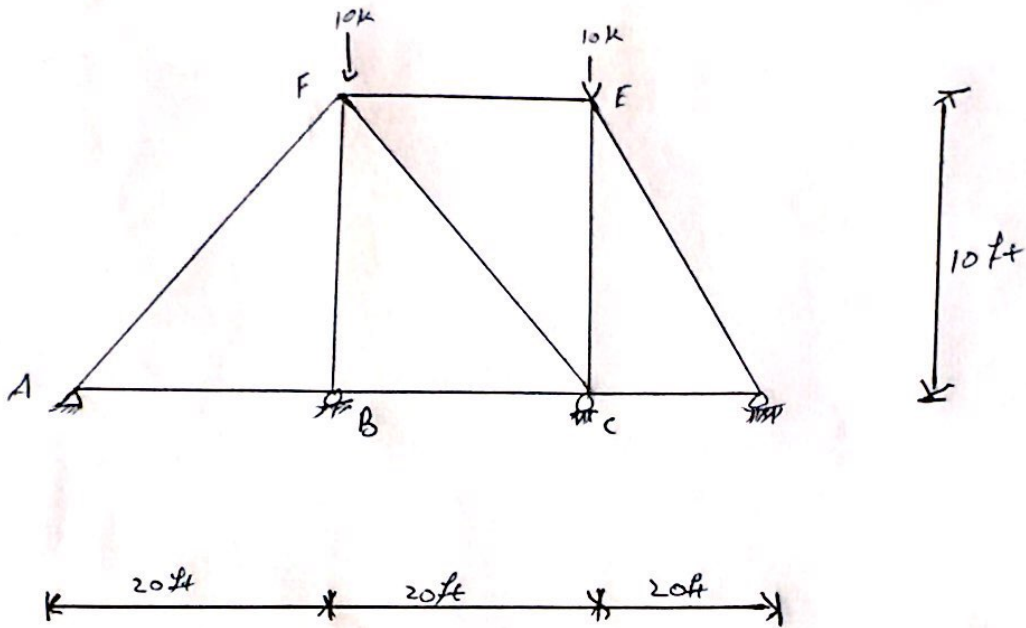
P.1

21-08-20

HILAL AHMAD
ID : 13144

Take $EI = \text{constant}$

S.I = 2 degree so Two redundant action should be chosen.



Sol: $EI = 3 - 3 = 0$

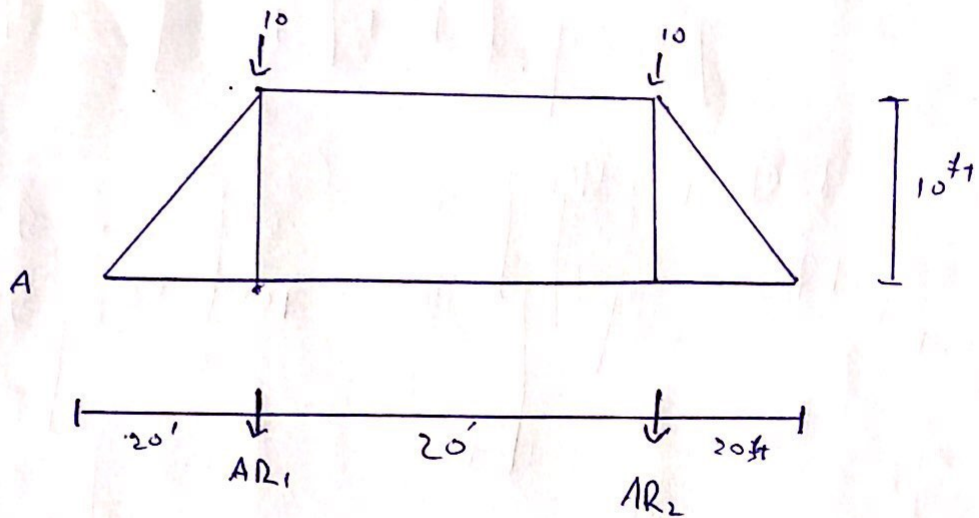
$$I \cdot I = 9 + 3 = 2(6) = 0$$

$$\begin{aligned} T \cdot I &= E \cdot I - I \cdot I \\ &= 2 - 0 \\ &= 2 \text{ degree} \end{aligned}$$

$$S \cdot I = 2 \text{ degree}$$

STEP #1

(P.2)



$$AR = \begin{bmatrix} AR_1 \\ AR_2 \end{bmatrix} = ?$$

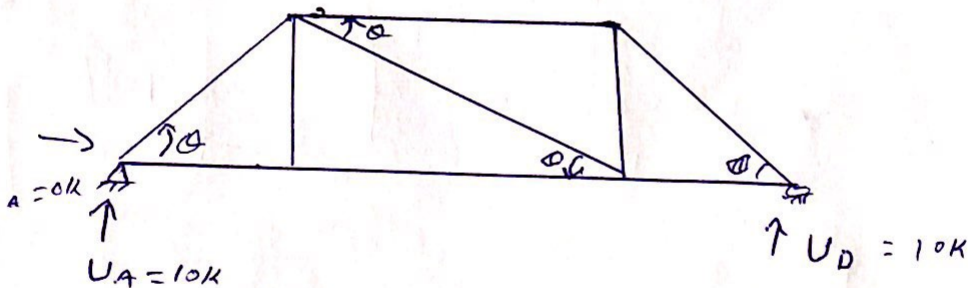
$$\tan \theta = \frac{10}{20} =$$

$$DRS = \begin{bmatrix} DRS_1 \\ DRS_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$\theta = \tan^{-1}(1/2)$$

$$\theta = 26.56^\circ$$

i) BDS att upon actual load



$$\sum M_A = 0$$

$$10 \times 20 + 20 \times 40 - U_D \times 60 = 0$$

$$U_D = 10K$$

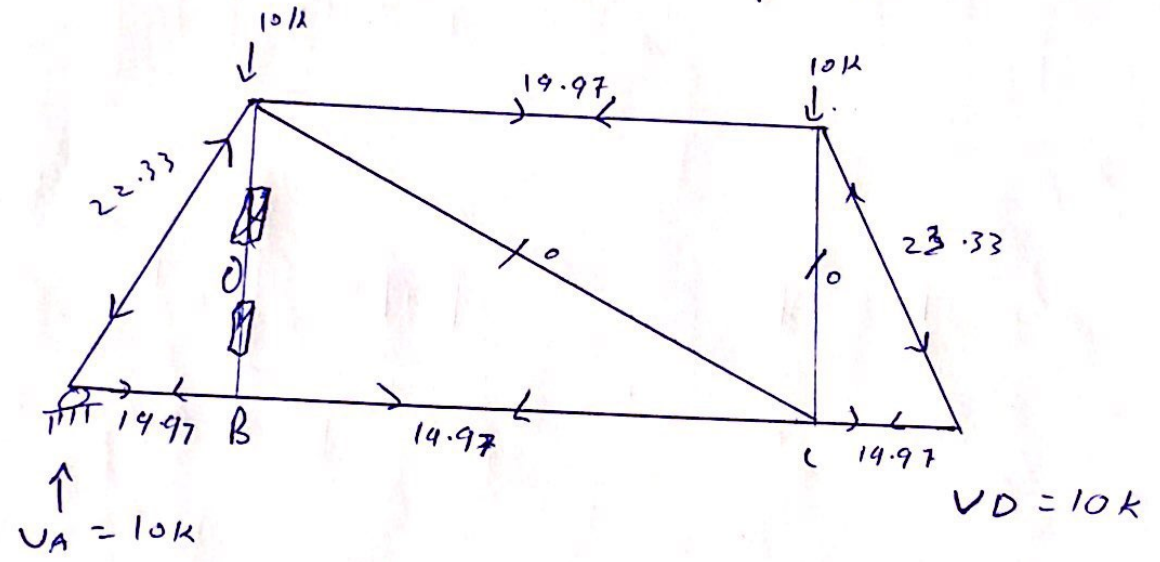
$F_y = 0$

$X_A = 20 - 10$

$V_A = 10K$

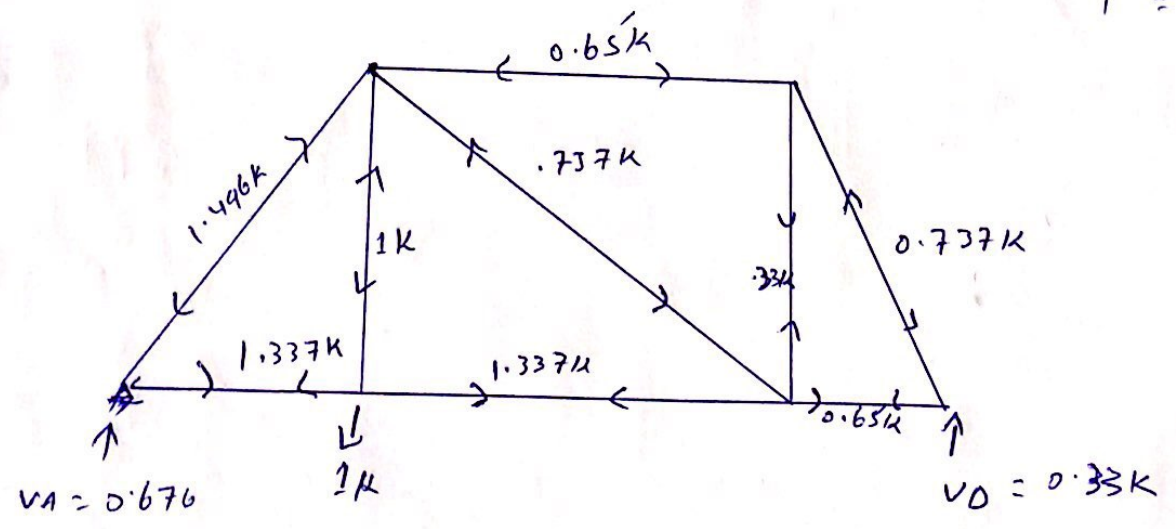
$\sum F_x = 0$

$H_A = 0K$



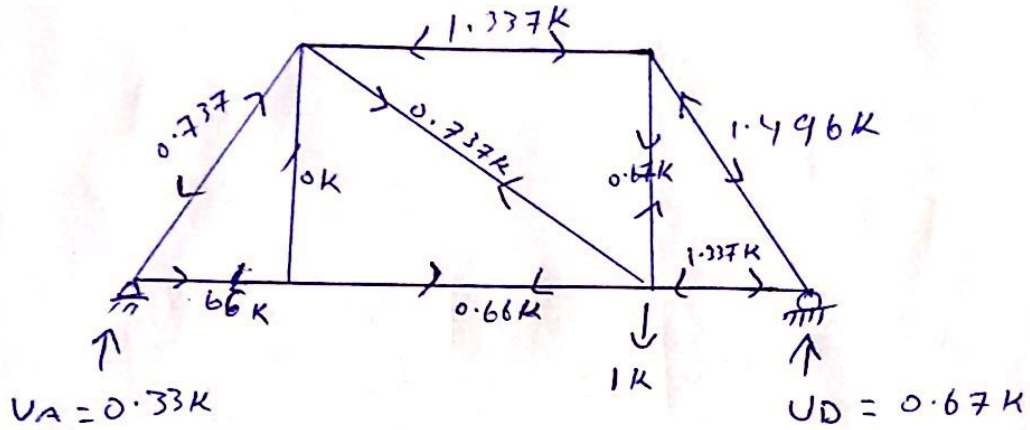
$I_Q = 26.6$

$S = P/H$
 $I = B/H$
 $\bar{i} = P/H$



U11 = value.

(P.4)



U_{2i} - value

members	AE	Length	P_i value	U_{1i}	U_{2i}
AB	1	20	11.92	1.337K	0.66K
BC	1	20	11.97	1.337K	0.66K
CD	1	20	11.97	0.65K	0.737K
DE	5	22.36	-23.33	-0.737K	-1.49K
EF	1	20	-19.97	-0.65K	-1.337K
AF	0	22.36	-23.33	-1.49K	-0.75K
BF	1	10	0	1	0
CF		22.36	0	-0.737K	0.737K
CE		10	0	0.33K	0.67K

$$DRL_i = \sum_{i=1}^m \frac{P_i U_{2i} L_i}{EA_i}$$

(P.s')

$$= \frac{1}{EA} \left\{ (20 \times 11.97 \times 1.337) + (20 \times 11.97) \right. \\ + (20 \times 11.97 \times 0.65') + (22.36 \times -23.33 \times -0.737) \\ + (20 \times -11.97 \times -0.65'K) + (22.36 \times -23.33 \\ \times -1.496) + 0 + 0 + 0 \left. \right\}$$

$$DRL_1 = \frac{1848.82}{EA}$$

$$DRL_2 = \frac{1}{EA} \left\{ (20 \times 11.97 \times 0.66) \right. \\ + (20 \times 11.97 \times 0.66) + (20 \times 11.97 \times 0.737) \\ + (22.36 \times -23.33 \times -1.496) \\ + (20 \times -19.97 \times -1.337) \\ + (22.36 \times -23.33 \times -0.73 \\ + 0 \\ + 0 \\ + 0 \left. \right\}$$

$$DRL_2 = \frac{2058.81}{EA}$$

$$F_{11} = \sum_{i=1}^m (P_i \cdot U_{1i} \cdot U_{2i} \cdot L_i) \quad F_{12} = F_{21} = \sum_{i=1}^m \frac{U_{1i} U_{2i} L_i}{EA}$$

$$F_{12} = \frac{1}{EA} \left\{ (20 \times 1.337 \times 0.66) + (20 \times 1.337 \times 0.66) \right.$$

$$+ (20 \times 0.065 \times 0.777) + (20 \times -0.65 \times -1.337) \\ + (22.36 \times -1.496 \times -0.777) \\ + 0 + (22.36 \times -0.737 \times 0.777) \\ + (10 \times 0.33 \times 0.67)$$

$$F_{12} = \frac{101.27}{EA}$$

$$F_{12} = F_{21} = \sum_{i=1}^m \frac{U_{1i} U_{2i} L_i}{EA}$$

$$F_{11} = \sum_{i=1}^m (P_i \cdot \Delta_i)$$

$$= \frac{1}{EA} \left\{ (20 \times 1.337 \times 1.337) + (20 \times 1.337 \times 1.337) + (20 \times 0.66 \times 0.66) + (22.36 \times -0.737 \times -0.737) + (20 \times (-0.66) \times 0.66) + (22.36 \times -1.496 \times -1.496) + (10 \times 1 \times 1) + (22.36 \times -0.737 \times -0.737) + (10 \times 0.33 \times 0.33) \right\}$$

$$F_{11} = \frac{65.31}{EA}$$

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$$F_{22} = \frac{1}{EA} \left\{ \begin{aligned} &20 \times 0.00 \times 0.66 \\ &+ (20 \times 0.66 \times 0.66) + (20 \times 0.737 \\ &\times 0.737) + (22.36 \times -1.496 \times \\ &-1.496) + (20 \times -1.337 \times 1.337) \\ &+ (22.36 \times -0.737 \times -0.737) \\ &+ (22.36 \times 0.737 \times 0.737) \\ &+ (10 \times 0.67 \times 0.67) \end{aligned} \right.$$

$$F_{22} = \frac{142.87}{E}$$

sorry no more time.