

Batang 5 :

$$\begin{bmatrix} d_1 \\ d_2 \\ d_3 \\ d_4 \\ d_5 \\ d_6 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0,00000000005 \\ -0,00006797977 \\ 0,00000000003 \\ 0,00000816474 \\ -0,00003235545 \\ 0,00006080635 \end{bmatrix} = \begin{bmatrix} 0,00000000005 \\ -0,00006797977 \\ 0,00000000003 \\ 0,00000816474 \\ -0,00003235545 \\ 0,00006080635 \end{bmatrix}$$

Batang 6:

$$\begin{bmatrix} d_1 \\ d_2 \\ d_3 \\ d_4 \\ d_5 \\ d_6 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0,00000816481 \\ -0,00003235545 \\ -0,00006080629 \\ 0,00000379135 \\ -0,00004891657 \\ -0,00005141681 \end{bmatrix} = \begin{bmatrix} -0,00003235545 \\ -0,00000816481 \\ -0,00006080629 \\ -0,00004891657 \\ -0,00000379135 \\ -0,00005141681 \end{bmatrix}$$

Batang 7 :

$$\begin{bmatrix} d_1 \\ d_2 \\ d_3 \\ d_4 \\ d_5 \\ d_6 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0,00000000005 \\ -0,00006797977 \\ 0,00000000003 \\ -0,00000000011 \\ -0,00010258500 \\ 0,00000000003 \end{bmatrix} = \begin{bmatrix} -0,00006797977 \\ -0,00000000005 \\ 0,00000000003 \\ -0,00010258500 \\ 0,00000000011 \\ 0,00000000003 \end{bmatrix}$$

Batang 8 :

$$\begin{bmatrix} d_1 \\ d_2 \\ d_3 \\ d_4 \\ d_5 \\ d_6 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0,00000816474 \\ -0,00003235545 \\ 0,00006080635 \\ -0,00003791563 \\ -0,00004891659 \\ 0,00005141685 \end{bmatrix} = \begin{bmatrix} -0,00003235545 \\ -0,00000816474 \\ 0,00006080635 \\ -0,00004891659 \\ 0,00003791563 \\ 0,00005141685 \end{bmatrix}$$

Sedangkan k untuk batang 6, 7, 8, 11, 12 dan 13 adalah sama, maka $k_6 = k_7 = k_8 = k_{11} = k_{12} = k_{13}$.

$$k_6 = \begin{bmatrix} 1611427,385 & 0 & 0 & -1611427,385 & 0 & 0 \\ 0 & 47356,272 & 82873,476 & 0 & -47356,272 & -82873,476 \\ 0 & 82873,476 & 193371,444 & 0 & 82873,476 & 96685,722 \\ -1611427,385 & 0 & 0 & 1611427,385 & 0 & 0 \\ 0 & -47356,272 & -82873,476 & 0 & 47356,272 & -82873,476 \\ 0 & 82873,476 & 96685,722 & 0 & -82873,476 & 193371,444 \end{bmatrix}$$

Dengan nilai k diatas dapat diperoleh gaya dalam tiap-tiap batang sebagai berikut :

Batang 1 :

$$f_1 = k_1 \begin{bmatrix} 0 \\ 0 \\ 0 \\ -0,00003235545 \\ 0,00000816481 \\ -0,00006080629 \end{bmatrix} = \begin{bmatrix} -45,62120 \\ -4,117189 \\ 5,662271 \\ -45,62120 \\ 4,117189 \\ -10,80648 \end{bmatrix}$$

Batang 2 :

$$f_2 = k_2 \begin{bmatrix} 0 \\ 0 \\ 0 \\ -0,00006797977 \\ 0,00000000005 \\ 0,00000000003 \end{bmatrix} = \begin{bmatrix} -95,851520 \\ -0,0000004 \\ 0,0000099 \\ -95,851520 \\ 0,0000004 \\ 0,0000016 \end{bmatrix}$$

Batang 3 :

$$f_3 = k_3 \begin{bmatrix} 0 \\ 0 \\ 0 \\ -0,00003235545 \\ -0,00000816474 \\ 0,00006080635 \end{bmatrix} = \begin{bmatrix} -45,56628 \\ 4,144137 \\ 5,751129 \\ -45,56628 \\ -4,144137 \\ 10,82541 \end{bmatrix}$$

Perhitungan baru :

$$\begin{aligned} Mn_1 &= b \cdot d^2 \cdot Rn_1 \\ &= 350 \cdot 485,889^2 \cdot 4,31557 \\ &= 3,56599 \cdot 10^8 \text{ Nmm} \end{aligned}$$

$$A_{s1} = \rho_1 \cdot b \cdot d = 0,01219 \cdot 350 \cdot 485,889 = 2073,417 \text{ mm}^2$$

$$\begin{aligned} Mn_2 &= Mn - Mn_1 \\ &= 6,2291 \cdot 10^8 - 3,56599 \cdot 10^8 = 2,66313 \cdot 10^8 \end{aligned}$$

$$\begin{aligned} A_{s2} &= \frac{Mn_2}{f_y \cdot (d - d')} \\ &= \frac{2,66313 \cdot 10^8}{400 \cdot (485,889 - 20 - \frac{1}{2} \cdot 22 - 10)} = 1496,514 \text{ mm}^2 \end{aligned}$$

$$\begin{aligned} a &= \frac{A_{s1} \cdot f_y}{0,85 \cdot f'c \cdot b} \\ &= \frac{2073,417 \cdot 400}{0,85 \cdot 25 \cdot 350} = 111,5115 \text{ mm} \end{aligned}$$

$$c = \frac{a}{\beta_1} = \frac{111,5115}{0,85} = 131,19 \text{ mm}$$

Luas tulangan tarik total :

$$\begin{aligned} A_s &= A_{s1} + A_{s2} \\ &= 2073,417 + 1496,514 = 3569,931 \text{ mm}^2 \end{aligned}$$

$$n = A_s / A_{\phi \text{ tul}} = 3569,931 / 379,94 = 9,396 \quad , n = 10 \text{ (dibulatkan)}$$

$$n \text{ lapis} = 10/5 = 2 \text{ lapis}$$

Titik berat tulangan :