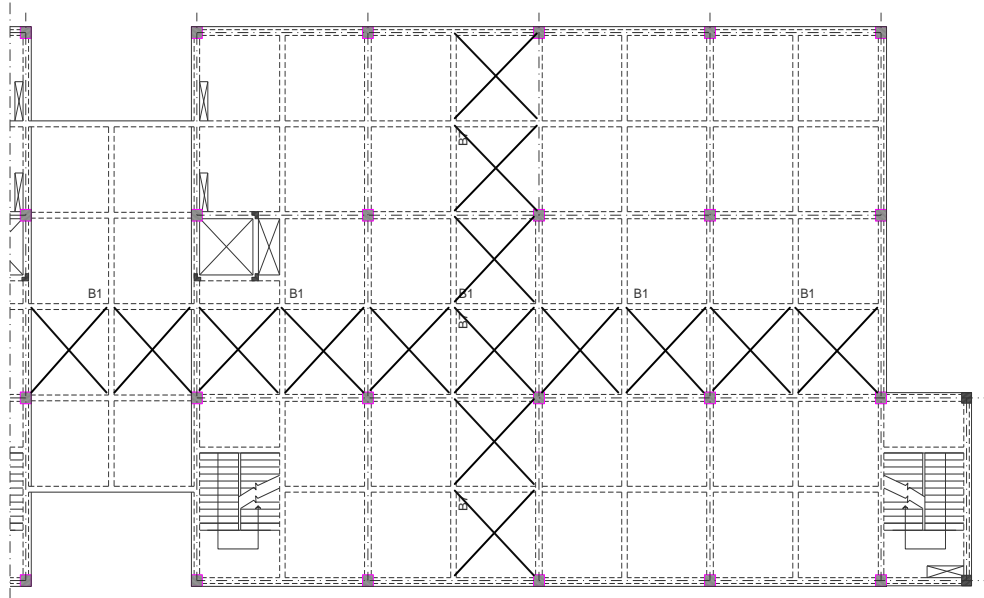
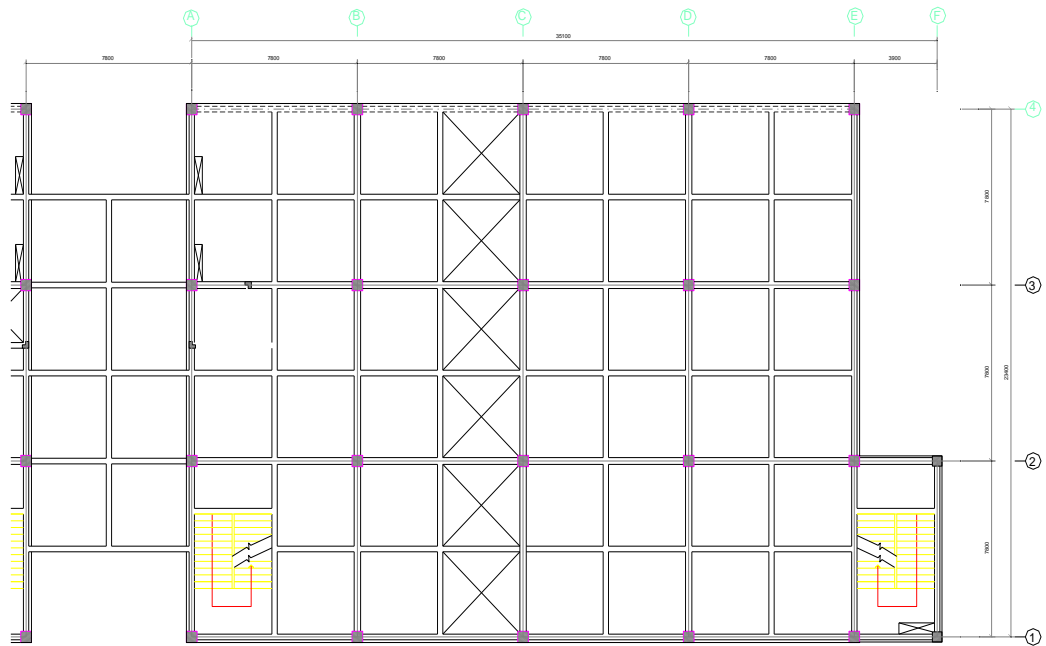


3.4 Pembebanan Balok Anak Arah Melintang Lantai 1-4

3.4.1 Pembebanan Balok Anak Arah Melintang Lantai 1-4



Gambar 3.4 balok anak



Gambar 3.4.1 Balok Anak Melintang

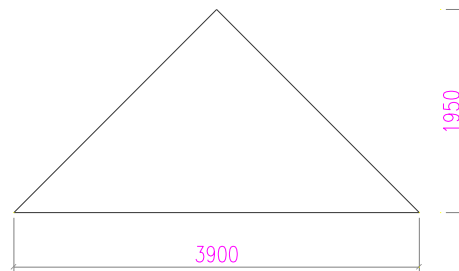
Data-data perhitungan

Dimensi balok anak

H	= 500 mm
B	= 250 mm
Fc	= 25 Mpa
Fy	= 400 Mpa
P	= 20 mm
Ø tulangan utama	= 19 mm
Ø sengkang	= 10 mm

a. Pembebanan ekuivalen untuk A

$$L = 3,9 \text{ m} \quad T = 1,950 \text{ m}$$



Gambar 3.4.1 pembebanan ekuivalen untuk A

$$A_1 = \frac{1}{2} \times 1,950 \text{ m} \times 1,950 \text{ m} = 1,901 \text{ m}^2$$

$$V_a = A_1 = 1,901 \text{ m}^2$$

$$M_{\max} = V_a \times 1,950 \text{ m} - A_1 \left(\frac{1}{3} \times 1,950 \text{ m} \right) = 2,471 \text{ m}^3$$

$$M_{\max} = \frac{1}{8} \times q_{\text{ek}} \times l^2$$

$$q_{\text{ek}} = \frac{2,471 \text{ m}^3 \times 8}{(3,9 \text{ m})^2} = 1,299 \text{ m}$$

$$q_{\text{ek1}} = q_{\text{ek2}} = 1,299 \text{ m}$$

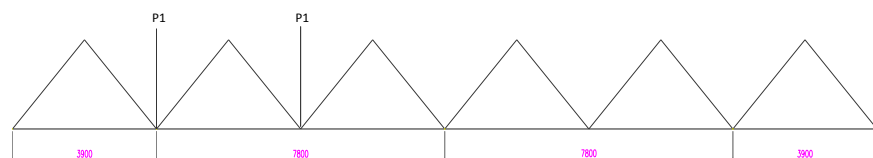
Akibat Beban Mati (WD)

- Berat Sendiri Balok
 - = $0,250\text{m} (0,500 - 0,10)\text{m} \times 24 \text{ Kn/m}^3$
 - = $2,4 \text{ Kn/m}$
 - Berat Sendiri Pelat dengan Tebal 10cm
 - = $3,87 \text{ Kn/m}^3 \times 1,299\text{m}$
 - = $5,027 \text{ Kn/m}$
 - Berat Plafond dan Penggantung
 - = $(0,11 + 0,07) \text{ Kn/m}^2 \times 1,299 \text{ m}$
 - = $0,467 \text{ Kn/m}$
- $Q_b = 7,894 \text{ Kn/m}$

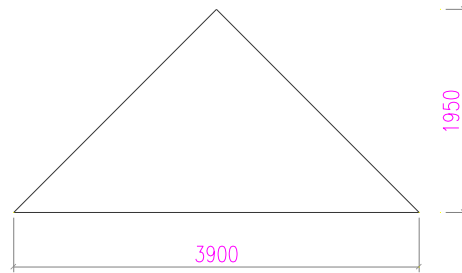
Akibat Beban Hidup (WL)

- Beban Hidup Untuk Lantai Kuliah
 - = $2,5 \text{ Kn/m}^2 \times 1,299 \text{ m}$
 - = $3,247 \text{ Kn/m}$
- $Q_l = 3,247 \text{ Kn/m}$

b. Pembebanan terpusat untuk P1



$$L = 3,9 \text{ m} \quad T = 1,950 \text{ m}$$



Gambar 3.4.2 Pembebanan terpusat untuk P1

$$A_1 = \frac{1}{2} \times 1,950 \text{ m} \times 1,950 \text{ m} = 1,901 \text{ m}^2$$

$$V_a = A_1 = 1,901 \text{ m}^2$$

$$M_{\max} = V_a \times 1,950 \text{ m} \times A_1 \left(\frac{1}{3} \times 1,950 \text{ m} \right) = 2,471 \text{ m}^3$$

$$M_{\max} = \frac{1}{8} \times q_{\text{ek}} \times l^2$$

$$q_{\text{ek}} = \frac{2,471 \text{ m}^3 \times 8}{(3,9 \text{ m})^2} = 1,299 \text{ m}$$

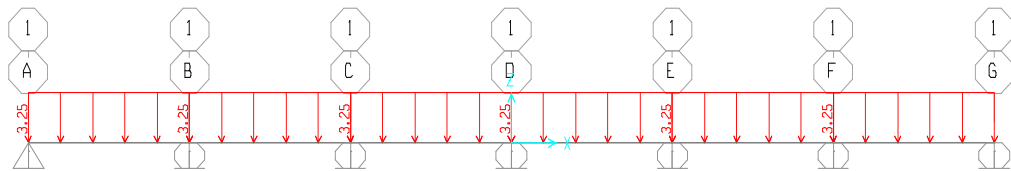
$$q_{\text{ek1}} = q_{\text{ek2}} = 2 \times 1,299 \text{ m} = 2,598 \text{ m}$$

Akibat Beban Mati (WD)

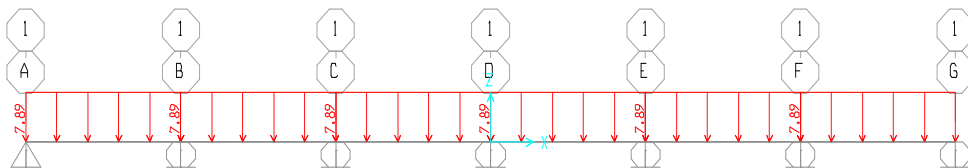
- Berat Sendiri Balok
 - = $0,250 \text{ m} (0,500 - 0,10) \text{ m} \times 24 \text{ Kn/m}^3$
 - = $2,4 \text{ Kn/m}$
 - Berat Sendiri Pelat dengan Tebal 10cm
 - = $3,87 \text{ Kn/m}^3 \times 2,598 \text{ m}$
 - = $10,054 \text{ Kn/m}$
 - Berat Plafond dan Penggantung
 - = $(0,11 + 0,07) \text{ Kn/m}^2 \times 2,598 \text{ m}$
 - = $0,467 \text{ Kn/m}$
- $$Q_b = 12,921 \text{ Kn/m}$$
- $$PD = \frac{1}{2} \times Q_b \times l$$
- $$= \frac{1}{2} \times 12,921 \text{ Kn/m} \times 3,9 \text{ m}$$
- $$= 25,195 \text{ Kn}$$

Akibat Beban Hidup (WL)

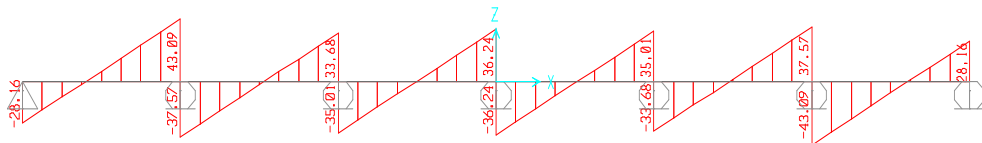
- Beban Hidup Untuk Lantai Kuliah
 - = $2,5 \text{ Kn/m}^2 \times 2,598 \text{ m}$
 - = $6,495 \text{ Kn/m}$
 - $Ql = 6,495 \text{ Kn/m}$
 - $PL = \frac{1}{2} \times Ql \times l$
 - = $\frac{1}{2} \times 6.495 \text{ Kn/m} \times 3,9 \text{ m}$
 - = $12,665 \text{ Kn}$



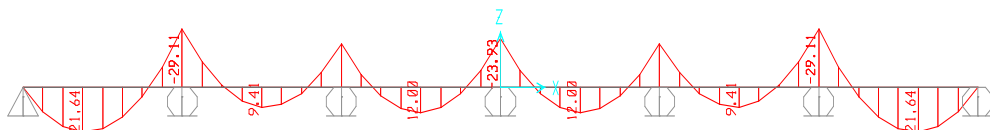
Gambar 3.4.3 Sketsa Pembebanan Hidup Balok Anak Arah Melintang



Gambar 3.4.4 Sketsa Pembebanan Mati Balok Anak Arah Melintang



Gambar 3.4.5 Diagram gaya lintang kombinasi balok beban hidup dan beban mati



Gambar 3.4.6 Diagram momen kombinasi balok beban hidup dan beban mati

3.4.2 Penulangan Balok Anak Arah Melintang

a. Tulangan pada lapangan

$$Mu = 21,64 \text{ Knm} = 21,64 \times 10^6 \text{ Nmm}$$

$$\text{Tinggi Efektif (d)} = h - \rho - \odot \text{ sengkang} - \frac{1}{2} \odot \text{ tulangan utama}$$

$$= 500 - 20 - 10 - \frac{1}{2} \times 19$$

$$= 460,5 \text{ mm}$$

$$K = \frac{Mu}{\odot b d^2} = \frac{21,64 \times 10^6}{0,8 \times 250 \times (460,5)^2} = 0,51$$

$$Mu = \odot \times \rho \times d^2 \times fy \left(1 - \rho \frac{fy}{2 \times 0,85 \times fc} \right)$$

$$\frac{Mu}{\odot b d^2} = \rho \times fy \left(1 - \rho \frac{fy}{2 \times 0,85 \times fc} \right)$$

$$0,51 = \rho \times 400 \left(1 - \rho \frac{400}{2 \times 0,85 \times 25} \right)$$

$$3764,70\rho^2 - 400\rho + 0,51 = 0$$

$$\rho_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\rho_1 = 0,1049$$

$$\rho_2 = 0,001$$

$$As_{\min} = \frac{1,4}{fy} b d = \frac{1,4}{400} 250 \times 460,5 = 402,93 \text{ mm}^2$$

$$As_{\min} = \frac{\sqrt{fc}}{4fy} b d = \frac{\sqrt{25}}{4 \times 400} 250 \times 460,5 = 359,76 \text{ mm}^2 \text{ (dipakai)}$$

untuk perbandingan nilai As)

$$As \text{ perlu} = \rho \times b \times d = 0,001 \times 250 \times 460,5 = 115,125 \text{ mm}^2$$

$$\begin{aligned} As \text{ max} &= 0,75 \times \frac{0,85 \times \beta \times fc}{fy} + \frac{600}{600+fy} \cdot b \cdot d \\ &= 0,75 \times \frac{0,85 \times 0,85 \times 25}{400} + \frac{600}{600+400} \cdot 250 \cdot 460,5 \\ &= 69075,03 \text{ mm}^2 \end{aligned}$$

$$As \text{ min} > As \text{ perlu} < As \text{ max}$$

$$402,93 \text{ mm}^2 > 115,125 \text{ mm}^2 < 69075,03 \text{ mm}^2$$

$$N = \frac{as}{\frac{1}{4} \times \pi \times 19^2} = \frac{359,76}{\frac{1}{4} \times \pi \times 19^2} = 1,26 \sim 2 \text{ buah}$$

$$As \text{ terpasang} = 2 \times \frac{1}{4} \times \pi \times 19^2 = 567,05 \text{ mm}^2$$

Jadi dipakai tulangan $2\odot 19 \text{ mm}$ ($As = 567,05 \text{ mm}^2$)

b. Tulangan pada tumpuan (momen negatif)

$$Mu = 29,11 \text{ Knm} = 29,11 \times 10^6 \text{ Nmm}$$

$$\begin{aligned} \text{Tinggi Efektif (d)} &= h - \rho - \odot \text{ sengkang} - \frac{1}{2} \odot \text{ tulangan utama} \\ &= 500 - 20 - 10 - \frac{1}{2} \times 19 \\ &= 460,5 \text{ mm} \end{aligned}$$

$$K = \frac{Mu}{\odot b d^2} = \frac{29,11 \times 10^6}{0,8 \times 250 \times (460,5)^2} = 0,68$$

$$Mu = \odot \times \rho \times d^2 \times fy \left(1 - \rho \frac{fy}{2 \times 0,85 \times fc} \right)$$

$$\frac{Mu}{\odot b d^2} = \rho \times fy \left(1 - \rho \frac{fy}{2 \times 0,85 \times fc} \right)$$

$$0,68 = \rho \times 400 \left(1 - \rho \frac{400}{2 \times 0,85 \times 25} \right)$$

$$3764,70\rho^2 - 400\rho + 0,68 = 0$$

$$\rho_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\rho_1 = 0,1045$$

$$\rho_2 = 0,001$$

$$As_{\min} = \frac{1,4}{fy} b d = \frac{1,4}{400} 250 \times 460,5 = 402,93 \text{ mm}^2$$

$$As_{\min} = \frac{\sqrt{fc}}{4fy} b d = \frac{\sqrt{25}}{4 \times 400} 250 \times 460,5 = 359,7 \text{ mm}^2 \text{ (dipakai)}$$

untuk perbandingan nilai As)

$$As \text{ perlu} = \rho \times b \times d = 0,001 \times 250 \times 460,5 = 115,125 \text{ mm}^2$$

$$\begin{aligned} As \text{ max} &= 0,75 \times \frac{0,85 \times \beta \times fc}{fy} + \frac{600}{600+fy} \cdot b \cdot d \\ &= 0,75 \times \frac{0,85 \times 0,85 \times 25}{400} + \frac{600}{600+400} \cdot 250 \cdot 460,5 \\ &= 69075,03 \text{ mm}^2 \end{aligned}$$

$$As \text{ min} > As \text{ perlu} < As_{\max}$$

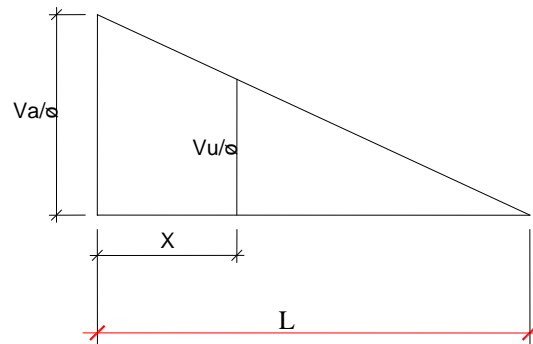
$$402,93 \text{ mm}^2 > 115,125 \text{ mm}^2 < 69075,03 \text{ mm}^2$$

$$N = \frac{as}{\frac{1}{4} \times \pi \times 19^2} = \frac{359,7}{\frac{1}{4} \times \pi \times 19^2} = 1,26 \sim 2 \text{ buah}$$

$$As \text{ terpasang} = 2 \times \frac{1}{4} \times \pi \times 19^2 = 567,05 \text{ mm}^2$$

Jadi dipakai tulangan $2\odot 19 \text{ mm}$ ($As = 567,05 \text{ mm}^2$)

c. Penulangan geser



$$Deff = 460,5 \text{ mm}$$

$$\phi = 0,75$$

$$Va = 43,09 \text{ Kn} = 43090 \text{ N}$$

$$\frac{va}{\phi} = 57453,33 \text{ N}$$

$$\text{Jarak } \frac{vu}{\phi} (x) = \frac{1}{2} b + deff = \frac{1}{2} \times 250 + 460,5 = 585,5$$

$$\frac{va}{\phi} : \frac{vu}{\phi} = 1,5 : (1,5 - x)$$

$$57453,33 : \frac{vu}{\phi} = 1,5 : (1,5 - 0,5855)$$

$$\frac{vu}{\phi} = \frac{0,5855 \times 57453,33}{1,5}$$

$$\frac{vu}{\phi} = 22425,94 \text{ N}$$

$$Vc = \frac{1}{6} \times \sqrt{fc} \times b \times deff = \frac{1}{6} \times \sqrt{25} \times 250 \times 460,5 = 95937,5$$

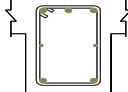
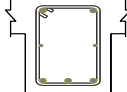
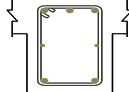
$$Vs = \frac{vu}{\phi} - vc = 22425,94 - 95937,5 = -73511,56 \text{ N}$$

$$Av = 2 \times \frac{1}{4} \times \pi \times d^2 = 2 \times \frac{1}{4} \times \pi \times 10^2 = 157,079 \text{ mm}^2$$

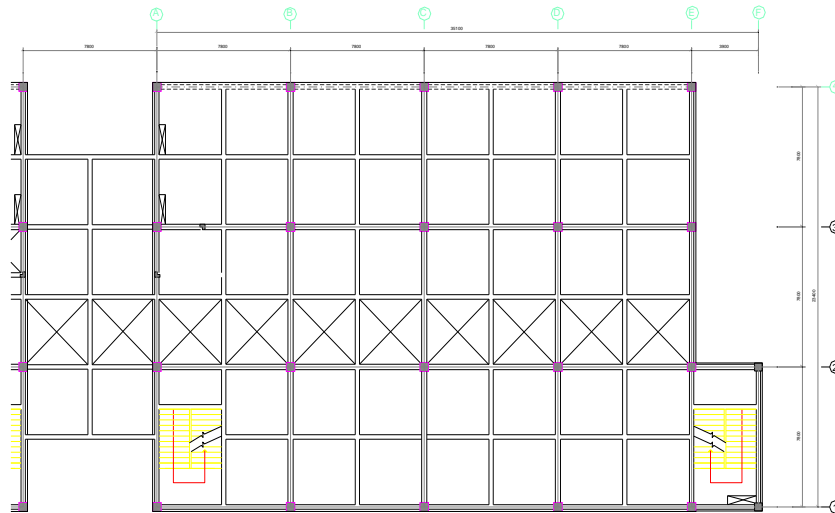
$$S_{max} = \frac{d}{2} = \frac{460,5}{2} = 230,25$$

$$S = \frac{av \times fy \times deff}{vs} = \frac{157,079 \times 400 \times 460,5}{73511,56} = 393,59 > S_{min}$$

Jadi dipakai sengkang $\varnothing 10-200$

B7		
TUMPUAN KIRI	LAPANGAN	TUMPUAN KANAN
		
250 X 500		
3 D 19	2 D 19	3 D 19
2 D 19	3 D 19	2 D 19
SK.D10-100	SK.D10-200	SK.D10-100
2 D10		

3.4.3 Pembebanan Balok Anak Arah Memanjang Lantai 1-4



Gambar 3.4.2 Balok Anak Memanjang

Data-data perhitungan

Dimensi balok anak

H = 650 mm

B = 300 mm

F_c = 25 Mpa

F_y = 400 Mpa

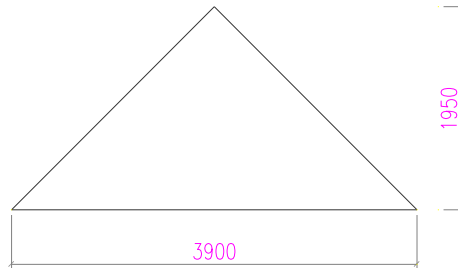
P = 20 mm

Ø tulangan utama = 19 mm

Ø sengkang = 10 mm

a. Pembebanan ekuivalen untuk A

$$L = 3,9 \text{ m} \quad T = 1,950 \text{ m}$$



Gambar 3.4.7 Pembebanan ekuivalen untuk A

$$A_1 = \frac{1}{2} \times 1,950 \text{ m} \times 1,950 \text{ m} = 1,901 \text{ m}^2$$

$$V_a = A_1 = 1,901 \text{ m}^2$$

$$M_{\max} = V_a \times 1,950 \text{ m} - A_1 \left(\frac{1}{3} \times 1,950 \text{ m} \right) = 2,471 \text{ m}^3$$

$$M_{\max} = \frac{1}{8} \times q_{\text{ek}} \times l^2$$

$$q_{\text{ek}} = \frac{2,471 \text{ m}^3 \times 8}{(3,9 \text{ m})^2} = 1,299 \text{ m}$$

$$q_{\text{ek1}} = q_{\text{ek2}} = 1,299 \text{ m}$$

Akibat Beban Mati (WD)

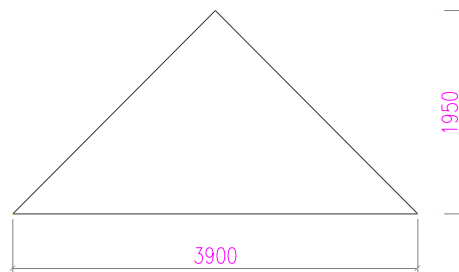
- Berat Sendiri Balok
 - = $0,300 \text{ m} (0,650 - 0,10) \text{ m} \times 24 \text{ Kn/m}^3$
 - = $3,96 \text{ Kn/m}$
 - Berat Sendiri Pelat dengan Tebal 10cm
 - = $3,87 \text{ Kn/m}^3 \times 1,299 \text{ m}$
 - = $5,027 \text{ Kn/m}$
 - Berat Plafond dan Penggantung
 - = $(0,11 + 0,07) \text{ Kn/m}^2 \times 1,299 \text{ m}$
 - = $0,467 \text{ Kn/m}$
- $$Q_b = 9,454 \text{ Kn/m}$$

Akibat Beban Hidup (WL)

- Beban Hidup Untuk Lantai Kuliah
 - = $2,5 \text{ Kn/m}^2 \times 1,299 \text{ m}$
 - = $3,247 \text{ Kn/m}$
 - $Ql = 3,247 \text{ Kn/m}$

b. Pembebanan terpusat untuk P1

$$L = 3,9 \text{ m} \quad T = 1,950 \text{ m}$$



Gambar 3.4.8 Pembebanan terpusat untuk P1

$$A_1 = \frac{1}{2} \times 1,950 \text{ m} \times 1,950 \text{ m} = 1,901 \text{ m}^2$$

$$V_a = A_1 = 1,901 \text{ m}^2$$

$$M_{\max} = V_a \times 1,950 \text{ m} \times A_1 \left(\frac{1}{3} \times 1,950 \text{ m} \right) = 2,471 \text{ m}^3$$

$$M_{\max} = \frac{1}{8} \times q_{ek} \times l^2$$

$$q_{ek} = \frac{2,471 \text{ m}^3 \times 8}{(3,9 \text{ m})^2} = 1,299 \text{ m}$$

$$q_{ek1} = q_{ek2} = 2 \times 1,299 \text{ m} = 2,598 \text{ m}$$

Akibat Beban Mati (WD)

- Berat Sendiri Balok
 - = $0,300 \text{ m} (0,650 - 0,10) \text{ m} \times 24 \text{ Kn/m}^3$
 - = $3,96 \text{ Kn/m}$
- Berat Sendiri Pelat dengan Tebal 10cm

$$= 3,87 \text{ Kn/m}^3 \times 2,598 \text{ m}$$

$$= 10,054 \text{ Kn/m}$$

- Berat Plafond dan Penggantung

$$= (0,11 + 0,07) \text{ Kn/m}^2 \times 2,598 \text{ m}$$

$$= 0,467 \text{ Kn/m}$$

$$Q_b = 14,481 \text{ Kn/m}$$

$$PD = \frac{1}{2} \times Q_b \times l$$

$$= \frac{1}{2} \times 14,481 \text{ Kn/m} \times 3,9 \text{ m}$$

$$= 28,237 \text{ Kn}$$

Akibat Beban Hidup (WL)

- Beban Hidup Untuk Lantai Kuliah

$$= 2,5 \text{ Kn/m}^2 \times 2,598 \text{ m}$$

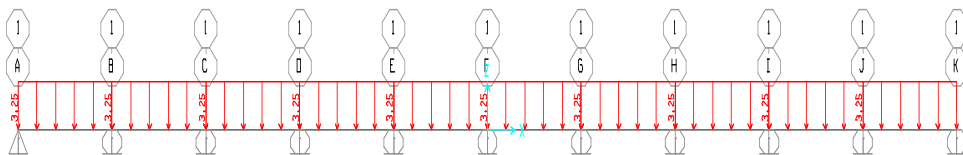
$$= 6,495 \text{ Kn/m}$$

$$Q_l = 6,495 \text{ Kn/m}$$

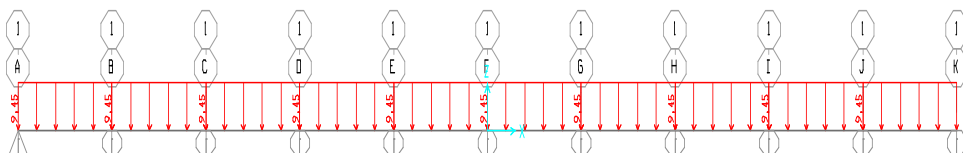
$$PL = \frac{1}{2} \times Q_l \times l$$

$$= \frac{1}{2} \times 6,495 \text{ Kn/m} \times 3,9 \text{ m}$$

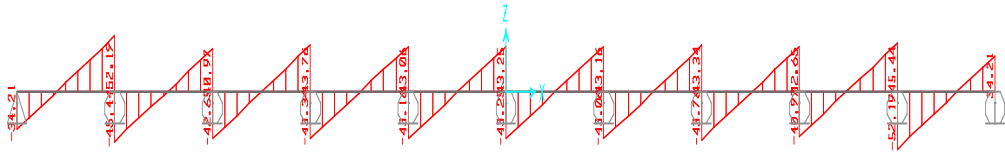
$$= 12,665 \text{ Kn}$$



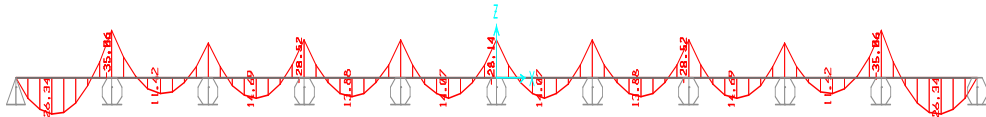
Gambar 3.4.9 Sketsa pembebanan hidup balok anak arah memanjang



Gambar 3.4.10 Sketsa pembebanan mati balok anak arah memanjang



Gambar 3.4.11 Diagram gaya lintang kombinasi beban hidup dan beban mati



Gambar 3.4.12 Diagram momen kombinasi beban hidup dan beban mati

3.4.4 Penulangan Balok Anak Arah Memanjang

a. Tulangan pada lapangan

$$M_u = 26,34 \text{ Knm} = 26,34 \times 10^6 \text{ Nmm}$$

$$\begin{aligned} \text{Tinggi Efektif (d)} &= h - \rho - \ominus \text{ sengkang} - \frac{1}{2} \ominus \text{ tulangan utama} \\ &= 650 - 20 - 10 - \frac{1}{2} \times 19 \\ &= 610,5 \text{ mm} \end{aligned}$$

$$K = \frac{M_u}{\ominus b d^2} = \frac{26,34 \times 10^6}{0,8 \times 300 \times (610,5)^2} = 0,29$$

$$M_u = \ominus \times \rho \times d^2 \times f_y \left(1 - \rho \frac{f_y}{2 \times 0,85 \times f_c} \right)$$

$$\frac{M_u}{\ominus b d^2} = \rho \times f_y \left(1 - \rho \frac{f_y}{2 \times 0,85 \times f_c} \right)$$

$$0,29 = \rho \times 400 \left(1 - \rho \frac{400}{2 \times 0,85 \times 25} \right)$$

$$3764,70\rho^2 - 400\rho + 0,29 = 0$$

$$\rho_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\rho_1 = 0,1055$$

$$\rho_2 = 0,0007$$

$$A_{S_{\min}} = \frac{1,4}{f_y} b d = \frac{1,4}{400} \times 300 \times 610,5 = 641,025 \text{ mm}^2$$

$$A_{s_{\min}} = \frac{\sqrt{f_c}}{4f_y} b d = \frac{\sqrt{25}}{4 \times 400} 300 \times 610,5 = 572,34 \text{ mm}^2 \text{ (dipakai)}$$

untuk perbandingan nilai A_s)

$$A_{s \text{ perlu}} = \rho \times b \times d = 0,0007 \times 300 \times 610,5 = 128,2 \text{ mm}^2$$

$$\begin{aligned} A_{s \text{ max}} &= 0,75 \times \frac{0,85 \times \beta \times f_c}{f_y} + \frac{600}{600+f_y} \cdot b \cdot d \\ &= 0,75 \times \frac{0,85 \times 0,85 \times 25}{400} + \frac{600}{600+400} \cdot 300 \cdot 610,5 \\ &= 88620,27 \text{ mm}^2 \end{aligned}$$

$A_{s \text{ min}} > A_{s \text{ perlu}} < A_{s \text{ max}}$

$$641,025 \text{ mm}^2 > 128,2 \text{ mm}^2 < 88620,27 \text{ mm}^2$$

$$N = \frac{a_s}{\frac{1}{4} \times \pi \times 19^2} = \frac{572,34}{\frac{1}{4} \times \pi \times 19^2} = 2,0 \sim 2 \text{ buah}$$

$$A_{s \text{ terpasang}} = 2 \times \frac{1}{4} \times \pi \times 19^2 = 567,05 \text{ mm}^2$$

Jadi dipakai tulangan 2 \varnothing 19 mm ($A_s = 567,05 \text{ mm}^2$)

b. Tulangan pada tumpuan (momen negatif)

$$M_u = 35,06 \text{ Knm} = 35,06 \times 10^6 \text{ Nmm}$$

Tinggi Efektif (d) = $h - \rho - \varnothing$ sengkang - $\frac{1}{2} \varnothing$ tulangan utama

$$= 650 - 20 - 10 - \frac{1}{2} \times 19$$

$$= 610,5 \text{ mm}$$

$$K = \frac{M_u}{\varnothing b d^2} = \frac{35,06 \times 10^6}{0,8 \times 300 \times (610,5)^2} = 0,39$$

$$M_u = \varnothing \times \rho \times d^2 \times f_y \left(1 - \rho \frac{f_y}{2 \times 0,85 \times f_c} \right)$$

$$\frac{M_u}{\varnothing b d^2} = \rho \times f_y \left(1 - \rho \frac{f_y}{2 \times 0,85 \times f_c} \right)$$

$$0,39 = \rho \times 400 \left(1 - \rho \frac{400}{2 \times 0,85 \times 25} \right)$$

$$3764,70\rho^2 - 400\rho + 0,39 = 0$$

$$\rho_1, \rho_2 = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\rho_1 = 0,105$$

$$\rho_2 = 0,0009$$

$$A_{s_{\min}} = \frac{1,4}{f_y} b d = \frac{1,4}{400} 300 \times 610,5 = 641,025 \text{ mm}^2$$

$$A_{s_{\min}} = \frac{\sqrt{f_c}}{4f_y} b d = \frac{\sqrt{25}}{4 \times 400} 300 \times 610,5 = 572,34 \text{ mm}^2 \text{ (dipakai)}$$

untuk perbandingan nilai A_s)

$$A_{s \text{ perlu}} = \rho \times b \times d = 0,0009 \times 300 \times 610,5 = 164,8 \text{ mm}^2$$

$$\begin{aligned} A_{s \text{ max}} &= 0,75 \times \frac{0,85 \times \beta \times f_c}{f_y} + \frac{600}{600+f_y} \cdot b \cdot d \\ &= 0,75 \times \frac{0,85 \times 0,85 \times 25}{400} + \frac{600}{600+400} \cdot 300 \cdot 610,5 \\ &= 88620,27 \text{ mm}^2 \end{aligned}$$

$A_{s \text{ min}} > A_{s \text{ perlu}} < A_{s \text{ max}}$

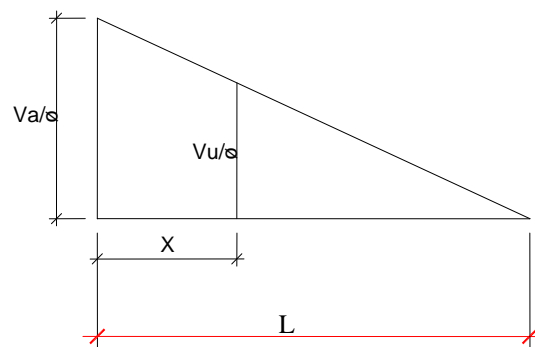
$$641,025 \text{ mm}^2 > 164,8 \text{ mm}^2 < 88620,27 \text{ mm}^2$$

$$N = \frac{a_s}{\frac{1}{4} \times \pi \times 19^2} = \frac{572,34}{\frac{1}{4} \times \pi \times 19^2} = 2,0 \sim 2 \text{ buah}$$

$$A_{s \text{ terpasang}} = 2 \times \frac{1}{4} \times \pi \times 19^2 = 567,05 \text{ mm}^2$$

Jadi dipakai tulangan $2\varnothing 19 \text{ mm}$ ($A_s = 567,05 \text{ mm}^2$)

c. Penulangan geser



$$d_{eff} = 610,5 \text{ mm}$$

$$\varnothing = 0,75$$

$$V_a = 52,19 \text{ Kn} = 52190 \text{ N}$$

$$\frac{v_a}{\varnothing} = 69586,6 \text{ N}$$

$$\text{Jarak } \frac{vu}{\varnothing} (x) = \frac{1}{2} b + d_{eff} = \frac{1}{2} \times 300 + 610,5 = 760,5$$

$$\frac{v_a}{\varnothing} : \frac{vu}{\varnothing} = 1,5 : (1,5 - x)$$

$$69586,6 : \frac{vu}{\varnothing} = 1,5 : (1,5 - 0,760)$$

$$\frac{vu}{\phi} = \frac{0,760 \times 69586,6}{1,5}$$

$$\frac{vu}{\phi} = 35257,21 \text{ N}$$

$$V_c = \frac{1}{6} \times \sqrt{f_c} \times b \times d_{eff} = \frac{1}{6} \times \sqrt{25} \times 300 \times 610,5 = 152625$$

$$V_s = \frac{vu}{\phi} - v_c = 35257,21 - 152625 = -117367,79 \text{ N}$$

$$A_v = 2 \times \frac{1}{4} \times \pi \times d^2 = 2 \times \frac{1}{4} \times \pi \times 10^2 = 157,079 \text{ mm}^2$$

$$S_{max} = \frac{d}{2} = \frac{610,5}{2} = 305,25$$

$$S = \frac{a_v \times f_y \times d_{eff}}{v_s} = \frac{157,079 \times 400 \times 610,5}{117367,79} = 326,82 > S_{min}$$

Jadi dipakai sengkang $\phi 10-200$

B1		
TUMPUAN KIRI	LAPANGAN	TUMPUAN KANAN
300 X 650		
3 D 19	2 D 19	3 D 19
2 D 19	3 D 19	2 D 19
SK.D10-100	SK.D10-200	SK.D10-100
2 D10		