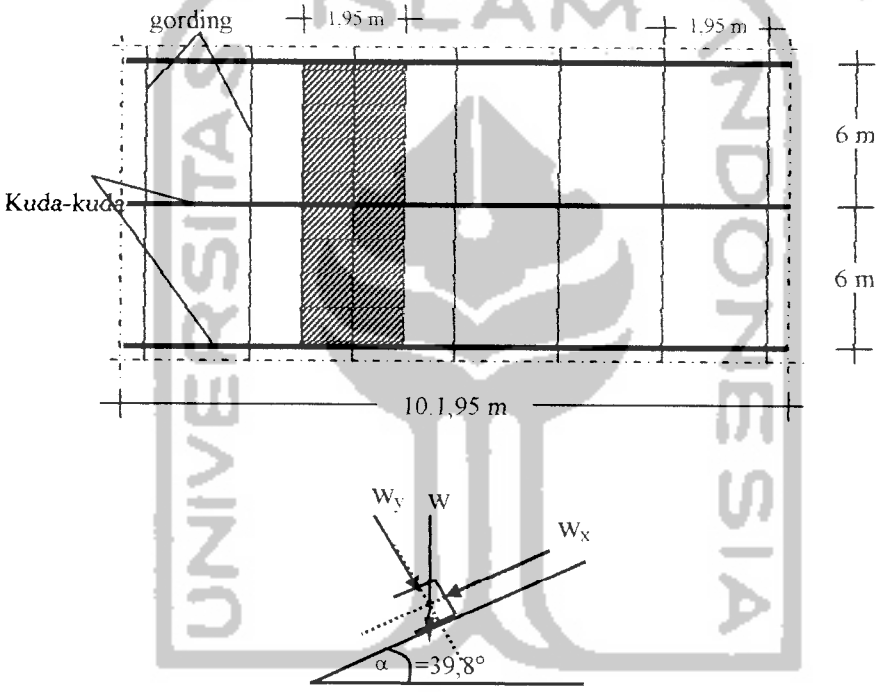
BAB IV

PERHITUNGAN STRUKTUR

4.1.Perencanaan Gording (untuk kuda-kuda KA_1, KA_2, KA_3, KA_4)



Gambar 4.1 Arah Pembebabanan Gording

4.1.1 Pembebanan Gording

a. Beban Mati, (Genting beton = 0,5 kN/m^2), (dari 3.1)

- Genting beton, reng, usuk : 0,5 x 1,95 = 0,975 kN/m
- Gording taksiran : = 0,15 kN/m

W_D = 1,125 kN/m

b. Beban Hidup, (L = 0,2 kN/m^2), (dari 3.2)

- Beban pekerja atap : W_L = 0,2 x 1,95 = 0,39 kN/m

c. Beban Air Hujan, (dari 3.3)

- Beban air hujan : W_R= (40-0,8α).0,0195 = 0,159 kN/m

d. Beban Angin (W = 0,4 kN/m^2), (dari 3.4)

- Tiup angin:

  c_1 = (0,02 α) – 0,4 = (0,02 x 39,8) - 0,4 = 0,396 (dari 3.4a)

  w_t = 0,396 x 0,4 x 1,95 = 0,309 kN/m

- Hisap angin

  c_2 = -0,4 (dari 3.4b)

  w_h = -0,4 . 0,4 . 1,95 = -0,312 kN/m

e. Momen arah sumbu x dan sumbu y, (dari 3.5)

- Sumbu x (satu sagrod)

- Sumbu y (dua sagrod)

Tabel 4.1 Pembebanan dan momen sumbu x dan sumbu y

No	Jenis pembebanan	Wx	Wy	Mx	My
		w.sin 39,8°	w.cos 39,8°	$M_x = \frac{1}{11}.w_y.L^2$	$M_y = \frac{1}{11}.w_x.L^2$
1	Beban mati (D)	0,720	0,864	0,262	2,828
2	Beban hidup (L)	0,250	0,300	0,091	0,981
3	Beban hujan (R)	0,102	0,122	0,037	0,399
4	Beban angin (W)				
	- Tiup angin	0	0,309	0	1,011
	- Hisap angin	0	-0,312	0	-1,021

Tabel 4.2 Kombinasi pembebanan LRFD

No	Kombinasi	Mu,x (kNm)	Mu,y (kNm)
1	1,4 MD	0,367	3,959
2	1,2 MD + 0,5 ML	0,460	3,672
3	1,2 MD + 0,5MR	0,333	3,381
4	1,2 MD + 1,6 ML + 0,8 MW_{tiup}	**0,460**	**5,772**
5	1,2 MD + 1,6 ML + 0,8 MW_{hisap}	0,460	3,934
6	1,2 MD +1,3 MW_{tiup} + 0,5 ML	0,339	4,986
7	1,2 MD +1,3 MW_{hisap} + 0,5 ML	0,339	2,345

4.1.2 Pendimensian Gording

a. Arah sumbu x

Mu,x = 0,440 kNm

Fy = 250 MPa,

Asumsi penampang kompak, kuat desain:

$$S_y \geq \frac{0{,}460 \times 10^6}{09 \times 250} = 1955{,}56 \quad mm^3 = 1{,}96 \quad cm^3 \qquad \text{(dari 3.6)}$$

Dipakai Profil $\lfloor_{250x50x20x4,0}$

$S_x = 83{,}7\ cm^3$; $S_y = 5{,}66\ cm^3$

$I_x = 1050\ cm^4$; $I_y = 23{,}3\ cm^4$

b. Arah sumbu y

Mu,y = 5,559 kNm

$$S_x = \frac{5{,}559 \times 10^6}{0{,}9 \times 250} = 24706{,}667 \quad mm^3$$

$= 24{,}707 \quad cm^3 < 83{,}7 \quad cm^3$

profil aman digunakan.

c. Kontrol Lendutan

- Lendutan sejajar gording

  E = 210.000 MPa

  L = 2000 mm (dipasang dua sagrod)

  $W_x = 1{,}2.0{,}720 + 1{,}6.0{,}250 + 0.8.0 = 1{,}264 \quad kN/m$

  dari persamaan 3.7a, didapat:

$$\delta_x = \frac{5}{384} x 1{,}264 x \frac{2000^4}{2.10^5 x 23{,}3.10^4} = 5{,}4 \quad mm < \frac{2000}{360} = 5{,}6 \quad mm$$

- Lendutan tegak lurus gording

  E = 210.000 MPa

  L = 6000 mm

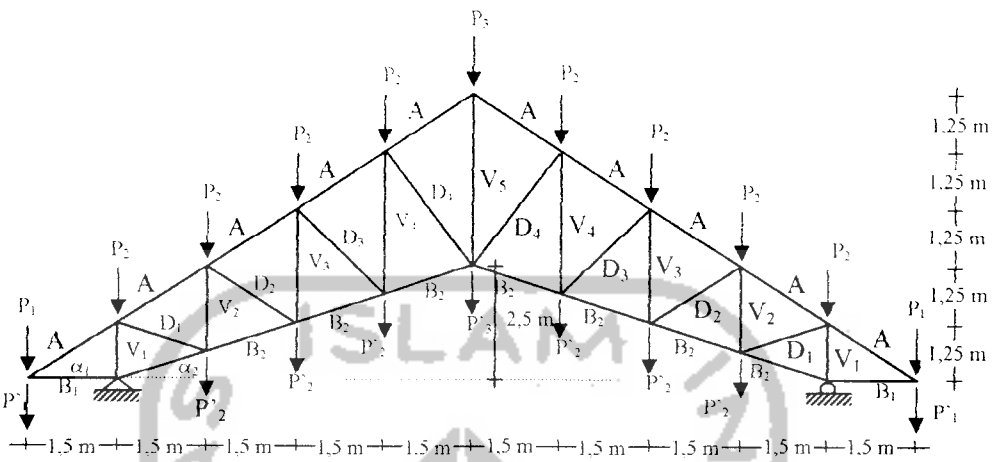
  $W_x = 1{,}2.0{,}864 + 1{,}6.0{,}300 + 0{,}8.0{,}309 = 1{,}764 \quad kN/m$

  dari persamaan 3.7b, didapat:

$$\delta_y = \frac{5}{384} x 1{,}764 x \frac{6000^4}{2.10^5 x 1050.10^4} = 14{,}175 \quad mm < \frac{6000}{360} = 16{,}67$$

4.2 Perencanaan Rangka Kuda-Kuda

4.2.1 Perencanaan Pembebanan Kuda-kuda KA_1



Gambar 4.2 Kuda-kuda baja KA_1

4.2.1.1 Beban Mati (dari 3.8)

P_1 = berat gording : 0,11 x 6 = 0,66 kN

berat genting : 0,5 x 6 x 0,5 x 1,95 = 2,93 kN

Berat total P_1 = 3,59 kN

P_2 = berat gording : 0,11 x 6 = 0,66 kN

berat genting : 0,5 x 6 x 1,95 = 5,86 kN

Berat total P_2 = 6,52 kN

P_3 = berat gording : 0,11 x 6 x 2 = 1,23 kN

berat genting : 0,5 x 6 x 1,95 = 5,86 kN

Berat total P_3 = 7,09 kN

P'_1 = berat eternit + penggantung : 0,18 x 6 x 0,5 x1,5 = 0,81 kN

berat taksiran kuda-kuda : 0,5 x 0,5 x 1,5 = 0,38 kN

Berat total P'_1 = 1,19 kN

P'_2 = berat eternit + penggantung = 0,18 x 6 x 1,625 = 1,76 kN

berat taksiran kuda-kuda = 0,5 x 1,625 = 0,81 kN

Berat total P'_2 = 2,57 kN

4.2.1.2 Beban Hidup, (dari 3.9)

P_1 = beban hidup = 0,2 x 6 x 0,5 x 1,95 = 1,17 kN

$P_2 = P_3$ = beban hidup = 0,2 x 6 x 1,95 = 2,34 kN

4.2.1.3 Beban Angin, (dari 3.9)

muatan angin = 0,4 kN/m^2

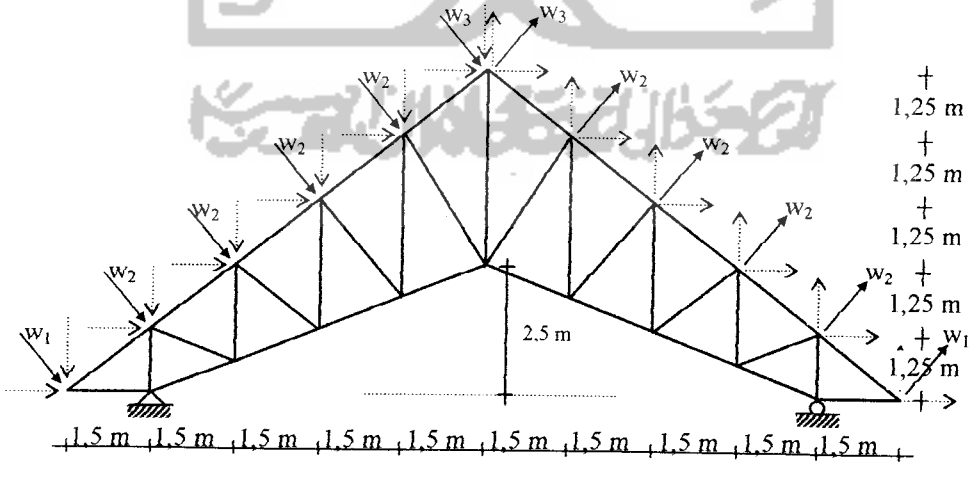
koefisien angin tekan, c_1 = (0,02 x α) - 0,4 = 0,02 (39,8) – 0,4 = 0,396

koefisien angin hisap, c_2 = -0,4

w_t = 0,396 x 0,4 = 0,16 kN/m^2

w_h = -0,4 x 0,4 = -0,16 kN/m^2

a. Angin Kiri



Gambar 4.3 Beban angin kiri pada kuda-kuda baja KA_1

- sisi kiri = angin tekan

$wt_1 = 0{,}16 \times 0{,}5 \times 1{,}95 \times 6 = 0{,}93$ kN

$wt_{x1} = 0{,}93 \times \sin 39{,}8 = 0{,}59$ kN

$wt_{y1} = 0{,}93 \times \cos 39{,}8 = 0{,}71$ kN

$wt_2 = 0{,}16 \times 1{,}95 \times 6 = 1{,}85$ kN

$wt_{x2} = 1{,}85 \times \sin 39{,}8 = 1{,}19$ kN

$wt_{y2} = 1{,}85 \times \cos 39{,}8 = 1{,}42$ kN

- sisi kanan = angin hisap

$wh_1 = -0{,}16 \times 0{,}5 \times 1{,}95 \times 6 = -0{,}93$ kN

$wh_{x1} = 0{,}93 \times \sin 39{,}8 = 0{,}59$ kN

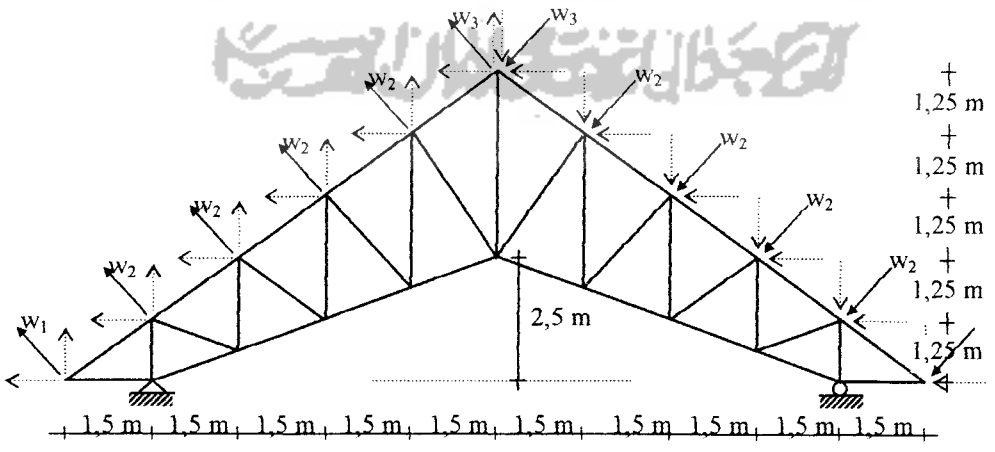
$wh_{y1} = 0{,}93 \times \cos 39{,}8 = 0{,}72$ kN

$wh_2 = -0{,}16 \times 1{,}95 \times 6 = -1{,}87$ kN

$wh_{x2} = 1{,}87 \times \sin 39{,}8 = 1{,}19$ kN

$wh_{y2} = 1{,}87 \times \cos 39{,}8 = 1{,}44$ kN

b. Angin Kanan



Gambar 4.4 Beban angin kanan pada kuda-kuda baja KA_1

- sisi kiri = hisap

wh_1 = -0,16 x 0,5 x 1,95 x 6 = -0,94 kN

wh_{x1} = 0,94 x sin 39,8 = 0,59 kN

wh_{y1} = 0,94 x cos 39,8 = 0,72 kN

wh_2 = -0,16 x 1,95 x 6 = -1,87 kN

wh_{x2} = 1,87 x sin 39,8 = 1,19 kN

wh_{y2} = 1,87 x cos 39,8 = 1,44 kN

- sisi kanan = tekan

wt_1 = 0,16 x 0,5 x 1,95 x 6 = 0,93 kN

wt_{x1} = 0,93 x sin 39,8 = 0,59 kN

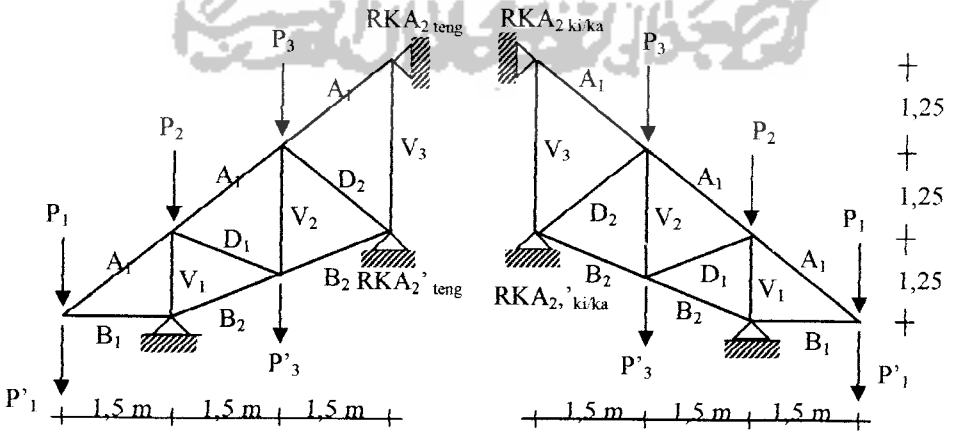
wt_{y1} = 0,93 x cos 39,8 = 0,71 kN

wt_2 = 0,16 x 1,95 x 6 = 1,85 kN

wt_{x2} = 1,85 x sin 39,8 = 1,19 kN

wt_{y2} = 1,85 x cos 39,8 = 1,42 kN

4.2.2 Perencanaan Pembebanan Kuda-Kuda KA_2



Gambar 4.5 Kuda-Kuda KA_2

4.2.2.1 Beban Mati

P_1 = berat gording : 0,11 x 6 = 0,66 kN

berat genting : 0,5 x $\left[\frac{(6+5,25)x0,98}{2}\right]$ = 2,75 kN

Berat total P_1 = 3,41 kN

P_2 = berat gording : 0,11 x 4,5 = 0,49 kN

berat genting : 0,5 x $\left[\frac{(5,25+3,75)x1,95}{2}\right]$ = 4,39 kN

Berat total P_2 = 4,88 kN

P_3 = berat gording : 0,11 x 3 = 0,33 kN

berat genting : 0,5 x $\left[\frac{(3,75+2,25)x1,95}{2}\right]$ = 2,93 kN

Berat total P_3 = 3,26 kN

P_4 = berat gording : 0,11 x 3 = 0,33 kN

berat genting : 0,5 $\left[\left(\frac{(2,25+0,75)x1,95}{2}\right)x2+\left(\frac{0,75}{2}x0,75x2\right)\right]$ = 3,21 kN

Berat total P_4 = 3,54 kN

P'_1 = berat eternit + penggantung : 0,18 x $\left[\frac{(6+5,25)x0,75}{2}\right]$ = 0,76 kN

berat taksiran kuda-kuda : 0,5 x 0,5 x 1,5 = 0,38 kN

Berat total P'_1 = 1,14 kN

P'_3 = berat eternit+penggantung = 0,18 x $\left[\frac{(3,75+2,25)x1,63}{2}\right]$ = 0,88 kN

berat taksiran kuda-kuda = 0,5 x 1,5 = 0,75 kN

Berat total P'_3 = 1,63 kN

P'_4 = berat eternit + penggantung :

$$0,18 \text{ x } \left[\left(\frac{(2,25+0,75)\text{x}1,63}{2}\right)\text{x}2+\left(\frac{0,75}{2}\text{x}0,75\text{x}2\right)\right] = 0,98 \text{ kN}$$

berat taksiran kuda-kuda : 0,5 x 2,25 = 1,13 kN

Berat total P'_4 = 2,11 kN

4.2.2.2 Beban Hidup

$$P_1 = 0,2 \text{ x } \left[\frac{(6+5,25)\text{x}0,98}{2}\right] = 1,09 \text{ kN}$$

$$P_2 = 0,2 \text{ x } \left[\frac{(5,25+3,75)\text{x}1,95}{2}\right] = 1,76 \text{ kN}$$

$$P_3 = 0,2 \text{ x } \left[\frac{(3,75+2,25)\text{x}1,95}{2}\right] = 1,17 \text{ kN}$$

$$P_4 = 0,2 \text{ x } \left[\left(\frac{(2,25+0,75)\text{x}1,95}{2}\right)\text{x}2+\left(\frac{0,75}{2}\text{x}0,75\text{x}2\right)\right] = 1,28 \text{ kN}$$

4.2.2.3 Beban Angin

muatan angin = 0,4 KN/m^2

koefisien angin tekan, $c_1 = (0,02 \text{ x } \alpha) - 0,4 = 0,02\ (39,8) - 0,4 = 0,396$

koefisien angin hisap, $c_2 = -0,4$

$w_t = 0,396 \text{ x } 0,4 = 0,16 \text{ kN/m}^2$

$w_h = -0,4 \text{ x } 0,4 = -0,16 \text{ kN/m}^2$

a. Angin Kiri

- sisi kiri = tekan

$$wt_1 = 0,16 \text{ x } \left[\frac{(6+5,25)\text{x}0,98}{2}\right] = 0,87 \text{ kN}$$

$$wt_2 = 0,16 \text{ x} \left[\frac{(5,25 + 3,75)\text{x}1,95}{2} \right] = 1,39 \text{ kN}$$

$$wt_3 = 0,16 \text{ x} \left[\frac{(3,75 + 2,25)\text{x}1,95}{2} \right] = 0,93 \text{ kN}$$

$$wt_4 = 0,16 \text{ x} \left[\left(\frac{(2,25 + 0,75)\text{x}1,95}{2} \right) + \left(\frac{0,75}{2} \text{x}0,75 \right) \right] = 0,508 \text{ kN}$$

- sisi kanan = hisap

$$wh_1 = -0,16 \text{ x} \left[\frac{(6 + 5,25)\text{x}0,98}{2} \right] = 0,88 \text{ kN}$$

$$wh_2 = -0,16 \text{ x} \left[\frac{(5,25 + 3,75)\text{x}1,95}{2} \right] = 1,41 \text{ kN}$$

$$wh_3 = -0,16 \text{ x} \left[\frac{(3,75 + 2,25)\text{x}1,95}{2} \right] = 0,94 \text{ kN}$$

$$wh_4 = -0,16 \text{ x} \left[\left(\frac{(2,25 + 0,75)\text{x}1,95}{2} \right) + \left(\frac{0,75}{2} \text{x}0,75 \right) \right] = 0,52 \text{ kN}$$

b. Angin Kanan

- sisi kiri = hisap

$$wh_1 = -0,16 \text{ x} \left[\frac{(6 + 5,25)\text{x}0,98}{2} \right] = 0,88 \text{ kN}$$

$$wh_2 = -0,16 \text{ x} \left[\frac{(5,25 + 3,75)\text{x}1,95}{2} \right] = 1,41 \text{ kN}$$

$$wh_3 = -0,16 \text{ x} \left[\frac{(3,75 + 2,25)\text{x}1,95}{2} \right] = 0,94 \text{ kN}$$

$$wh_4 = -0,16 \text{ x} \left[\left(\frac{(2,25 + 0,75)\text{x}1,95}{2} \right) + \left(\frac{0,75}{2} \text{x}0,75 \right) \right] = 0,52 \text{ kN}$$

- sisi kanan = tekan

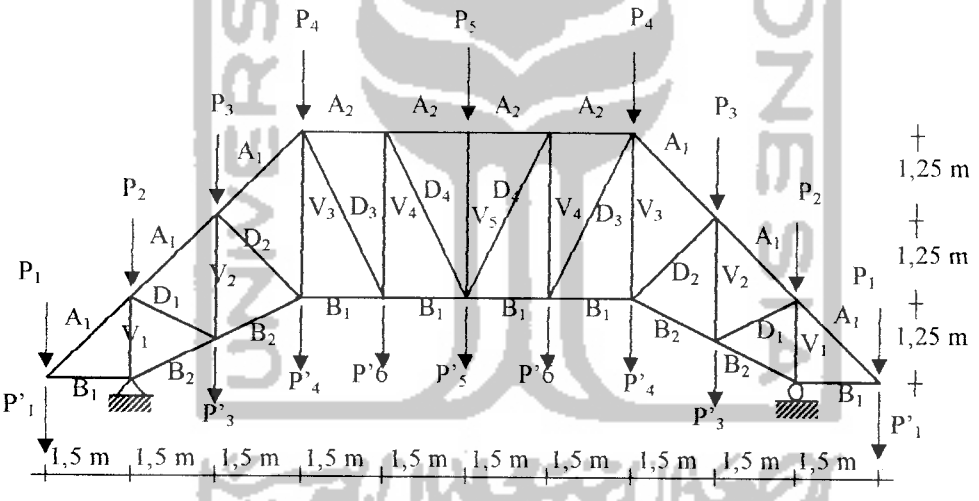
$$wt_1 = 0{,}16 \text{ x } \left[\frac{(6+5{,}25)\text{x}0{,}98}{2}\right] = 0{,}88 \text{ kN}$$

$$wt_2 = 0{,}16 \text{ x } \left[\frac{(5{,}25+3{,}75)\text{x}1{,}95}{2}\right] = 1{,}39 \text{ kN}$$

$$wt_3 = 0{,}16 \text{ x } \left[\frac{(3{,}75+2{,}25)\text{x}1{,}95}{2}\right] = 0{,}93 \text{ kN}$$

$$wt_4 = 0{,}16 \text{ x } \left[\left(\frac{(2{,}25+0{,}75)\text{x}1{,}95}{2}\right)+\left(\frac{0{,}75}{2}\text{x}0{,}75\right)\right] = 0{,}51\text{kN}$$

4.2.3 Perencanaan Pembebanan Kuda-kuda KA_3



Gambar 4.6 Kuda-Kuda KA_3

4.2.3.1 Beban Mati

P_1 = berat gording : 0,11 x 6 = 0,66 kN

berat genting : 0,5 x $\left[\frac{(6+5{,}25)\text{x}0{,}98}{2}\right]$ = 2,75 kN

Berat total P_1 = 3,41 kN

P_2 = berat gording : 0,11 x 4,5 = 0,49 kN

berat genting : 0,5 x $\left[\frac{(5,25+3,75)x1,95}{2}\right]$ = 4,39 kN

Berat total P_2 = 4,88 kN

P_3 = berat gording : 0,11 x 3 = 0,33 kN

berat genting : 0,5 x $\left[\frac{(3,75+2,25)x1,95}{2}\right]$ = 2,93 kN

Berat total P_3 = 3,26 kN

P_4 = berat gording : 0,11 x 3 = 0,33 kN

berat genting : 0,5 $\left[\left(\frac{(2,25+0,75)x1,95}{2}\right)x2+\left(\frac{0,75}{2}x0,75x2\right)\right]$ = 3,21 kN

$RKA_{2\ ki/ka}$: = 2,17 kN

Berat total P_4 = 5,71 kN

P_5 = berat gording : 0,11 x 3 = 0,33 kN

berat genting : 0,5 x 3 x 2,25 = 3,38 kN

$RKA_{2\ teng}$: = 2,61 kN

Berat total P_5 = 6,32 kN

P'_1 = berat eternit + penggantung : 0,18 x $\left[\frac{(6+5,25)x0,75}{2}\right]$ = 0,76 kN

berat taksiran kuda-kuda : 0,5 x 0,5 x 1,5 = 0,38 kN

Berat total P'_1 = 1,14 kN

P'_3 = eternit + penggantung = 0,18 x $\left[\frac{(3,75+2,25)x1,625}{2}\right]$ = 0,88 kN

berat taksiran kuda-kuda = 0,5 x 1,5 = 0,75 kN

Berat total P'_3 = 1,63 kN

P'_4 = berat eternit + penggantung :

$$0{,}18 \text{ x } \left[\left(\frac{(2{,}25+0{,}75)\text{x}1{,}63}{2}\right)\text{x}2+\left(\frac{0{,}75}{2}\text{x}0{,}75\text{x}2\right)\right] = 0{,}98 \text{ kN}$$

berat taksiran kuda-kuda : 0,5 x 2,25 = 1,13 kN

$RKA_2{}'_{ki/ka}$: = 0,26 kN

Berat total P'_4 = 4,07 kN

P'_5 = berat eternit + penggantung = 0,18 x 3 x 2,44 = 1,32 kN

berat taksiran kuda-kuda = 0,5 x 3 = 1,50 kN

$RKA_2{}'_{teng}$ = 1,69 kN

Berat total P'_5 = 4,51 kN

P'_6 = berat eternit + penggantung = 0,18 x 3 x 2,44 = 1,32 kN

berat taksiran kuda-kuda = 0,5 x 3 = 1,50 kN

Berat total P'_5 = 2,82 kN

4.2.3.2 Beban Hidup

$$P_1 = 0{,}2 \text{ x } \left[\frac{(6+5{,}25)\text{x}0{,}98}{2}\right] = 1{,}09 \text{ kN}$$

$$P_2 = 0{,}2 \text{ x } \left[\frac{(5{,}25+3{,}75)\text{x}1{,}95}{2}\right] = 1{,}76 \text{ kN}$$

$$P_3 = 0{,}2 \text{ x } \left[\frac{(3{,}75+2{,}25)\text{x}1{,}95}{2}\right] = 1{,}17 \text{ kN}$$

$$P_4 = 0{,}2 \text{ x } \left[\left(\frac{(2{,}25+0{,}75)\text{x}1{,}95}{2}\right)\text{x}2+\left(\frac{0{,}75}{2}\text{x}0{,}75\text{x}2\right)\right] + 0{,}66 = 1{,}94 \text{ kN}$$

$P_4' = RKA_2{}'_{ki/ka} = 0{,}04$ kN

$P_5 = 0{,}2 \text{ x } 3 \text{ x } 2{,}25 + 0{,}78 = 2{,}13$ kN

$P_5' = RKA_{2\,teng} = 0{,}44$ kN

4.2.3.3 Beban Angin

muatan angin = 0,4 kN/m^2

koefisien angin tekan, $c_1 = (0{,}02 \times \alpha) - 0{,}4 = 0{,}02\ (39{,}8) - 0{,}4 = 0{,}4$

koefisien angin hisap, $c_2 = -0{,}4$

$w_t = 0{,}4 \times 0{,}4 = 0{,}16$ kN/m^2

$w_h = -0{,}4 \times 0{,}4 = -0{,}16$ kN/m^2

a. Angin Kiri

- sisi kiri = tekan

$$wt_1 = 0{,}16 \times \left[\frac{(6 + 5{,}25) \times 0{,}98}{2}\right] = 0{,}87 \text{ kN}$$

$wt_{x1} = 0{,}87 \times \sin 39{,}8 = 0{,}56$ kN

$wt_{y1} = 0{,}87 \times \cos 39{,}8 = 0{,}67$ kN

$$wt_2 = 0{,}16 \times \left[\frac{(5{,}25 + 3{,}75) \times 1{,}95}{2}\right] = 1{,}39 \text{ kN}$$

$wt_{x2} = 1{,}39 \times \sin 39{,}8 = 0{,}89$ kN

$wt_{y2} = 1{,}39 \times \cos 39{,}8 = 1{,}07$ kN

$$wt_3 = 0{,}1584 \times \left[\frac{(3{,}75 + 2{,}25) \times 1{,}95}{2}\right] = 0{,}93 \text{ kN}$$

$wt_{x3} = 0{,}93 \times \sin 39{,}8 = 0{,}59$ kN

$wt_{y3} = 0{,}93 \times \cos 39{,}8 = 0{,}71$ kN

$$wt_4 = 0{,}16 \times \left[\left(\frac{(2{,}25 + 0{,}75) \times 1{,}95}{2}\right) + \left(\frac{0{,}75}{2} \times 0{,}75\right)\right] = 0{,}51 \text{ kN}$$

$wt_{x4} = 0{,}51 \times \sin 39{,}8 = 0{,}33$ kN

$wt_{y4} = 0{,}51 \times \cos 39{,}8 = 0{,}39$ kN

$P_4 = RKA_{2\ ki'ka} = -0{,}02$ kN $P_4' = RKA_{2'\ ki'ka} = 0{,}04$ kN

$P_5 = RKA_{2teng} = 0{,}16$ kN $P_5' = RKA_{2\ teng} = 0{,}62$ kN

- sisi kanan = hisap

$$wh_1 = -0{,}16 \times \left[\frac{(6+5{,}25)\times 0{,}98}{2}\right] = 0{,}88 \text{ kN}$$

$wh_{x1} = 0{,}88 \times \sin 39{,}8 = 0{,}56$ kN

$wh_{y1} = 0{,}88 \times \cos 39{,}8 = 0{,}68$ kN

$$wh_2 = -0{,}16 \times \left[\frac{(5{,}25+3{,}75)\times 1{,}95}{2}\right] = 1{,}41 \text{ kN}$$

$wh_{x2} = 1{,}41 \times \sin 39{,}8 = 0{,}90$ kN

$wh_{y2} = 1{,}41 \times \cos 39{,}8 = 1{,}08$ kN

$$wh_3 = -0{,}16 \times \left[\frac{(3{,}75+2{,}25)\times 1{,}95}{2}\right] = 0{,}94 \text{ kN}$$

$wh_{x3} = 0{,}94 \times \sin 39{,}8 = 0{,}60$ kN

$wh_{y3} = 0{,}94 \times \cos 39{,}8 = 0{,}72$ kN

$$wh_4 = -0{,}16 \times \left[\left(\frac{(2{,}25+0{,}75)\times 1{,}95}{2}\right) + \left(\frac{0{,}75}{2} \times 0{,}75\right)\right] = 0{,}51 \text{ kN}$$

$wh_{x4} = 0{,}51 \times \sin 39{,}8 = 0{,}33$ kN

$wh_{y4} = 0{,}51 \times \cos 39{,}8 = 0{,}39$ kN

b. Angin Kanan

- sisi kiri = hisap

$$wh_1 = -0{,}16 \times \left[\frac{(6+5{,}25)\times 0{,}98}{2}\right] = 0{,}88 \text{ kN}$$

$wh_{x1} = 0{,}88 \times \sin 39{,}8 = 0{,}56$ kN

$wh_{y1} = 0,88 \times \cos 39,8 = 0,66$ kN

$$wh_2 = -0,16 \times \left[\frac{(5,25+3,75)\times 1,95}{2}\right] = 1,41 \text{ kN}$$

$wh_{x2} = 1,41 \times \sin 39,8 = 0,90$ kN

$wh_{y2} = 1,41 \times \cos 39,8 = 1,08$ kN

$$wh_3 = -0,16 \times \left[\frac{(3,75+2,25)\times 1,95}{2}\right] = 0,94 \text{ kN}$$

$wh_{x3} = 0,94 \times \sin 39,8 = 0,60$ kN

$wh_{y3} = 0,94 \times \cos 39,8 = 0,72$ kN

$$wh_4 = -0,16 \times \left[\left(\frac{(2,25+0,75)\times 1,95}{2}\right)+\left(\frac{0,75}{2}\times 0,75\right)\right] = 0,51 \text{ kN}$$

$wh_{x4} = 0,51 \times \sin 39,8 = 0,33$ kN

$wh_{y4} = 0,51 \times \cos 39,8 = 0,39$ kN

$P_4 = RKA_{2\ ki/ka} = 0,02$ kN $P_4' = RKA_{2'\ ki/ka} = -0,04$ kN

$P_5 = RKA_{2teng} = -0,63$ kN $P_5' = RKA_{2\ teng} = -0,63$ kN

- sisi kanan = tekan

$$wt_1 = 0,16 \times \left[\frac{(6+5,25)\times 0,98}{2}\right] = 0,87 \text{ kN}$$

$wt_{x1} = 0,87 \times \sin 39,8 = 0,56$ kN

$wt_{y1} = 0,87 \times \cos 39,8 = 0,67$ kN

$$wt_2 = 0,16 \times \left[\frac{(5,25+3,75)\times 1,95}{2}\right] = 1,39 \text{ kN}$$

$wt_{x2} = 1,39 \times \sin 39,8 = 0,89$ kN

$wt_{y2} = 1,39 \times \cos 39,8 = 1,07$ kN

$$wt_3 = 0{,}16 \times \left[\frac{(3{,}75 + 2{,}25)\times 1{,}95}{2}\right] = 0{,}93 \text{ kN}$$

$$wt_{x3} = 0{,}93 \times \sin 39{,}8 = 0{,}59 \text{ kN}$$

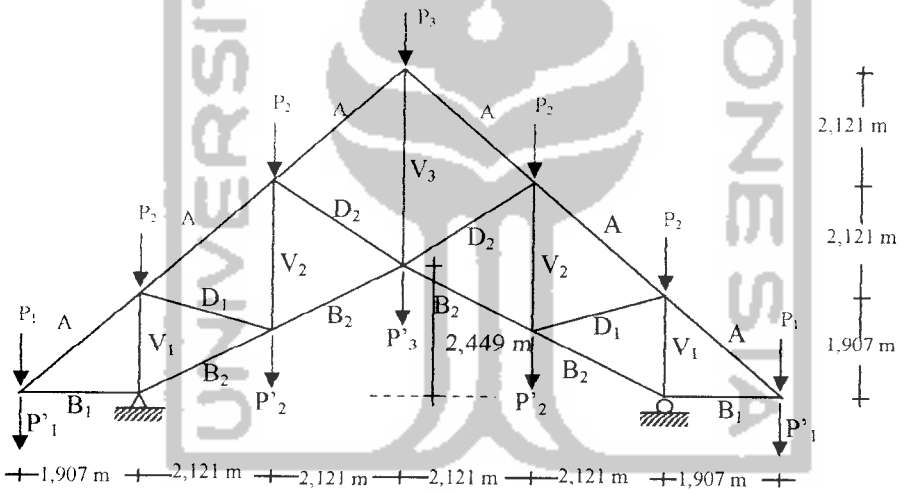
$$wt_{y3} = 0{,}93 \times \cos 39{,}8 = 0{,}71 \text{ kN}$$

$$wt_4 = 0{,}16 \times \left[\left(\frac{(2{,}25 + 0{,}75)\times 1{,}95}{2}\right) + \left(\frac{0{,}75}{2} \times 0{,}75\right)\right] = 0{,}51 \text{ kN}$$

$$wt_{x4} = 0{,}51 \times \sin 39{,}8 = 0{,}33 \text{ kN}$$

$$wt_{y4} = 0{,}51 \times \cos 39{,}8 = 0{,}39 \text{ kN}$$

4.2.4 Perencanaan Kuda-Kuda KA_4



Gambar 4.7 Kuda-Kuda KA_4

4.2.4.1 Beban Mati

P_1 = berat gording : 0,11 x 8,7 = 0,96 kN

berat genting : $0{,}5 \times \left[\left(\frac{(4{,}35 + 3{,}68)\times 0{,}95}{2}\right)\times 2\right] = 3{,}82$ kN

Berat total $P_1 = 4{,}78$ kN

P_2 = berat gording : 0,11 x 6 = 0,66 kN

berat genting : 0,5 x $\left[\left(\frac{(3,68+2,25)x2,01}{2}\right)x2\right]$ = 5,97 kN

Berat total P_2 = 6,63 kN

P_3 = berat gording : 0,11 x 3 = 0,33 kN

berat genting : 0,5 x $\left[\left(\frac{(2,25+0,75)x2,12}{2}\right)x2\right]$ = 3,18 kN

Berat total P_3 = 3,41 kN

P_4 = berat genting : 0,5.4. $\left[\left(\frac{(2,25+0,75)x1,95}{2}\right)2+\left(\frac{0,75}{2}x0,75\right)2\right]$ = 1,13 kN

P'_1 = berat eternit + penggantung: 0,18 $\left[\left(\frac{(4,35+3,68)0,675}{2}\right).2\right]$ = 0,98 kN

berat taksiran kuda-kuda : 0,5 x 0,5 x 1,91 = 0,48 kN

Berat total P'_1 = 1,46 kN

P'_3 = berat eternit + penggantung = 0,18. $\left[\left(\frac{(2,25+0,75)2,12}{2}\right).2\right]$ = 1,14 kN

berat taksiran kuda-kuda = 0,5 x 2,12 = 1,07 kN

Berat total P'_3 = 2,21 kN

P'_4 = berat eternit + penggantung : 0,18 x $\left[\frac{0,75}{2}x0,75x2\right]$ = 0,10 kN

berat taksiran kuda-kuda : 0,5 x 1,06 = 0,53 kN

Berat total P'_4 = 0,63 kN

P'_4 = 0,63 x 4 = 2,52 kN

4.2.4.2 Beban Hidup

$$P_1 = 0{,}2 \text{ x } \left[\left(\frac{(6+5{,}25)\text{x}0{,}98}{2}\right)\text{x}2\right] = 1{,}53 \text{ kN}$$

$$P_2 = 0{,}2 \text{ x } \left[\left(\frac{(5{,}25+3{,}75)\text{x}1{,}95}{2}\right)\text{x}2\right] = 2{,}39 \text{ kN}$$

$$P_3 = 0{,}2 \text{ x } \left[\left(\frac{(3{,}75+2{,}25)\text{x}1{,}95}{2}\right)\text{x}2\right] = 1{,}27 \text{ kN}$$

$$P_4 = 0{,}2 \text{ x } 4 \text{ x } \left[\frac{0{,}75}{2} x0{,}75x2\right] = 0{,}45 \text{ kN}$$

4.2.4.3 Beban Angin

muatan angin = 0,4 kN/m^2

sudut kemiringan α = 45°

koefisien angin tekan, $c_1 = (0{,}02 \text{ x } \alpha) - 0{,}4 = 0{,}02\ (45) - 0{,}4 = 0{,}5$

koefisien angin hisap, $c_2 = -0{,}4$

$w_t = 0{,}5 \text{ x } 0{,}4 = 0{,}20 \text{ kN/m}^2$

$w_h = -0{,}4 \text{ x } 0{,}4 = -0{,}16 \text{ kN/m}^2$

a. Angin Kiri

- sisi kiri = tekan

$$wt_1 = 0{,}2 \text{ x } \left[\frac{(4{,}35+3{,}68)\text{x}0{,}95}{2}\right] = 0{,}77 \text{ kN}$$

$$wt_{x1} = wt_{y1} = 0{,}77 \text{ x } \sin 45 = 0{,}54 \text{ kN}$$

$$wt_2 = 0{,}2 \text{ x } \left[\frac{(3{,}68+2{,}25)\text{x}2{,}01}{2}\right] = 1{,}19 \text{ kN}$$

$$wt_{x2} = wt_{y2} = 1{,}19 \text{ x } \sin 45 = 0{,}84 \text{ kN}$$

$$wt_3 = 0{,}2 \times \left[\frac{(2{,}25+0{,}75)x2{,}12}{2}\right] = 0{,}64 \text{ kN}$$

$$wt_{x3} = wt_{y3} = 0{,}64 \times \sin 45 = 0{,}45 \text{ kN}$$

$$wt_4 = 0{,}2 \times \left[\frac{0{,}75}{2} x 0{,}75\right] = 0{,}06 \text{ kN}$$

$$wt_{x4} = wt_{y4} = 2 \times (0{,}06 \times \sin 45) = 2 \times 0{,}04 = 0{,}08 \text{ kN}$$

- sisi kanan = hisap

$$wh_1 = -0{,}16 \times \left[\frac{(4{,}35+3{,}68)x0{,}95}{2}\right] = 0{,}61 \text{ kN}$$

$$wh_{x1} = wh_{y1} = 0{,}61 \times \sin 45 = 0{,}43 \text{ kN}$$

$$wh_2 = -0{,}16 \times \left[\frac{(3{,}68+2{,}25)x2{,}01}{2}\right] = 0{,}96 \text{ kN}$$

$$wh_{x2} = wh_{y2} = 0{,}96 \times \sin 45 = 0{,}68 \text{ kN}$$

$$wh_3 = -0{,}16 \times \left[\frac{(2{,}25+0{,}75)x2{,}12}{2}\right] = 0{,}51 \text{ kN}$$

$$wh_{x3} = wh_{y3} = 0{,}51 \times \sin 45 = 0{,}36 \text{ kN}$$

$$wh_4 = -0{,}16 \times \left[\frac{0{,}75}{2} x 0{,}75\right] = 0{,}05 \text{ kN}$$

$$wh_{x4} = wh_{y4} = 2 \times (0{,}05 \times \sin 45) = 0{,}06 \text{ kN}$$

b. Angin Kanan

- sisi kiri = hisap

$$wh_1 = -0{,}16 \times \left[\frac{(4{,}35+3{,}68)x0{,}95}{2}\right] = 0{,}61 \text{ kN}$$

$$wh_{x1} = wh_{y1} = 0{,}61 \times \sin 45 = 0{,}43 \text{ kN}$$

$$wh_2 = -0{,}16 \times \left[\frac{(3{,}68+2{,}25)x2{,}01}{2}\right] = 0{,}96 \text{ kN}$$

$$wh_{x2} = wh_{y2} = 0{,}96 \times \sin 45 = 0{,}68 \text{ kN}$$

$$wh_3 = -0{,}16 \times \left[\frac{(2{,}25+0{,}75)x2{,}12}{2}\right] = 0{,}51 \text{ kN}$$

$$wh_{x3} = wh_{y3} = 0{,}51 \times \sin 45 = 0{,}36 \text{ kN}$$

$$wh_4 = -0{,}16 \times \left[\frac{0{,}75}{2} x 0{,}75\right] = 0{,}05 \text{ kN}$$

$$wh_{x4} = wh_{y4} = 2 \times (0{,}05 \times \sin 45) = 0{,}06 \text{ kN}$$

- sisi kanan = tekan

$$wt_1 = 0{,}2 \times \left[\frac{(4{,}35+3{,}68)x0{,}95}{2}\right] = 0{,}77 \text{ kN}$$

$$wt_{x1} = wt_{y1} = 0{,}77 \times \sin 45 = 0{,}54 \text{ kN}$$

$$wt_2 = 0{,}2 \times \left[\frac{(3{,}68+2{,}25)x2{,}01}{2}\right] = 1{,}19 \text{ kN}$$

$$wt_{x2} = wt_{y2} = 1{,}19 \times \sin 45 = 0{,}84 \text{ kN}$$

$$wt_3 = 0{,}2 \times \left[\frac{(2{,}25+0{,}75)x2{,}12}{2}\right] = 0{,}64 \text{ kN}$$

$$wt_{x3} = wt_{y3} = 0{,}64 \times \sin 45 = 0{,}45 \text{ kN}$$

$$wt_4 = 0{,}2 \times \left[\frac{0{,}75}{2} x 0{,}75\right] = 0{,}06 \text{ kN}$$

$$wt_{x4} = wt_{y4} = 2 \times (0{,}06 \times \sin 45) = 0{,}08 \text{ kN}$$

$$wt_1 = 0{,}2 \times \left[\frac{(4{,}35+3{,}68)x0{,}95}{2}\right] = 0{,}77 \text{ kN}$$

$$wt_{x1} = wt_{y1} = 0{,}77 \times \sin 45 = 0{,}54 \text{ kN}$$

$$wt_2 = 0{,}2 \text{ x } \left[\frac{(3{,}68 + 2{,}25)\text{x}2{,}01}{2}\right] = 1{,}19 \text{ kN}$$

$$wt_{x2} = wt_{y2} = 1{,}19 \text{ x } \sin 45 = 0{,}84 \text{ kN}$$

$$wt_3 = 0{,}2 \text{ x } \left[\frac{(2{,}25 + 0{,}75)\text{x}2{,}12}{2}\right] = 0{,}64 \text{ kN}$$

$$wt_{x3} = wt_{y3} = 0{,}64 \text{ x } \sin 45 = 0{,}45 \text{ kN}$$

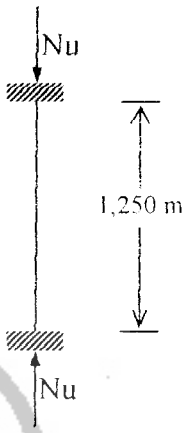
$$wt_4 = 0{,}2 \text{ x } \left[\frac{0{,}75}{2} x 0{,}75\right] = 0{,}06 \text{ kN}$$

$$wt_{x4} = wt_{y4} = 2 \text{ x } (0{,}06 \text{ x } \sin 45) = 2 \text{ x } 0{,}04 = 0{,}08 \text{ kN}$$

4.3 Pendimensian Rangka Kuda-Kuda

4.3.1 Dimensi Rangka Kuda-Kuda KA_1

a. Perhitungan Batang Desak Vertikal



Nu = -64,588 kN

L = 1,250 m

Fy = 250 MPa = $250 . 10^3$ kN/m^2

Menentukan Nn perlu

$$Nn = \frac{-64,588}{0,85} = -75,99 \quad kN \qquad \text{(dari 3.10)}$$

Estimasi jarak kopel minimum

$$L_1 = \frac{1250}{3} = 416,667 \text{ mm} \qquad \text{(dari 3.11)}$$

Menentukan i minimum perlu

$$i_{x\,min} = i_{y\,min} \; ; \qquad i_{min} = \frac{416,667}{200} = 2,083 \quad \text{mm} \qquad \text{(dari 3.12a)}$$

Dicoba profil 2 L 50.50.5

Ag = 480 mm^2 $i\eta$ = 9,8 mm

$I_x = I_y = 11.10^4$ mm^4

Kontrol kestabilan elemen batang

$$\lambda_1 = \frac{1x416,67}{9,8} = 42,52 < 50 \qquad \text{(dari 3.13)}$$

Jari-jari batang ganda

$$I_x = 2.11.10^4 = 22.10^4 \text{ mm}^4 \qquad \text{(dari 3.14a)}$$

$$i_x = \sqrt{\frac{22.10^4}{2.480}} = 15,1 \text{ mm} \qquad \text{(dari 3.14c)}$$

$$I_y = 2\left[110000 + 480(14 + 0{,}5x5)^2\right] = 481360\ mm^4 \qquad \text{(dari 3.14d)}$$

$$i_y = \sqrt{\frac{481360}{960}} = 22{,}392 \qquad \text{(dari 3.14e)}$$

Kontrol batas kelangsingan dan batas kekompakan profil

$$\lambda_f = \frac{50}{5} = 10 < \lambda_r = \frac{200}{\sqrt{250}} = 12{,}65 \qquad \text{(dari 3.15)}$$

Kelangsingan arah sumbu bahan (sumbu x-x)

$$\lambda_x = \frac{1x1250}{30{,}2} = 82{,}781 \qquad \text{(dari 3.16)}$$

Kontrol kestabilan batang

$$\frac{\lambda_x}{\lambda_1} = \frac{82{,}781}{42{,}517} = 1{,}947 > 1{,}2 \qquad \text{(dari 3.17)}$$

Kelangsingan arah sumbu bebas bahan (sumbu y-y)

$$\lambda_y = \frac{1x1250}{22{,}392} = 55{,}823 \qquad \text{(dari 3.18)}$$

Kelangsingan ideal, (dari 3.19)

$$\lambda_{iy} = \sqrt{55{,}823^2 + \tfrac{2}{2}x42{,}517^2} = 70{,}170 > 1{,}2\lambda_1 = 1{,}2x42{,}517 = 51{,}02$$

Tekuk terjadi pada sumbu bahan

$$\lambda_{cx} = \frac{82{,}781}{\pi}\sqrt{\frac{250}{2x10^5}} = 0{,}932\ ;\ (0{,}25 < \lambda_c < 1{,}2) \qquad \text{(dari 3.20)}$$

$$\omega_x = \frac{1{,}43}{(1{,}6 - 0{,}67x0{,}932)} = 1{,}466 \qquad \text{(dari 3.20b)}$$

Tekuk terjadi pada sumbu bebas bahan

$$\lambda_{cy} = \frac{70{,}170}{\pi}\sqrt{\frac{250}{2x10^5}} = 0{,}789\ ;\ (0{,}25 < \lambda_c < 1{,}2) \qquad \text{(dari 3.21)}$$

$\omega_x = 1{,}3347$ (dari 3.20b)

Kapasitas gaya tekan, (dari 3.22a dan 22b)

$$\phi N_{nx} = 0{,}85x960x\frac{250}{1{,}466}x10^{-3} = 139{,}154 \text{ kN} > Nu = 64{,}5876 \text{ kN}$$

$$\phi N_{ny} = 0{,}85x960x\frac{250}{1{,}3347}x10^{-3} = 152{,}843 \text{ kN} > Nu = 64{,}5876 \text{ kN}$$

Kontrol tekuk lentur-torsi ($\nu = 0{,}3$)

$$G = \frac{2.10^5}{2(1+0{,}3)} = 76923{,}077 \text{ MPa} \quad \text{(dari 3.23a)}$$

$$J = \sum 2.\left[\tfrac{1}{3}x50x5^3 + \tfrac{1}{3}\left(50 - \tfrac{5}{2}\right)x5^3\right] = 8125 \text{ mm}^4 \quad \text{(dari 3.23b)}$$

$$y_o = 14 - \frac{5}{2} = 11{,}5 \text{ mm} \quad \text{(dari 3.23c)}$$

$$x_o = 0 \quad \text{(dari 3.23d)}$$

$$r_o^2 = \frac{110000 + 110000}{960} + 0 + 11{,}5^2 = 361{,}417 \text{ mm}^2 \quad \text{(dari 3.23e)}$$

$$f_{crz} = \frac{76923{,}077x8125}{960x361{,}417} = 1801{,}359 \text{ MPa} \quad \text{(dari 3.23f)}$$

$$H = 1 - \left(\frac{0 + 11{,}5^2}{361{,}417}\right) = 0{,}634 \quad \text{(dari 3.23g)}$$

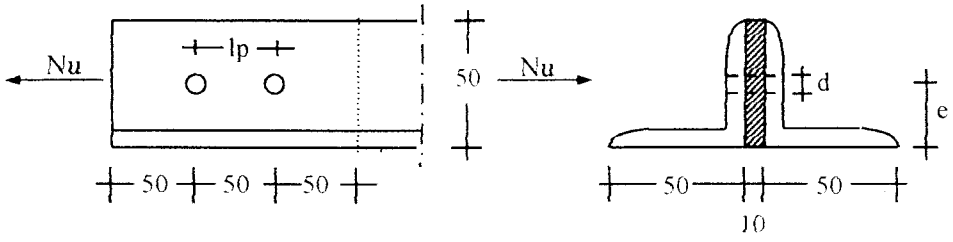
$$f_{cry} = \frac{250}{1{,}466} = 170{,}532 \text{ MPa} \quad \text{(dari 3.23h)}$$

$$f_{clt} = \left(\frac{170{,}532 + 1801{,}359}{2x0{,}634}\right)\left[1 - \sqrt{1 - \frac{4x170{,}532x1801{,}359x0{,}634}{(170{,}532 + 1801{,}359)^2}}\right]$$

$= 164{,}483$ MPa (dari 3.23i)

$\phi N_{nlt} = 134{,}218 \text{ kN} > Nu = 64{,}588 \text{ kN}$ (dari 3.23j)

b. Perencanaan Batang Tarik Bawah



Gambar 4.8 Gambar Batang Tarik Ganda

Nu = 60,023 kN

L = 1,625 m

Rumus yang digunakan dalam perhitungan batang tarik sama dengan perhitungan batang desak sampai pada perhitungan kestabilan batang ganda

Estimasi jarak kopel minimum

$$L_1 = \frac{1625}{3} = 541{,}67 \text{ mm}$$

Menentukan i minimum perlu

$$i_{x\,min} = i_{y\,min} \; ; \qquad i_{min} = \frac{541{,}67}{240} = 2{,}257 \text{ mm}$$

Menentukan luas (Ag) perlu

$$Ag = \frac{60{,}023.1000}{0{,}9.250} = 266{,}77 \text{ mm}^2$$

Menentukan luas efektif (Ae) perlu

$$Ag = \frac{60{,}023.1000}{0{,}75.310} = 258{,}164 \text{ mm}^2$$

Dicoba profil 2 ∟ 50.50.5

$Ag = 480\ mm^2$ $i\eta = 9,8\ mm > i_{min} = 2,257\ mm$

$I_x = I_y = 11.10^4\ mm^4$

Kestabilan batang ganda

$I_x = 2.11.10^4 = 22.10^4\ mm^4$

$$i_x = \sqrt{\frac{22.10^4}{2.480}} = 15,1\ mm$$

$$I_y = 2\left[110000 + 480(14 + 0,5x5)^2\right] = 481360\ mm^4$$

$$i_y = \sqrt{\frac{481360}{960}} = 22,392$$

$$\frac{L}{i_{min}} = \frac{1625}{15,1} = 107,6 < 240$$

Luas penampang netto

$A_n = 960 - 1x14x5 = 890\ mm^2$ (dari 3.24)

Luas penampang efektif (tarik murni)

$$A_e = \left(1 - \frac{14}{50}\right)890 = 640,8\ mm^2$$ (dari 3.25)

Luas bidang geser (geser murni)

$A_{ns} = 2(2x50)x5 = 1000\ mm^2$ (dari 3.26)

Luas bidang kombinasi geser + tarik pada blok ujung

$A_{nt} = \left[(50 - 14) - \frac{1}{2}x14\right]x5 = 145\ mm^2$ (dari 3.27a)

$A_{gt} = (50 - 14)x\ 5 = 180\ mm^2$ (dari 3.27b)

$A_{nv} = (100 - 14x1,5)\ x\ 5 = 395\ mm^2$ (dari 3.27c)

$A_{gv} = 100x5 = 500\ mm^2$ (dari 3.27d)

Kontrol kapasitas penampang

a. Tarik murni (kriteria leleh), (dari 3.28a dan 3.28b)

- Leleh ; $\phi_t N_n = 0{,}9x250x(2x480)x10^{-3} = 216$ kN
- Fraktur; $\phi_t N_n = 0{,}75x310x640{,}8x10^{-3} = 190{,}65$ kN

b. Geser murni (kriteria fraktur), (dari 3.28c)

$\phi_t N_n = 0{,}75\ (0{,}6x310)\ 500x10^{-3} = 69{,}75$ kN

c. Kombinasi geser + tarik (pada blok ujung), (dari 3.28d dan 3.28e)

- Geser fraktur; $N_n = 0{,}6x310x395x10^{-3} = 73{,}47$ kN
- Tarik fraktur; $N_n = 310x145x10^{-3} = 44{,}95$ kN

Kapasitas satu penampang adalah:

- Kriteria pelelehan geser – retakan tarik

$\phi_t N = 0{,}75(0{,}6x250x500 + 310x145)x10^{-3}$

$= 90{,}017$ kN > ½ Nu = 30,0116 kN (dari 3.29a)

- Kriteria retakan geser – pelelehan tarik

$\phi N = 0{,}75(250x180 + 0{,}6x310x395)x10^{-3}$

$= 88{,}852$ kN > ½ Nu = 30,0116 kN (dari 3.29b)

Untuk perhitungan rangka batang kuda-kuda yang lainnya ditabelkan dibawah ini

Tabel 4.3.a Perencanaan Batang Tarik Kuda-Kuda KA_1

Batang	Beban Rencana		L (mm)	Profil	Data Profil			Penamapng Perlu			Nn Leleh (kN)	Nn Fraktur (kN)	Cek Blok Geser		Aman/tdk aman Nn frak ≈ 190,65 kN Nn PGRT ≈ 89,9 kN
	Tarik (kN)	Tekan (kN)			Luas Ag mm^2	i min (mm)	Ae=U.An (mm^2)	Ag mm^2	I min (mm)	Ae (mm^2)			Nn PGRT	Nn RGPT	
A_1	11,1868	-	1953	2L 50.50.5	960	9,8	640,8	49,179	8,138	47,69	216	190,65	146,94	89,9	Aman
A_2	-	- 44,4920	1953	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_2	-	-61,2392	1953	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_4	-	-62,4140	1953	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_5	-	-55,8012	1953	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_6	-	-55,8012	1953	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_7	-	-62,4140	1953	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_8	-	-61,2392	1953	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_9	-	- 44,4920	1953	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_{10}	11,1868		1953	2L 50.50.5	960	9,8	640,8	49,179	8,138	47,69	216	190,65	146,94	89,9	Aman
B_1	-	-8,9299	1500	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
B_2	-	-22,3655	1625	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
B_3	48,7843	-	1625	2L 50.50.5	960	9,8	640,8	216,82	6,771	209,8	216	190,65	146,94	89,9	Aman
B_4	60,0232	-	1625	2L 50.50.5	960	9,8	640,8	266,77	6,771	258,2	216	190,65	146,94	89,9	Aman
B_5	59,0903	-	1625	2L 50.50.5	960	9,8	640,8	262,62	6,771	257,6	216	190,65	146,94	89,9	Aman
B_6	52,9049	-	1625	2L 50.50.5	960	9,8	640,8	235,13	6,771	227,5	216	190,65	146,94	89,9	Aman
B_7	50,9660	-	1625	2L 50.50.5	960	9,8	640,8	226,52	6,771	219,2	216	190,65	146,94	89,9	Aman
B_8	37,0284	-	1625	2L 50.50.5	960	9,8	640,8	164,57	6,771	159,3	216	190,65	146,94	89,9	Aman
B_9	-	-9,6749	1625	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
B_{10}	-	-8,9299	1500	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-

Lanjutan Tabel 4.3.a Perencanaan Batang Tarik Kuda-Kuda KA_1

Batang	Beban Rencana		L (mm)	Profil	Data Profil			Penamapng Perlu			Nn Leleh (kN)	Nn Fraktur (kN)	Cek Blok Geser		Aman/tdk aman Nn frak ≈ 190,65 kN Nn PGRT = 89,9 kN
	Tarik (kN)	Tekan (kN)			Luas Ag mm^2	i min (mm)	Ae=U.An (mm^2)	Ag mm^2	i min (mm)	Ae (mm^2)			Nn PGRT	Nn RGPT	
V_1	-	-64,5876	1250	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_2	-	-32,5632	1875	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_3	-	-13,0000	2500	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_4	4,5174	-	3125	2L 50.50.5	960	9,8	1353,6	20,09	6,510	19,43	423	405,01	198,84	157,01	Aman
V_5	59,9688	-	3750	2L 50.50.5	960	9,8	2676,6	266,53	7,813	257,9	697,5	622,31	279,5	242,16	Aman
V_6	7,0992	-	3125	2L 50.50.5	960	9,8	1353,6	31,56	6,510	30,53	423	405,01	198,84	157,01	Aman
V_7	-	-13,5485	2500	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_8	-	-32,5632	1875	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_9	-	-64,5876	1250	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
D_1	46,3380	-	1625	2L 50.50.5	960	9,8	640,8	205,96	6,771	199,3	216	190,65	146,94	89,9	Aman
D_2	16,7468	-	1953	2L 50.50.5	960	9,8	640,8	74,45	8,138	72,03	216	190,65	146,94	89,9	Aman
D_3	3,7960	-	2401	2L 50.50.5	960	9,8	1166,2	16,89	5,002	16,33	283,95	271,11	191,39	114,04	Aman
D_4	-	-12,5953	2915	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
D_5	-	-14,6025	2915	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
D_6	6,2764	-	2401	2L 50.50.5	960	9,8	1166,2	27,89	5,002	26,94	283,95	271,11	191,39	114,04	Aman
D_7	17,3171	-	1953	2L 50.50.5	960	9,8	640,8	76,98	8,138	74,36	216	190,65	146,94	89,9	Aman
D_8	46,3380	-	1625	2L 50.50.5	960	9,8	640,8	205,96	6,771	198,9	216	190,65	146,94	89,9	Aman

Tabel 4.3.b Perencanaan Batang Tekan Kuda-Kuda KA_1

Btg	Beban Rencana		L (mm)	Profil	Data Profil		L_1	L_1/I min <50	Penampang perlu		$\chi=\frac{b}{t}$	λR	λcx	ωx	Nnx kN	λcy	ωy	Nny kN	Aman/ tdk aman Nnx&Nny > Nn perlu
	Tarik (kN)	Tekan (kN)			Ag mm^2	i min (mm)			Nn perlu (kN)	I min (mm)									
A_1	11,19	-	1953	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
A_2	-	- 44,49	1953	2L 50.50.5	960	9,8	448,25	45,73	-52,34	2,24	10	12,64	0,52	1,139	210,64	1,09	1,647	123,88	Aman
A_2	-	-61,24	1953	2L 50.50.5	960	9,8	448,25	45,73	-72,05	2,24	10	12,64	0,52	1,139	210,64	1,09	1,647	123,88	Aman
A_4	-	-62,41	1953	2L 50.50.5	960	9,8	448,25	45,73	-73,43	2,24	10	12,64	0,52	1,139	210,64	1,09	1,647	123,88	Aman
A_5	-	-55,80	1953	2L 50.50.5	960	9,8	448,25	45,73	-65.65	2,24	10	12,64	0,52	1,139	210,64	1,09	1,647	123,88	Aman
A_6	-	-55,80	1953	2L 50.50.5	960	9,8	448,25	45,73	-65.65	2,24	10	12,64	0,52	1,139	210,64	1,09	1,647	123,88	Aman
A_7	-	-62,41	1953	2L 50.50.5	960	9,8	448,25	45,73	-73,43	2,24	10	12,64	0,52	1,139	210,64	1,09	1,647	123,88	Aman
A_8	-	-61,24	1953	2L 50.50.5	960	9,8	448,25	45,73	-72,05	2,24	10	12,64	0,52	1,139	210,64	1,09	1,647	123,88	Aman
A_9	-	- 44,49	1953	2L 50.50.5	960	9,8	448,25	45,73	-52,35	2,24	10	12,64	0,52	1,139	210,64	1,09	1,647	123,88	Aman
A_{10}	11,19	-	1953	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_1	-	-8,93	1500	2L 50.50.5	960	9,8	375	38,27	-10,51	1,87	10	12,64	0,43	1,090	220,042	0,89	1,428	142,87	Aman
B_2	-	-22,37	1625	2L 50.50.5	960	9,8	406,25	41,45	-26,31	2,03	10	12,64	0,47	1,087	220,709	0,95	1,481	137,78	Aman
B_3	48,78	-	1625	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_4	60,02	-	1625	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_5	59,09	-	1625	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_6	52,90	-	1625	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_7	50,97	-	1625	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_8	37,03	-	1625	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_9	-	-9,68	1625	2L 50.50.5	960	9,8	406,25	41,45	-11,38	2,03	10	12,64	0,47	1,087	220,71	0,95	1,481	137,78	Aman
B_{10}	-	-8,93	1500	2L 50.50.5	960	9,8	375	38,27	-10,51	1,87	10	12,64	0,43	1,090	220,04	0,89	1,428	142,87	Aman

Lanjutan Tabel 4.3.b Perencanaan Batang Tekan Kuda-Kuda KA_1

Btg	Beban Rencana		L (mm)	Profil	Data Profil		L_1	L_1/I min <50	Penampang perlu		$\chi=\frac{b}{t}$	λ. R	λcx	ωx	Nnx kN	λcy	ωy	Nny kN	Aman/ tdk aman Nnx&Nny > Nn perlu
	Tarik (kN)	Tekan (kN)			$Ag\ mm^2$	i min (mm)			Nn perlu (kN)	i min (mm)									
V_1	-	-64,59	1250	2L 50.50.5	960	9,8	416,7	42,51	-75,99	2,08	10	12,64	0,47	1,087	220,71	0,79	1,34	152,84	Aman
V_2	-	-32,56	1875	2L 50.50.5	960	9,8	468,7	47,83	-38,31	2,34	10	12,64	0,43	1,090	220,04	1,05	1,60	127,24	Aman
V_3	-	-13,00	2500	2L 50.50.5	960	9,8	500	46,72	-15,29	2,50	9,17	12,64	0,53	1,146	275,26	1,34	2,26	90,35	Aman
V_4	4,52	-	3125	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V_5	59,97	-	3750	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V_6	7,09	-	3125	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V_7	-	-13,55	2500	2L 50.50.5	960	9,8	500	46,72	-15,29	2,50	9,17	12,64	0,53	1,146	275,26	1,34	2,26	90,35	Aman
V_8	-	-32,56	1875	2L 50.50.5	960	9,8	468,7	47,83	-38,31	2,34	10	12,64	0,43	1,090	220,04	1,05	1,60	127,24	Aman
V_9	-	-64,59	1250	2L 50.50.5	960	9,8	416,7	42,51	-75,99	2,08	10	12,64	0,47	1,087	220,71	0,79	1,34	152,84	Aman
D_1	46,34	-	1625	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D_2	16,75	-	1953	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D_3	3,79	-	2401	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D_4	-	-12,59	2915	2L 50.50.5	960	9,8	583	46,26	-14,82	2,92	9,28	12,64	0,52	1,143	380,58	1,54	0,37	75,32	Aman
D_5	-	-14,60	2915	2L 50.50.5	960	9,8	583	46,26	-17,18	2,92	9,28	12,64	0,52	1,143	380,58	1,54	0,37	75,32	Aman
D_6	6,28	-	2401	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D_7	17,32	-	1953	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D_8	46,34	-	1625	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Tabel 4.4.a Perencanaan Batang Tarik Kuda-Kuda KA_2

Batang	Beban Rencana		L (mm)	Profil	Data Profil			Penamapng Perlu			Nn Leleh (kN)	Nn Fraktur (kN)	Cek Blok Geser		Aman/tdk aman Nn frak = 190,65 kN Nn PGRT = 89,9 kN
	Tarik (kN)	Tekan (kN)			Luas Ag Mm^2	I min (mm)	Ae=U.An (mm^2)	Ag mm^2	i min (mm)	Ae (mm^2)			Nn PGRT	Nn RGPT	
A_1	10,5764	-	1952	2L 50.50.5	960	9,8	640,8	49,179	8,133	47,51	216	190,65	146,94	89,9	Aman
A_2	4,1708	-	1952	2L 50.50.5	960	9,8	640,8	18,537	8,133	17,91	216	190,65	146,94	89,9	Aman
A_2	6,8436	-	1952	2L 50.50.5	960	9,8	640,8	30,416	8,133	29,38	216	190,65	146,94	89,9	Aman
B_{11}	-	-8,4437	1500	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
B_{12}	-	-2,6666	1625	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
B_{13}	2,6666	-	1625	2L 50.50.5	960	9,8	640,8	11,852	6,771	11,45	216	190,65	146,94	89,9	Aman
V_{21}	-	-14,504	1250	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{22}	-	-2,148	1874	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{23}	0	-	2499	2L 50.50.5	960	9,8	640,8	0	5,206	0	216	190,65	146,94	89,9	Aman
D_{30}	5,3308	-	1625	2L 50.50.5	960	9,8	640,8	23,692	6,771	22,89	216	190,65	146,94	89,9	Aman
D_{31}	-	-3,4919	1952	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_8	5,7124	-	1952	2L 50.50.5	960	9,8	640,8	25,388	8,133	24,53	216	190,65	146,94	89,9	Aman
A_9	3,4168	-	1952	2L 50.50.5	960	9,8	640,8	15,186	8,133	14,67	216	190,65	146,94	89,9	Aman
A_{10}	10,5764	-	1952	2L 50.50.5	960	9,8	640,8	47,006	8,133	45,41	216	190,65	146,94	89,9	Aman
B_{18}	-	-4,0999	1625	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
B_{19}	-	-9,1472	1625	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
B_{20}	-	-8,4437	1500	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{27}	0	-	2499	2L 50.50.5	960	9,8	640,8	0	5,206	0	216	190,65	146,94	89,9	Aman
V_{28}	-	-2,632	1874	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{29}	-	-15,2284	1250	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
D_{36}	-	-3,0634	1952	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
D_{37}	5,9588	-	1625	2L 50.50.5	960	9,8	640,8	26,484	6,771	25,58	216	190,65	146,94	89,9	Aman

Tabel 4.4.b Perencanaan Batang Tekan Kuda-Kuda KA_2

Btg	Beban Rencana		L (mm)	Profil	Data Profil		L_1	L_1/I_{min} <50	Penampang perlu		$\chi=\frac{b}{t}$	λR	λcx	ωx	Nnx kN	λcy	ωy	Nny kN	Aman/ tdk aman Nnx&Nny > Nn perlu
	Tarik (kN)	Tekan (kN)			Ag mm^2	I min mm			Nn perlu (kN)	I min (mm)									
A_1	10,57	-	1952	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
A_2	4,17	-	1952	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
A_2	6,84	-	1952	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_{11}	-	-8,44	1500	2L 50.50.5	960	9,8	375	38,26	-9,94	1,88	10	12,64	0,43	1,09	220,11	0,89	1,62	142,91	Aman
B_{12}	-	-2,66	1625	2L 50.50.5	960	9,8	406,3	41,45	-3,14	2,03	10	12,64	0,47	1,11	216,07	0,95	1,48	137,78	Aman
B_{13}	2,66	-	1625	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
V_{21}	-	-14,5	1250	2L 50.50.5	960	9,8	416,7	42,51	-17,06	2,08	10	12,64	0,48	0,96	248,46	0,79	1,34	152,77	Aman
V_{22}	-	-2,14	1874	2L 50.50.5	960	9,8	468,5	47,81	-2,53	2,34	10	12,64	0,54	1,15	208,03	1,06	1,60	127,24	Aman
V_{23}	0	-	2499	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
D_{30}	5,33	-	1625	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
D_{31}	-	-3,49	1952	2L 50.50.5	960	9,8	488	49,79	-4,11	2,44	10	12,64	0,56	1,17	205,51	1,09	1,65	123,88	Aman
A_8	5,71	-	1952	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
A_9	3,41	-	1952	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
A_{10}	10,57	-	1952	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_{18}	-	-4,09	1625	2L 50.50.5	960	9,8	406,3	41,45	-4,82	2,03	10	12,64	0,47	1,11	216,07	0,95	1,48	137,78	Aman
B_{19}	-	-9,14	1625	2L 50.50.5	960	9,8	406,3	41,45	-10,76	2,03	10	12,64	0,47	1,11	216,07	0,95	1,48	137,78	Aman
B_{20}	-	-8,44	1500	2L 50.50.5	960	9,8	416,7	42,51	-9,94	1,88	10	12,64	0,43	1,09	220,11	0,89	1,62	142,91	Aman
V_{27}	0	-	2499	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
V_{28}	-	-2,63	1874	2L 50.50.5	960	9,8	406,3	41,45	-3,09	2,03	10	12,64	0,47	1,08	220,71	1,06	1,60	127,24	Aman
V_{29}	-	-15,22	1250	2L 50.50.5	960	9,8	416,7	42,51	-17,92	2,08	10	12,64	0,48	0,96	248,46	0,79	1,34	152,77	Aman
D_{36}	-	-3,06	1952	2L 50.50.5	960	9,8	488	49,79	-3,60	2,44	10	12,64	0,56	1,17	205,51	1,09	1,65	123,88	Aman
D_{37}	5,95	-	1625	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-

Tabel 4.5.a Perencanaan Batang Tarik Kuda-Kuda KA_3

Batang	Beban Rencana		L (mm)	Profil	Data Profil			Penamapng Perlu			Nn Leleh (kN)	Nn Fraktur (kN)	Cek Blok Geser		Aman/tdk aman Nn frak = 190,65 kN Nn PGRT = 89,9 kN
	Tarik (kN)	Tekan (kN)			Luas Ag mm^2	i min (mm)	Ae=U.An (mm^2)	Ag mm^2	i min (mm)	Ae (mm^2)			Nn PGRT	Nn RGPT	
A_1	10,5764	-	1952	2L 50.50.5	960	9,8	640,8	52,882	8,133	45,49	216	190,65	146,94	89,9	Aman
A_2	-	- 14,8380	1952	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_2	-	-21,6716	1952	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_4	-	-19,5812	1500	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_5	-	-22,5128	1500	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_6	-	-22,5128	1500	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_7	-	-19,5812	1500	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_8	-	-21,6716	1952	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_9	-	- 14,8380	1952	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_{10}	10,5764		1952	2L 50.50.5	960	9,8	640,8	52,882	8,133	45,49	216	190,65	146,94	89,9	Aman
B_{11}	-	-8,4437	1500	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
B_{12}	-	-12,0020	1625	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
B_{13}	17,0004	-	1625	2L 50.50.5	960	9,8	640,8	85,002	6,771	73,12	216	190,65	146,94	89,9	Aman
B_{14}	19,9849	-	1500	2L 50.50.5	960	9,8	640,8	99,925	6,25	85,96	216	190,65	146,94	89,9	Aman
B_{15}	21,4106	-	1500	2L 50.50.5	960	9,8	640,8	95,158	6,25	92,09	216	190,65	146,94	89,9	Aman
B_{16}	10.4884	-	1500	2L 50.50.5	960	9,8	640,8	46,615	6,25	45,11	216	190,65	146,94	89,9	Aman
B_{17}	17,3407	-	1500	2L 50.50.5	960	9,8	640,8	77,069	6,25	74,58	216	190,65	146,94	89,9	Aman
B_{18}	12,7702	-	1625	2L 50.50.5	960	9,8	640,8	56,765	6,771	54,93	216	190,65	146,94	89,9	Aman
B_{19}	-	-9,1472	1625	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
B_{20}	-	-8,4437	1500	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-

Lanjutan Tabel 4.5.a Perencanaan Batang Tarik Kuda-Kuda KA_3

Batang	Beban Rencana		L (mm)	Profil	Data Profil			Penamapng Perlu			Nn Leleh (kN)	Nn Fraktur (kN)	Cek Blok Geser		Aman/tdk aman Nn frak = 190,65 kN Nn PGRT = 89,9 kN
	Tarik (kN)	Tekan (kN)			Luas Ag mm^2	i min (mm)	Ae=U.An (mm^2)	Ag mm^2	i min (mm)	Ae (mm^2)			Nn PGRT	Nn RGPT	
V_{21}	-	-32,7524	1250	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{22}	-	-14,3144	1874	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{23}	5,4873	-	2499	2L 50.50.5	960	9,8	1211,5	31,56	5,206	30,53	283,95	281,67	194,98	113,62	Aman
V_{24}	-	-4,8840	2499	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{25}	-	-6,3888	2499	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{26}	-	-5,2426	2499	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{27}	3,3166	-	2499	2L 50.50.5	960	9,8	1764,2	14,74	5,206	14,23	283,95	281,67	194,98	113,62	Aman
V_{28}	-	-14,3144	1874	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{29}	-	-32,7524	1250	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
D_{30}	21,1516	-	1625	2L 50.50.5	960	9,8	640,8	205,96	6,771	590,4	216	190,65	146,94	89,9	Aman
D_{31}	6,8324	-	1952	2L 50.50.5	960	9,8	640,8	74,45	8,133	590,4	216	190,65	146,94	89,9	Aman
D_{32}	6,1143	-	2915	2L 50.50.5	960	9,8	1166,2	16,89	6,073	590,4	283,95	271,11	191,39	114,04	Aman
D_{33}	6,1143	-	2915	2L 50.50.5	960	9,8	1166,2	16,89	6,073	590,4	283,95	271,11	191,39	114,04	Aman
D_{34}	6,1143	-	2915	2L 50.50.5	960	9,8	1166,2	16,89	6,073	590,4	283,95	271,11	191,39	114,04	Aman
D_{35}	6,1143	-	2915	2L 50.50.5	960	9,8	1166,2	16,89	6,073	590,4	283,95	271,11	191,39	114,04	Aman
D_{36}	7,2263	-	1952	2L 50.50.5	960	9,8	640,8	76,98	8,133	590,4	216	190,65	146,94	89,9	Aman
D_{37}	21,1516	-	1625	2L 50.50.5	960	9,8	640,8	205,96	6,771	590,4	216	190,65	146,94	89,9	Aman

Tabel 4.5.b Perencanaan Batang Tekan Kuda-Kuda KA_3

Btg	Beban Rencana		L (mm)	Profil	Data Profil		L_1	L_1/I_{min} <50	Penampang perlu		$\chi=\frac{b}{t}$	λR	λcx	ωx	Nnx kN	λcy	ωy	Nny kN	Aman/ tdk aman Nnx&Nny > Nn perlu
	Tarik (kN)	Tekan (kN)			Ag Mm^2	i min (mm)			Nn perlu (kN)	i min (mm)									
A_1	10,58	-	1952	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A_2	-	- 14,84	1952	2L 50.50.5	960	9,8	448	49,79	-17,46	2,24	10	12,64	0,51	1,14	210,63	1,09	1,646	123,93	Aman
A_2	-	-21,67	1952	2L 50.50.5	960	9,8	448	49,79	-25,49	2,24	10	12,64	0,51	1,14	210,63	1,09	1,646	123,93	Aman
A_4	-	-19,58	1500	2L 50.50.5	960	9,8	375	38,26	-23,04	1,87	10	12,64	0,43	1,09	220,04	0,89	1,427	142,90	Aman
A_5	-	-22,51	1500	2L 50.50.5	960	9,8	375	38,26	-26,48	1,87	10	12,64	0,43	1,09	220,04	0,89	1,427	142,90	Aman
A_6	-	-22,51	1500	2L 50.50.5	960	9,8	375	38,26	-26,48	1,87	10	12,64	0,43	1,09	220,04	0,89	1,427	142,90	Aman
A_7	-	-19,58	1500	2L 50.50.5	960	9,8	375	38,26	-23,04	1,87	10	12,64	0,43	1,09	220,04	0,89	1,427	142,90	Aman
A_8	-	-21,67	1952	2L 50.50.5	960	9,8	448	49,79	-25,49	2,24	10	12,64	0,51	1,14	210,63	1,09	1,646	123,93	Aman
A_9	-	-14,84	1952	2L 50.50.5	960	9,8	448	49,79	-17,46	2,24	10	12,64	0,51	1,14	210,63	1,09	1,646	123,93	Aman
A_{10}	10,58	-	1952	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_{11}	-	-8,44	1500	2L 50.50.5	960	9,8	375	38,26	-10,50	1,87	10	12,64	0,43	1,09	220,04	0,89	1,427	142,90	Aman
B_{12}	-	-12,00	1625	2L 50.50.5	960	9,8	406	41,45	-26,31	2,03	10	12,64	0,46	1,08	220,71	0,94	1,481	137,78	Aman
B_{13}	17,00	-	1625	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_{14}	19,98	-	1500	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_{15}	21,41	-	1500	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_{16}	10.48	-	1500	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_{17}	17,34	-	1500	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_{18}	12,77	-	1625	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_{19}	-	-9,15	1625	2L 50.50.5	960	9,8	406	41,45	-11,38	2,03	10	12,64	0,46	1,08	220,71	0,94	1,481	137,78	Aman
B_{20}	-	-8,45	1500	2L 50.50.5	960	9,8	375	38,26	-10,50	1,87	10	12,64	0,43	1,09	220,04	0,89	1,427	142,90	Aman

Lanjutan Tabel 4.5.b Perencanaan Batang Tekan Kuda-Kuda KA_3

Btg	Beban Rencana		L (mm)	Profil	Data Profil		L_1	L_1/I min <50	Penampang perlu		$\chi=\frac{b}{t}$	λR	λcx	ωx	Nnx kN	λcy	ωy	Nny kN	Aman/ tdk aman Nnx&Nny > Nn perlu
	Tarik (kN)	Tekan (kN)			Ag mm^2	i min (mm)			Nn perlu (kN)	i min (mm)									
V_{21}	-	-32,75	1250	2L 50.50.5	960	9,8	416,67	42,51	-38,53	2,08	10	12,64	0,46	1,08	220,70	0,79	1,33	152,83	Aman
V_{22}	-	-14,31	1874	2L 50.50.5	960	9,8	468,75	47,83	-16,84	2,34	10	12,64	0,43	1,09	220,04	1,05	1,60	127,23	Aman
V_{23}	5,48	-	2499	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V_{24}	-	-4,88	2499	2L 50.50.5	960	9,8	500	46,72	-15,29	2,50	9,17	12,64	0,52	1,14	275,25	1,34	2,25	90,34	Aman
V_{25}	-	-6,38	2499	2L 50.50.5	960	9,8	500	46,72	-15,29	2,50	9,17	12,64	0,52	1,14	275,25	1,34	2,25	90,34	Aman
V_{26}	-	-5,24	2499	2L 50.50.5	960	9,8	500	46,72	-15,29	2,50	9,17	12,64	0,52	1,14	275,25	1,34	2,25	90,34	Aman
V_{27}	3,31	-	2499	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
V_{28}	-	-14,31	1874	2L 50.50.5	960	9,8	468,75	47,83	-38,30	2,34	10	12,64	0,43	1,09	220,04	1,05	1,60	127,23	Aman
V_{29}	-	-32,75	1250	2L 50.50.5	960	9,8	416,67	42,51	-75,98	2,08	10	12,64	0,46	1,08	220,70	0,79	1,33	152,83	Aman
D_{30}	21,15	-	1625	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
D_{31}	6,83	-	1952	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
D_{32}	6,11	-	2915	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
D_{33}	6,11	-	2915	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
D_{34}	6,11	-	2915	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
D_{35}	6,11	-	2915	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
D_{36}	7,22	-	1952	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
D_{37}	21,15	-	1625	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-

Tabel 4.6.a Perencanaan Batang Tarik Kuda-Kuda KA_4

Batang	Beban Rencana		L (mm)	Profil	Data Profil			Penamapng Perlu			Nn Leleh (kN)	Nn Fraktur (kN)	Cek Blok Geser		Aman/tdk aman Nn frak ≈ 190,65 kN Nn PGRT = 89,9 kN
	Tarik (kN)	Tekan (kN)			Luas Ag mm^2	i min (mm)	Ae=U.An (mm^2)	Ag mm^2	I min (mm)	Ae (mm^2)			Nn PGRT	Nn RGPT	
A_1	13,4108	-	2697	2L 50.50.5	960	9,8	1373,5	187,5	5,619	181,1	310,95	319,3	199,17	121,94	Aman
A_2	-	- 1,9206	3000	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_2	-	-2,7701	3000	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_4	-	-2,5057	3000	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_5	-	-2,1013	3000	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_6	13,4108	-	2697	2L 50.50.5	960	9,8	1373,5	187,5	5,619	181,1	310,95	319,3	199,17	121,94	Aman
B_7	-	-9,4832	1907	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
B_8	-	-14,1809	2449	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
B_9	4,7395	-	2449	2L 50.50.5	960	9,8	1764,2	31,56	5,102	30,53	283,95	281,67	194,98	113,62	Aman
B_{10}	2,9806		2449	2L 50.50.5	960	9,8	1764,2	31,56	5,102	30,53	283,95	281,67	194,98	113,62	Aman
B_{11}	-	-10,9508	2449	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
B_{12}	-	-9,4832	1907	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{13}	-	-25,4940	1907	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{14}	-	-7,0516	2803	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{15}	5,3046	-	3700	2L 50.50.5	960	9,8	2041	95,158	7,708	92,09	553,5	474,71	276,36	144,97	Aman
V_{16}	-	-6,8948	2803	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{17}	-	-25,4940	1907	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
D_{18}	11,3322	-	2228	2L 50.50.5	960	9,8	640,8	56,765	4,642	54,93	216	190,65	146,94	89,9	Aman
D_{19}	1,6828	-	2644	2L 50.50.5	960	9,8	1373,5	187,5	5,508	181,1	310,95	319,3	199,17	121,94	Aman
D_{20}	1,4228	-	2644	2L 50.50.5	960	9,8	1373,5	187,5	5,508	181,1	310,95	319,3	199,17	121,94	Aman

Lanjutan Tabel 4.6.a Perencanaan Batang Tarik Kuda-Kuda KA_4

Batang	Beban Rencana		L (mm)	Profil	Data Profil			Penamapng Perlu			Nn Leleh (kN)	Nn Fraktur (kN)	Cek Blok Geser		Aman/tdk aman Nn frak ≈ 190,65 kN Nn PGRT = 89,9 kN
	Tarik (kN)	Tekan (kN)			Luas Ag mm^2	i min (mm)	Ae=U.An (mm^2)	Ag mm^2	I min (mm)	Ae (mm^2)			Nn PGRT	Nn RGPT	
D_{21}	11,1496	-	2228	2L 50.50.5	960	9,8	820	56,765	4,642	54,93	216	190,65	146,94	89,9	Aman
A_{22}	13,4108	-	2697	2L 50.50.5	960	9,8	1373,5	187,5	5,619	181,1	310,95	319,3	199,17	121,94	Aman
A_{23}	-	-1,9596	3000	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_{24}	-	-3,1861	3000	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_{25}	-	-3,1861	3000	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_{26}	-	-2,5355	3000	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
A_{27}	13,4108	-	2697	2L 50.50.5	960	9,8	1373,5	187,5	5,619	181,1	310,95	319,3	199,17	121,94	Aman
B_{28}	-	-9,4832	1907	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
B_{29}	-	-13,9664	2449	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
B_{30}	4,5497	-	2449	2L 50.50.5	960	9,8	1764,2	31,56	5,102	30,53	283,95	281,67	194,98	113,62	Aman
B_{31}	2,8636	-	2449	2L 50.50.5	960	9,8	1764,2	31,56	5,102	30,53	283,95	281,67	194,98	113,62	Aman
B_{32}	-	-10,9508	2449	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
B_{33}	-	-9,4832	1907	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{34}	-	-25,4940	1907	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{35}	-	-7,2310	2803	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{36}	-	-6,8948	2803	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
V_{37}	-	-25,4940	1907	2L 50.50.5	960	-	-	-	-	-	-	-	-	-	-
D_{38}	11,5428	-	2228	2L 50.50.5	960	9,8	640,8	56,765	4,642	54,93	216	190,65	146,94	89,9	Aman
D_{39}	1,8115	-	2644	2L 50.50.5	960	9,8	1373,5	187,5	5,508	181,1	310,95	319,3	199,17	121,94	Aman
D_{40}	1,3565	-	2644	2L 50.50.5	960	9,8	1373,5	187,5	5,508	181,1	310,95	319,3	199,17	121,94	Aman
D_{41}	11,1496	-	2228	2L 50.50.5	960	9,8	640,8	56,765	4,642	54,93	216	190,65	146,94	89,9	Aman

Tabel 4.6.b Perencanaan Batang Tekan Kuda-Kuda KA_4

Btg	Beban Rencana		L (mm)	Profil	Data Profil		L_1	L_1/i min <50	Penampang perlu		$\chi = \frac{b}{t}$	λR	λcx	ωx	Nnx kN	λcy	ωy	Nny kN	Aman/tdk aman Nnx&Nny > Nn perlu
	Tarik (kN)	Tekan (kN)			Ag mm^2	i min mm			Nn perlu (kN)	i min (mm)									
A_1	13,41	-	2697	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
A_2	-	-1,92	3000	2L 50.50.5	960	9,8	600	47,6	-2,2295	3	9,28	12,64	0,53	1,15	377,47	1,58	0,35	71,49	Aman
A_2	-	-2,77	3000	2L 50.50.5	960	9,8	600	47,6	-3,2589	3	9,28	12,64	0,53	1,15	377,47	1,58	0,35	71,49	Aman
A_4	-	-2,50	3000	2L 50.50.5	960	9,8	600	47,6	-2,9479	3	9,28	12,64	0,53	1,15	377,47	1,58	0,35	71,49	Aman
A_5	-	-2,10	3000	2L 50.50.5	960	9,8	600	47,6	-2,4721	3	9,28	12,64	0,53	1,15	377,47	1,58	0,35	71,49	Aman
A_6	13,41	-	2697	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_7	-	-9,48	1907	2L 50.50.5	960	9,8	476,7	48,6	-11,1567	2,3	10	12,64	0,54	1,15	206,96	1,07	1,62	125,8	Aman
B_8	-	-14,18	2449	2L 50.50.5	960	9,8	489,8	45,7	-16,6834	2,4	9,16	12,64	0,51	1,13	276,84	1,34	2,25	90,34	Aman
B_9	4,73	-	2449	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_{10}	2,98	-	2449	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_{11}	-	-10,95	2449	2L 50.50.5	960	9,8	489,8	45,7	-12,8833	2,4	9,16	12,64	0,51	1,13	276,84	1,34	2,25	90,34	Aman
B_{12}	-	-9,48	1907	2L 50.50.5	960	9,8	476,7	48,6	-10,8038	2,3	10	12,64	0,54	1,15	206,96	1,07	1,62	125,8	Aman
V_{13}	-	-25,49	1907	2L 50.50.5	960	9,8	476,7	48,6	-29,9929	2,3	10	12,64	0,54	1,15	206,96	1,07	1,62	125,8	Aman
V_{14}	-	-7,05	2803	2L 50.50.5	960	9,8	560,6	47,9	-8,2960	2,8	10	12,64	0,53	1,15	299,28	1,48	2,76	73,72	Aman
V_{15}	5,30	-	3700	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
V_{16}	-	-6,89	2803	2L 50.50.5	960	9,8	560,6	47,9	-8,1115	2,8	10	12,64	0,53	1,15	299,28	1,48	2,76	73,72	Aman
V_{17}	-	-25,49	1907	2L 50.50.5	960	9,8	476,7	48,6	-29,9929	2,3	10	12,64	0,54	1,15	206,96	1,07	1,62	125,8	Aman
D_{18}	11,33	-	2228	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
D_{19}	1,68	-	2644	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
D_{20}	1,42	-	2644	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
																			Aman

Lanjutan Tabel 4.6.b Perencanaan Batang Tekan Kuda-Kuda KA_4

Btg	Beban Rencana		L (mm)	Profil	Data Profil		L_1	L_1/I min <50	Penampang perlu		$\chi=\frac{b}{t}$	λR	λcx	ωx	Nnx kN	λcy	ωy	Nny kN	Aman/ tdk aman Nnx&Nny > Nn perlu
	Tarik (kN)	Tekan (kN)			Ag mm^2	i min mm			Nn perlu (kN)	i min (mm)									
D_{21}	11,14	-	2228	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
A_{22}	13,41	-	2697	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
A_{23}	-	-1,95	3000	2L 50.50.5	960	9,8	600	47,619	-2,3054	3	9,28	12,64	0,53	1,15	377,47	1,58	0,35	71,49	Aman
A_{24}	-	-3,18	3000	2L 50.50.5	960	9,8	600	47,619	-3,7484	3	9,28	12,64	0,53	1,15	377,47	1,58	0,35	71,49	Aman
A_{25}	-	-3,18	3000	2L 50.50.5	960	9,8	600	47,619	-3,7484	3	9,28	12,64	0,53	1,15	377,47	1,58	0,35	71,49	Aman
A_{26}	-	-2,53	3000	2L 50.50.5	960	9,8	600	47,619	-2,9829	3	9,28	12,64	0,53	1,15	377,47	1,58	0,35	71,49	Aman
A_{27}	13,41	-	2697	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_{28}	-	-9,48	1907	2L 50.50.5	960	9,8	476,7	48,648	-11,157	2,38	10	12,64	0,54	1,15	206,96	1,07	1,62	125,8	Aman
B_{29}	-	-13,96	2449	2L 50.50.5	960	9,8	489,8	45,775	-16,431	2,44	9,16	12,64	0,51	1,13	276,84	1,34	2,25	90,28	Aman
B_{30}	4,54	-	2449	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_{31}	2,86	-	2449	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
B_{32}	-	-10,95	2449	2L 50.50.5	960	9,8	489,8	45,775	-12,883	2,44	9,16	12,64	0,51	1,13	276,84	1,34	2,25	90,28	Aman
B_{33}	-	-9,48	1907	2L 50.50.5	960	9,8	476,7	48,648	-11,157	2,38	10	12,64	0,54	1,15	206,96	1,07	1,62	125,8	Aman
V_{34}	-	-25,49	1907	2L 50.50.5	960	9,8	476,7	48,648	-29,993	2,38	10	12,64	0,54	1,15	206,96	1,07	1,62	125,8	Aman
V_{35}	-	-7,23	2803	2L 50.50.5	960	9,8	560,6	47,915	-8,507	2,80	10	12,64	0,53	1,15	299,28	1,48	2,76	73,72	Aman
V_{36}	-	-6,89	2803	2L 50.50.5	960	9,8	560,6	47,915	-8,112	2,80	10	12,64	0,53	1,15	299,28	1,48	2,76	73,72	Aman
V_{37}	-	-25,49	1907	2L 50.50.5	960	9,8	476,7	48,648	-29,993	2,38	10	12,64	0,54	1,15	206,96	1,07	1,62	125,8	Aman
D_{38}	11,54	-	2228	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
D_{39}	1,81	-	2644	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
D_{40}	1,35	-	2644	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-
D_{41}	11,14	-	2228	2L 50.50.5	960	9,8	-	-	-	-	-	-	-	-	-	-	-	-	-

4.4 Perencanaan Plat Lantai

4.4.1 Lantai ruang kuliah (plat 10)

a. Pembebanan plat per meter panjang

- Beban mati (dari 3.30a)

slab beton : $0{,}12 x 24 x 1 x 1 = 2{,}88$ kN/m

pasir : $0{,}04 x 18 x 1 x 1 = 0{,}72$ kN/m

speci : $0{,}02 x 21 x 1 x 1 = 0{,}42$ kN/m

tegel : $0{,}01 x 24 x 1 x 1 = 0{,}24$ kN/m

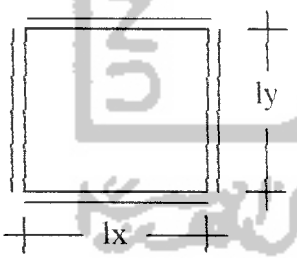
$W_D = 4{,}26$ kN/m

- Beban hidup ruang kuliah

$W_L = 2{,}5$ kN/m (dari 3.30b)

- Beban berfaktor yang bekerja adalah:

$W_U = 1{,}2x4{,}26 + 1{,}6x2{,}5 = 9{,}112$ kN/m (dari 3.30c)



$\frac{l_y}{l_x} = \frac{3}{3} = 1$

$f_c' = 22{,}5$ MPa

$fy = 350$ MPa

- Momen-momen yang bekerja

$M_{lx} = 0{,}025x9{,}112x3^2 = 1{,}953$ kNm (dari 3.31a)

$M_{ly} = 0{,}025x9{,}112x3^2 = 1{,}953$ kNm (dari 3.31b)

$M_{tx} = -0{,}051x9{,}112x3^2 = -3{,}9841$ kNm (dari 3.31c)

$M_{ty} = -0{,}051x9{,}112x3^2 = -3{,}9841$ kNm (dari 3.31d)

b. Penulangan Plat

- Tebal plat

$$h_{min} = \frac{1}{24} x3000\left(0,4 + \frac{350}{700}\right) = 112,5 \text{ mm} \qquad \text{(dari 3.32)}$$

dipakai h = 120 mm

- Tinggi efektif balok

selimut beton (p_b) = 20 mm

tulangan pokok polos (Øp) = 10 mm

tulangan bagi polos ($Ø_b$) = 8 mm

$$d_x = 120 - 20 - \tfrac{1}{2}10 = 95 \text{ mm} \qquad \text{(dari 3.33a)}$$

$$d_y = 120 - 20 - 10 - \tfrac{1}{2}10 = 85 \text{ mm} \qquad \text{(dari 3.33b)}$$

- Rasio penulangan

$$\rho_{min} = \frac{1,4}{350} = 0,004 \qquad \text{(dari 3.34)}$$

$$\rho_b = \frac{0,85x22,5}{350} 0,85\left(\frac{600}{600+350}\right) = 0,0293 \qquad \text{(dari 3.35)}$$

$$\rho_{max} = 0,75x0,2608 = 0,022 \qquad \text{(dari 3.36)}$$

- Luas tulangan

✡ Tulangan lapangan arah x

$$R_n = \frac{1,953x10^6}{0,8x1000x95^2} = 0,2705 \qquad \text{(dari 3.37)}$$

$$m = \frac{350}{0{,}85x22{,}5} = 18{,}30 \qquad \text{(dari 3.38)}$$

Dari persamaan 3.39)

$$\rho_{perlu} = \frac{1}{18{,}30}\left(1 - \sqrt{1 - \frac{2x18{,}30x0{,}2705}{350}}\right) = 0{,}00078 < \rho_{min} = 0{,}004$$

$$As_{perlu} = 0{,}004x1000x95 = 380 \text{ mm}^2 \qquad \text{(dari 3.40)}$$

dipakai tulangan : $Ø_{10\text{-}200}$

Seperti langkah - langkah perhitungan tulangan lapangan arah x, didapat:

- Tulangan lapangan arah y

$$R_n = \frac{1{,}953x10^6}{0{,}8x1000x85^2} = 0{,}2705$$

$$m = 18{,}30$$

$$\rho_{perlu} = 0{,}00078 < \rho_{min} = 0{,}004$$

$$As_{perlu} = 0{,}004x1000x85 = 340 \text{ mm}^2$$

dipakai tulangan : $Ø_{10\text{-}200}$

- Tulangan tumpuan arah x

$$R_n = \frac{3{,}9841x10^6}{0{,}8x1000x95^2} = 0{,}5518$$

$$m = 18{,}30$$

$$\rho_{perlu} = 0{,}0016 < \rho_{min} = 0{,}004$$

$$As_{perlu} = 0{,}004x1000x95 = 380 \text{ mm}^2$$

dipakai tulangan : $Ø_{10\text{-}200}$

- Tulangan tumpuan arah y

$$R_n = \frac{3{,}9841 \text{x} 10^6}{0{,}8 \text{x} 1000 \text{x} 85^2} = 0{,}5518$$

$$m = 18{,}30$$

$$\rho_{perlu} = 0{,}0016 < \rho_{min} = 0{,}004$$

$$As_{perlu} = 0{,}004 \text{x} 1000 \text{x} 85 = 340 \ mm^2$$

dipakai tulangan : $Ø_{10\text{-}200}$

- Tulangan bagi untuk tumpuan dan lapangan arah x

$As_{bagi} = 0{,}0014 \text{x} 1000 \text{x} 95 = 168 \ mm^2$ (dari 3.41)

dipakai tulangan : $Ø_{8\text{-}300}$

- Tulangan bagi untuk tumpuan dan lapangan arah y

$As_{bagi} = 0{,}0014 \text{x} 1000 \text{x} 85 = 119 \ mm^2$

dipakai tulangan : $Ø_{8\text{-}300}$

Tabel 4.7 Penulangan plat

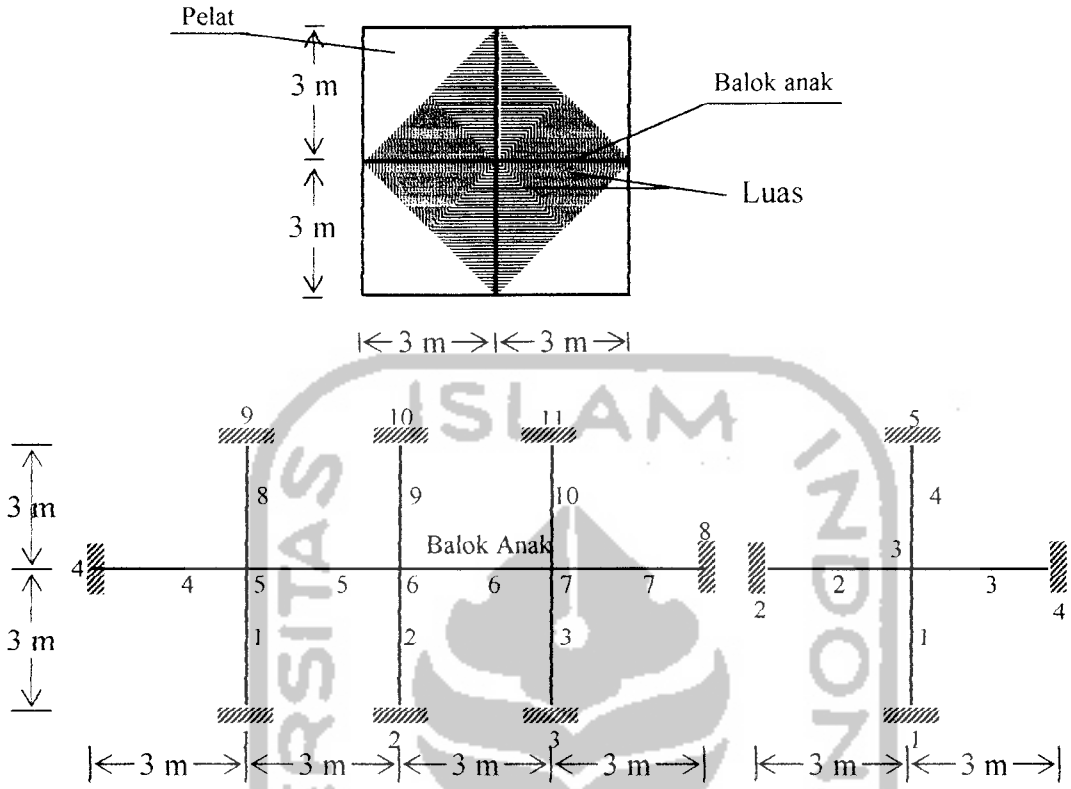
plat	tebal (mm)	tebal efektif (mm)	arah plat	$\frac{M}{\phi.b.d^2}$	Rasio tulangan ρmin = 0,004		tulangan pokok terpasang		tulangan bagi	
					ρ_{perlu}	ρ_{pasang}	As (mm^2)	Tulangan	As (mm^2)	tulangan pasang
1	120	95	M_{lx}	0,2705	0,0008	0,0066	628	ϕ10-115	251,3	ϕ8-200
		85	M_{ly}	0,2705	0,0008	-	-	-	251,3	ϕ8-200
		95	M_{tx}	0,5578	0,0016	0,0066	628	ϕ10-115	251,3	ϕ8-200
		85	M_{ty}	0,5578	0,0016	-	-	-	251,3	ϕ8-200
2	120	95	M_{lx}	1,0092	0,0029	0,0066	628	ϕ10-115	251,3	ϕ8-200
		85	M_{ly}	0,5971	0,0017	-	-	-	251,3	ϕ8-200
		95	M_{tx}	1,7926	0,0054	0,0066	628	ϕ10-115	251,3	ϕ8-200
		85	M_{ty}	1,8245	0,0055	-	-	-	251,3	ϕ8-200
3	120	95	M_{lx}	1,0092	0,0029	0,0066	628	ϕ10-115	-	-
		85	M_{ly}	0,5971	0,0017	0,0055	471	ϕ10-165	-	-
		95	M_{tx}	1,7926	0,0054	0,0066	628	ϕ10-115	-	-
		85	M_{ty}	1,8245	0,0055	0,0055	471	ϕ10-165	-	-
4	120	95	M_{lx}	1,0092	0,0029	0,0066	628	ϕ10-115	-	-
		85	M_{ly}	0,5971	0,0017	0,0055	471	ϕ10-165	-	-
		95	M_{tx}	1,7926	0,0054	0,0066	628	ϕ10-115	-	-
		85	M_{ty}	1,8245	0,0055	0,0055	471	ϕ10-165	-	-
5	120	95	M_{lx}	0,9029	0,0026	0,0066	628	ϕ10-115	-	-
		85	M_{ly}	0,7298	0,0021	0,0055	471	ϕ10-165	-	-
		95	M_{tx}	1,9121	0,0058	0,0066	628	ϕ10-115	-	-
		85	M_{ty}	1,7914	0,0054	0,0055	471	ϕ10-165	-	-
6	120	95	M_{lx}	1,0092	0,0029	0,0066	628	ϕ10-115	-	-
		85	M_{ly}	0,5971	0,0017	0,0055	471	ϕ10-165	-	-
		95	M_{tx}	1,7926	0,0054	0,0066	628	ϕ10-115	-	-
		85	M_{ty}	1,8245	0,0055	0,0055	471	ϕ10-165	-	-
7	120	95	M_{lx}	1,5403	0,0046	0,0066	628	ϕ10-115	-	-
		85	M_{ly}	0,4976	0,0015	0,0055	471	ϕ10-165	-	-
		95	M_{tx}	2,1776	0,0066	0,0066	628	ϕ10-115	-	-
		85	M_{ty}	1,7250	0,0052	0,0055	471	ϕ10-165	-	-

Lanjutan Tabel 4.7 Penulangan plat

plat	tebal (mm)	Tebal Efektif (mm)	arah plat	$\frac{M}{\phi.b.d^2}$	Rasio tulangan ρmin = 0,004		tulangan pokok terpasang		tulangan bagi	
					ρ_{perlu}	ρ_{pasang}	As (mm^2)	Tulangan	As (mm^2)	tulangan pasang
8	120	95	M_{lx}	1,0092	0,0029	0,0066	628	ϕ10-115	-	-
		85	M_{ly}	0,5971	0,0017	0,0055	471	ϕ10-165	-	-
		95	M_{tx}	1.7926	0.0054	0.0066	628	ϕ10-115	-	-
		85	M_{ty}	1,8245	0,0055	0,0055	471	ϕ10-165	-	-
9	120	95	M_{lx}	0,4112	0,0012	0,0066	628	ϕ10-115	-	-
		85	M_{ly}	0,2703	0,0008	0,0040	392,7	ϕ10-200	-	-
		95	M_{tx}	0,7358	0,0022	0,0066	628	ϕ10-115	-	-
		85	M_{ty}	0,7434	0,0022	0,0040	392,7	ϕ10-200	-	-
10	120	95	M_{lx}	0,2705	0,0008	0,0040	392,7	ϕ10-200	168	ϕ8-300
		85	M_{ly}	0,2705	0,0008	0,0040	392,7	ϕ10-200	168	ϕ8-300
		95	M_{tx}	0,5578	0,0016	0,0040	392,7	ϕ10-200	168	ϕ8-300
		85	M_{ty}	0,5578	0,0016	0,0040	392,7	ϕ10-200	168	ϕ8-300
11 & 12	120	95	M_{lx}	0,4972	0,0014	0,0040	392,7	ϕ10-200	168	ϕ8-300
		85	M_{ly}	0,4969	0,0014	0,0040	392,7	ϕ10-200	-	-
		95	M_{tx}	0,9447	0,0028	0,0040	392,7	ϕ10-200	168	ϕ8-300
		85	M_{ty}	1,09722	0,0032	0,0040	392,7	ϕ10-200	-	-
13 & 14	120	95	M_{lx}	0,3529	0,0010	0,0040	392,7	ϕ10-200	-	-
		85	M_{ly}	0,2255	0,0007	0,0040	392,7	ϕ10-200	-	-
		95	M_{tx}	0,5170	0,0015	0,0040	392,7	ϕ10-200	-	-
		85	M_{ty}	0,5536	0,0016	0,0040	392,7	ϕ10-200	-	-
15	120	95	M_{lx}	0,5088	0,0015	0,0040	392,7	ϕ10-200	168	ϕ8-300
		85	M_{ly}	0,1440	0,0004	0,0040	392,7	ϕ10-200	168	ϕ8-300
		95	M_{tx}	0,6811	0,0019	0,0040	392,7	ϕ10-200	168	ϕ8-300
		85	M_{ty}	0,5228	0,0015	0,0040	392,7	ϕ10-200	168	ϕ8-300
16	120	80	M_{lx}	2,367	0,0072	0,0096	769,3	ϕ10-100	168	ϕ8-300
		75	M_{ly}	0,666	0,0020	0,0068	509	ϕ10-150	168	ϕ8-300
		80	M_{tx}	3,069	0,0096	0,0096	769,3	ϕ10-100	168	ϕ8-300
		75	M_{ty}	2,23	0,0068	0,0068	509	ϕ10-150	168	ϕ8-300

Keterangan: plat 16 adalah plat atap (mangkok)

4.5 Perencanaan Balok Anak



4.5.1 Pembebanan Balok anak

Perhitungan pembebanan seperti perhitungan sebelumnya

- Beban plat

$$W_D = 4{,}26x\frac{4{,}5}{3} = 6{,}39 \quad KN/m$$

- Berat taksiran balok anak

$$W_{Do} = 3{,}0 \quad KN/m$$

- Beban mati total

$$W_D = 6{,}39 + 3 = 9{,}39 \quad KN/m$$

- Beban hidup

$$W_L = 2{,}5x\frac{4{,}5}{3} = 3{,}75 \quad KN/m$$

Tabel 4.8 Reaksi Akibat Beban Rencana (SAP 90)

El	L (m)	Akibat beban mati			Akibat beban hidup			1,4.D			1,2.D+1,2.L		
		Torsi (KNm)	Geser (KN)	Momen (KNm)	Torsi (KNm)	Geser (KN)	Momen (KNm)	Torsi (KNm)	Geser (KN)	Momen (KNm)	Torsi (KNm)	Geser (KN)	Momen (KNm)
1	0.0	**1,857**	35,361	-38,95	**0,744**	14,159	-15,599	2,598	49,505	-54,5384	**3,418**	65,0876	-71,705
	3.0	1,857	7,191	24,87	0,744	2,879	9,959	2,600	10,067	34,8194	3,418	13,2356	45,779
2	0.0	0,060	**43,157**	**-50,56**	0,023	**17,281**	**-20,282**	0,084	60,419	-70,7854	0,108	**79,438**	**-93,124**
	3.0	0,061	14,987	36,56	0,024	6,001	14,642	0,085	20,981	51,1924	0,111	27,586	67,306
3	0.0	0	42,861	-50,20	0	17,163	-20,104	0,000	60,005	-70,2884	0	78,894	-92,413
	3.0	0	14,691	36,12	0	5,883	14,464	0,000	20,567	50,5694	0	27,042	66,487
4	0.0	-0,060	43,157	-50,56	-0,023	17,281	-20,282	-0,084	60,419	-70,7854	-0,108	79,438	-93,124
	3.0	-0,060	14,987	36,56	-0,023	6,001	14,642	-0,084	20,981	51,1924	-0,108	27,586	67,306
5	0.0	-1,857	35,361	-38,95	-0,743	14,159	-15,599	-2,600	49,505	-54,5384	-3,417	65,0876	-71,705
	3.0	-1,857	7,191	24,87	-0,743	2,879	9,959	-2,600	10,067	34,8194	-3,417	13,2356	45,779
6	0.0	0	25,464	-29,05	0	10,169	-11,636	0,000	35,649	-40,6826	0	46,8272	-53,488
	3.0	0	-2,706	5,07	0	-1,084	2,033	0,000	-3,7884	7,1092	0	-4,9816	9,3464
7	0.0	0	11,675	1,36	0	4,675	0,547	0,000	16,345	1,9124	0	21,49	2,5144
	3.0	0	-16,495	-5,86	0	-6,605	-2,348	0,000	-23,093	-8,2082	0	-30,362	-10,792
8	0.0	0	13,479	-5,97	0	5,398	-2,394	0,000	18,870	-8,3706	0	24,8116	-11,005
	3.0	0	-14,691	-7,79	0	-5,883	-3,122	0,000	-1000,5	-10,9144	0	-17,9891	-14,350
9	0.0	0	14,691	-7,79	0	5,883	-3,122	0,000	20,567	-10,9144	0	27,042	-14,350
	3.0	0	-13,467	-5,97	0	-5,398	-2,394	0,000	-18,853	-8,3706	0	-24,7972	-11,005
10	0.0	0	16,495	-5,66	0	6,605	-2,348	0,000	23,093	-8,2062	0	30,362	-10,792
	3.0	0	-11,675	1,36	0	-4,675	0,547	0,000	-16,345	1,9124	0	-21,49	2,405
11	0.0	0	2,706	5,07	0	1,084	2,033	0,000	3,7884	7,1092	0	4,9816	9,3464
	3.0	0	-25,464	-29,05	0	-10,19	-11,636	0,000	-35,649	-40,6826	0	-46,8704	-53,488
12	0.0	-1,857	-7,191	24,87	-0,743	-2,879	9,959	-2,600	-10,067	34,8194	-3,417	-13,2356	45,779
	3.0	-1,857	-35,361	-38,95	-0,743	-14,15	-15,599	-2,600	-49,505	-54,5384	-3,417	-65,0876	-71,705
13	0.0	-0,060	-14,987	36,56	-0,023	-6,001	14,642	-0,084	-20,981	51,1924	-0,108	-27,586	67,306
	3.0	-0,060	-43,157	-50,56	-0,023	-17,28	-20,282	-0,084	-60,419	-70,7854	-0,108	-79,438	-93,124
14	0.0	0	-14,691	36,12	0	-5,883	14,464	0,000	-20,567	50,5694	0	-27,042	66,487
	3.0	0	-42,861	-50,20	0	-17,16	-20,104	0,000	-60,005	-70,2884	0	-78,894	-92,413
15	0.0	0,060	-14,987	36,56	0,023	-6,001	14,642	0,084	-20,981	51,1924	0,108	-27,586	67,306
	3.0	0,060	-43,157	-50,56	0,023	-17,28	-20,282	0,084	-60,419	-70,7854	0,108	-79,438	-93,124
16	0.0	1,856	-7,191	24,87	0,743	-2,879	9,959	2,598	-10,067	34,8194	3,416	-13,2356	45,779
	3.0	1,856	-35,361	-38,95	0,743	-14,15	-15,599	2,598	-49,505	-54,5384	3,416	-65,0876	-71,705

4.5.2 Dimensi balok anak

Langkah-langkah perencanaan penulangan balok anak (balok non struktural) sama seperti perencanaan penulangan pelat lantai

$M_u = 93,1244$ KNm

$f_c^{'} = 22,5$ MPa

$f_y = 350$ MPa

$\rho_{min} = 0,004$

$$\rho_b^{'} = \frac{0,85x22,5}{350} x0,85x\left\{\frac{600}{600+350}\right\} = 0,029335$$

$\rho_{max} = 0,75x0,029335 = 0,022$

dicoba $\rho = 0,0165$

$m = 18,3$

$$R_n = \rho.f_y\left(1-0,5.\rho.m\right) = 0,0165x350\left(1-0,5x0,0165x18,3\right) = 4,903$$

$$bd^2 = \frac{93,1244}{0,8x4,903} x10^6 = 23741688,76 \quad mm^3.$$

tabel dimensi balok berdasarkan lebar coba-coba

b (mm)	d (mm)
200	344,5
250	308,2

Diambil nilai b = 250mm ; h = 400 mm

- Kontrol berat sendiri balok

  $W = 0,25x0,4x24 = 2,4$ KN/m < 3 KN/m

- Dipakai ukuran balok 250/400 mm

$d' = 40 \quad mm^2$

$d = 400 - 40 = 360 \quad mm$

$$R_n = \frac{93{,}1244}{0{,}8x250x360^2} x10^6 = 3{,}6$$

$$\rho' = \frac{3{,}6}{4{,}903} x0{,}0165 = 0{,}012$$

$As = 0{,}012.250.360 = 1090{,}4 \quad mm^2$

- Kapasitas balok

$$M_n = \frac{93{,}1244}{0{,}8} = 116{,}406 \quad KNm$$

$$a = \frac{1090{,}4x350}{0{,}85x22{,}5x250} = 80 \quad mm$$

$$Mn = 1090{,}4x350\left(360 - \frac{80}{2}\right)x10^{-6}$$

$$= 122{,}16 \quad KNm > M_n = 116{,}406 \quad KNm$$

dipakai tulangan sebelah $4D_{20} = 1256{,}6\ mm^2 > A_s = 1090{,}4\ mm^2$.

- kontrol regangan yang terjadi

$$\varepsilon_y = \frac{350}{210.000} = 0{,}00167$$

$$c = \frac{80}{0{,}85} = 94 \quad mm$$

$$\varepsilon_s = \frac{360 - 94}{94}(0{,}003) = 0{,}0085 > \varepsilon_y$$

- kontrol tulangan torsi

$T = 3{,}4188 \quad KNm$

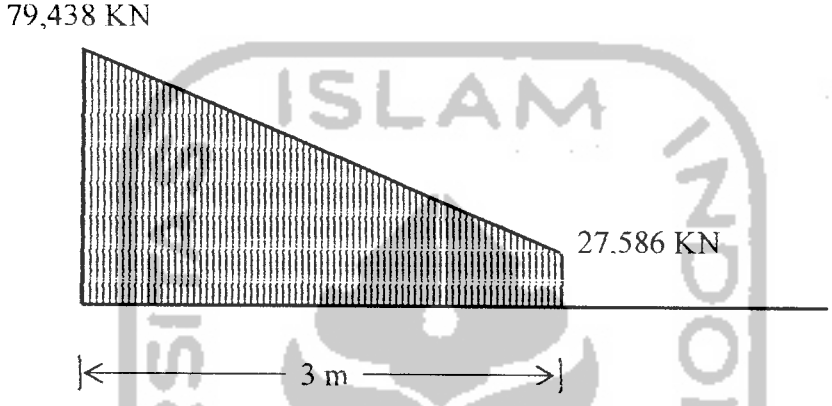
$$\Sigma x^2 y = 250^2(600) = 37500000 \quad mm^3$$

$$\phi \frac{1}{24} f_c' \Sigma x^2 y = 0{,}6 \frac{1}{24} x22{,}5x37500000x10^{-6}$$

$$= 21{,}09 \quad KNm > 3{,}4188 \quad KNm$$

efek torsi boleh diabaikan

- kontrol tulangan geser



$$Vu = \frac{3000 - 360}{3000} x79{,}438 = 69{,}905 \quad KN$$

$$Vn = \frac{69{,}905}{0{,}60} = 116{,}509 \quad KN$$

$$Vc = \left(1/6\sqrt{22{,}5}\right)x250x360x10^{-3} = 71{,}151 \quad KN < 116{,}509 \quad KN$$

$$\tfrac{1}{2} Vc = 35{,}5755 \quad KN$$

- Kuat geser tulangan geser

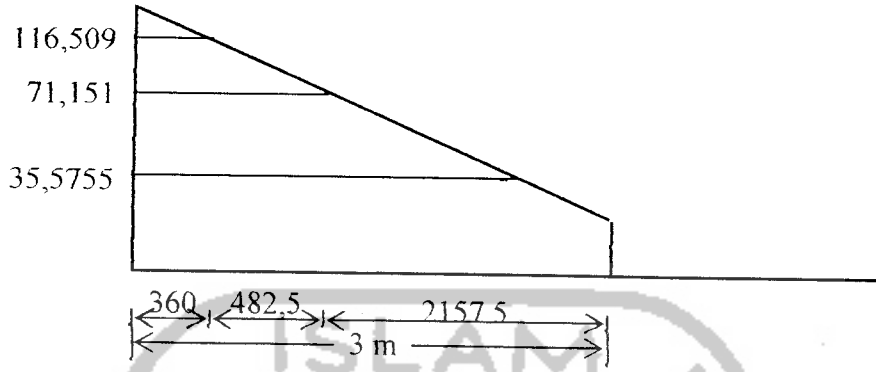
$$Vs_1 = \tfrac{1}{3}\sqrt{22{,}5}x250x360x10^{-3} = 142{,}302 \quad KN$$

$$Vc + Vs_1 = 71{,}151 + 142{,}302 = 213{,}453 \quad KN$$

$$Vc = 71{,}151 \text{ KN} < Vn = 116{,}509 \text{ KN} < Vc + Vs_1 = 213{,}453 \text{ KN}$$

Penampang memerlukan tulangan geser untuk menahan gaya geser yang terjadi.

Dipakai tulangan geser $2(\phi 10) = 157\ mm^2$



- Untuk semua daerah

  Jarak sengkang

  $$Vs = 116,509 - 71,151 = 45,358 \quad KN$$

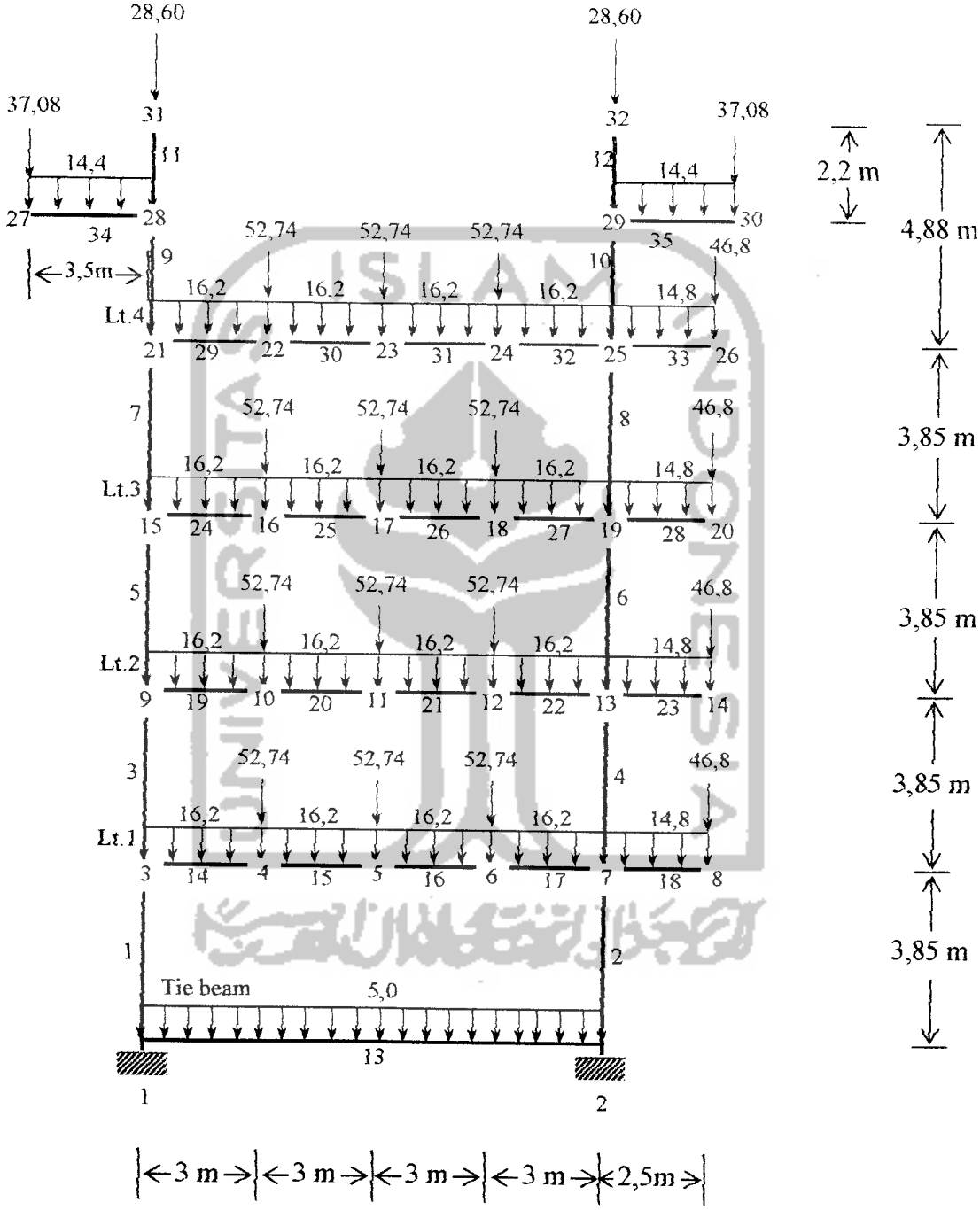
  $$s = \frac{157x350x360x10^{-3}}{45,358} = 436 \quad mm$$

  $$\frac{d}{2} = 180 \quad mm$$

  dipakai sengkang P10 – 180 mm

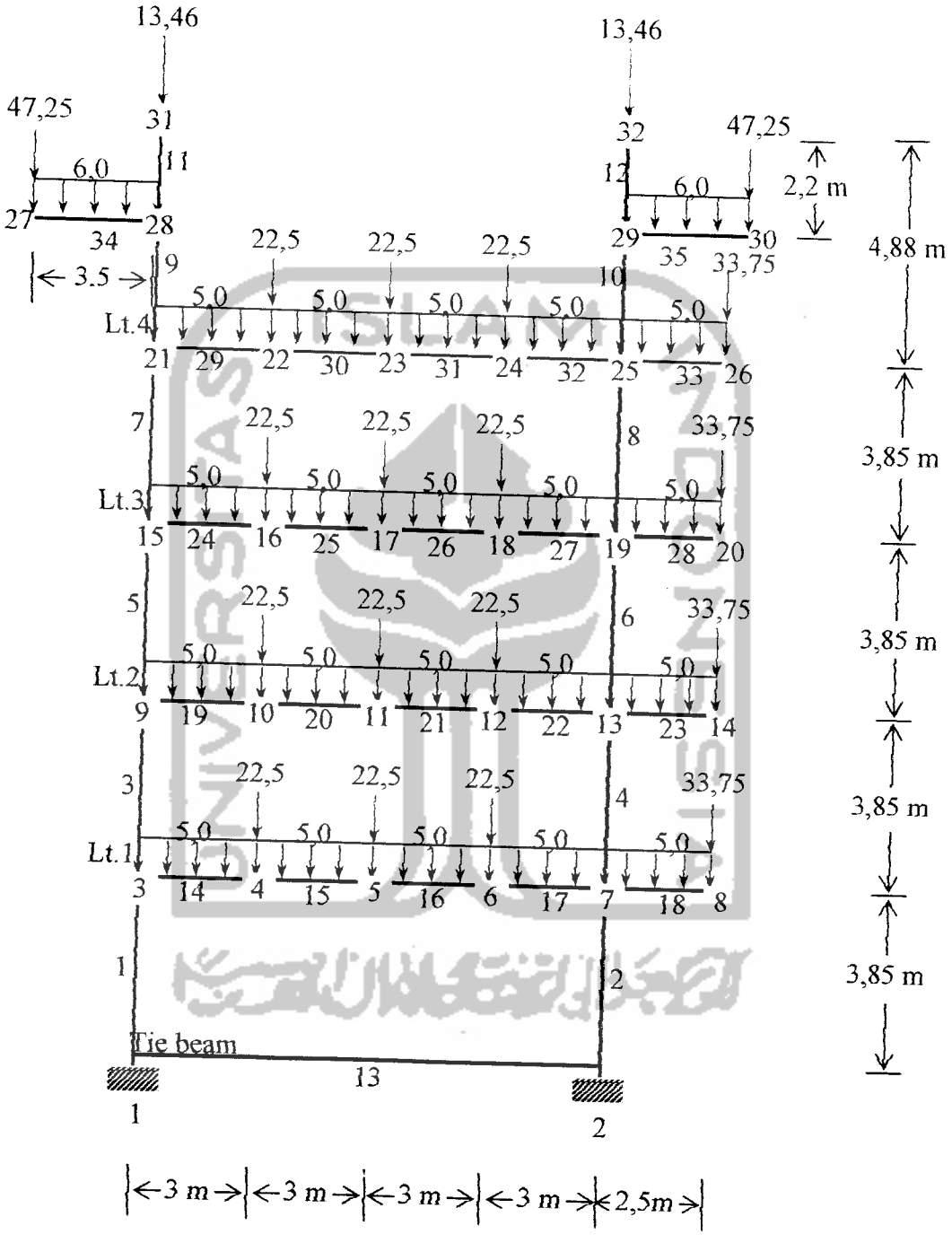
Pembebanan Portal As. 9 dan As 10

a. Beban mati



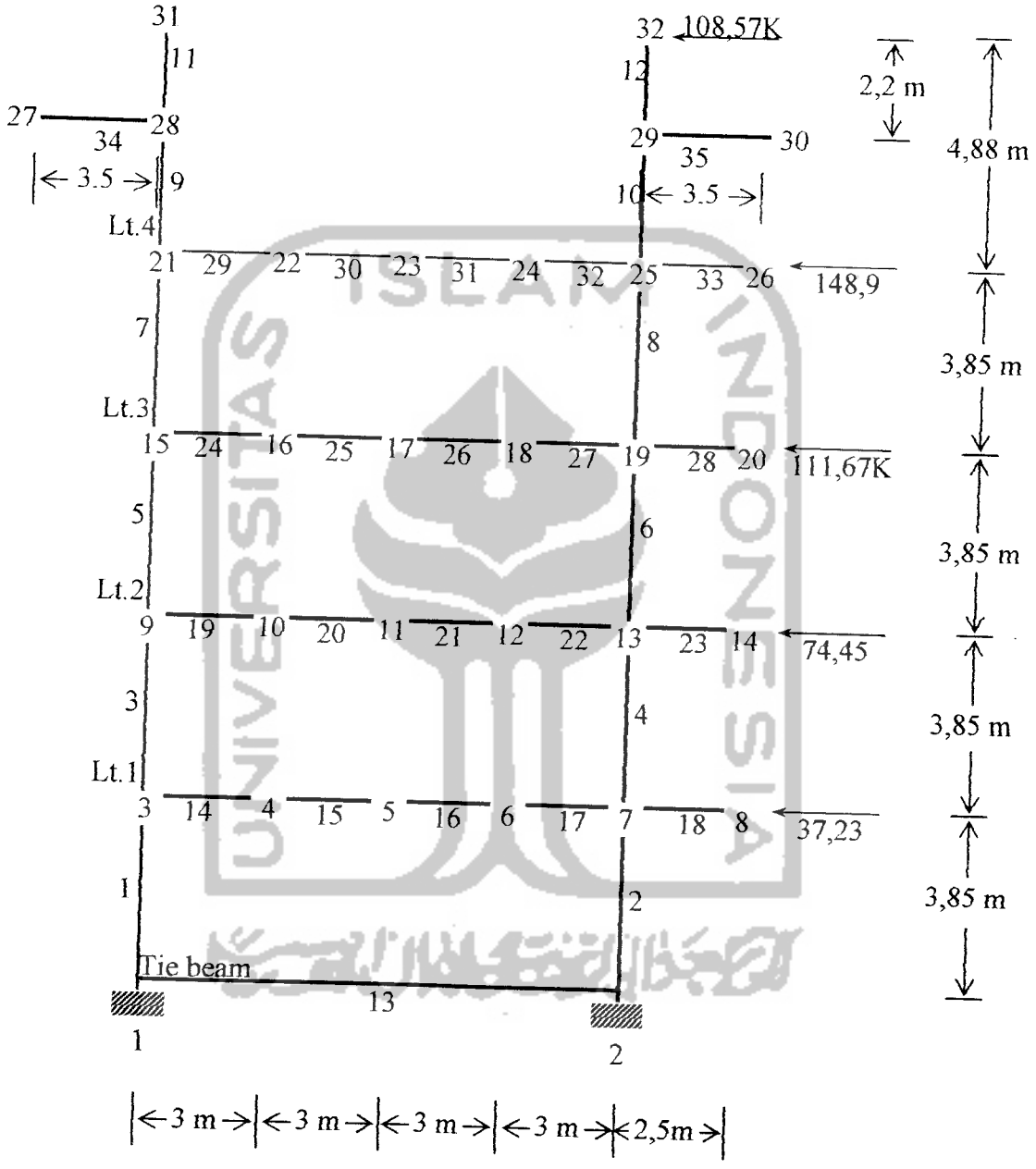
Gambar 4.9.a Pembebanan mati Portal As. 9 dan As 10

b. Beban hidup



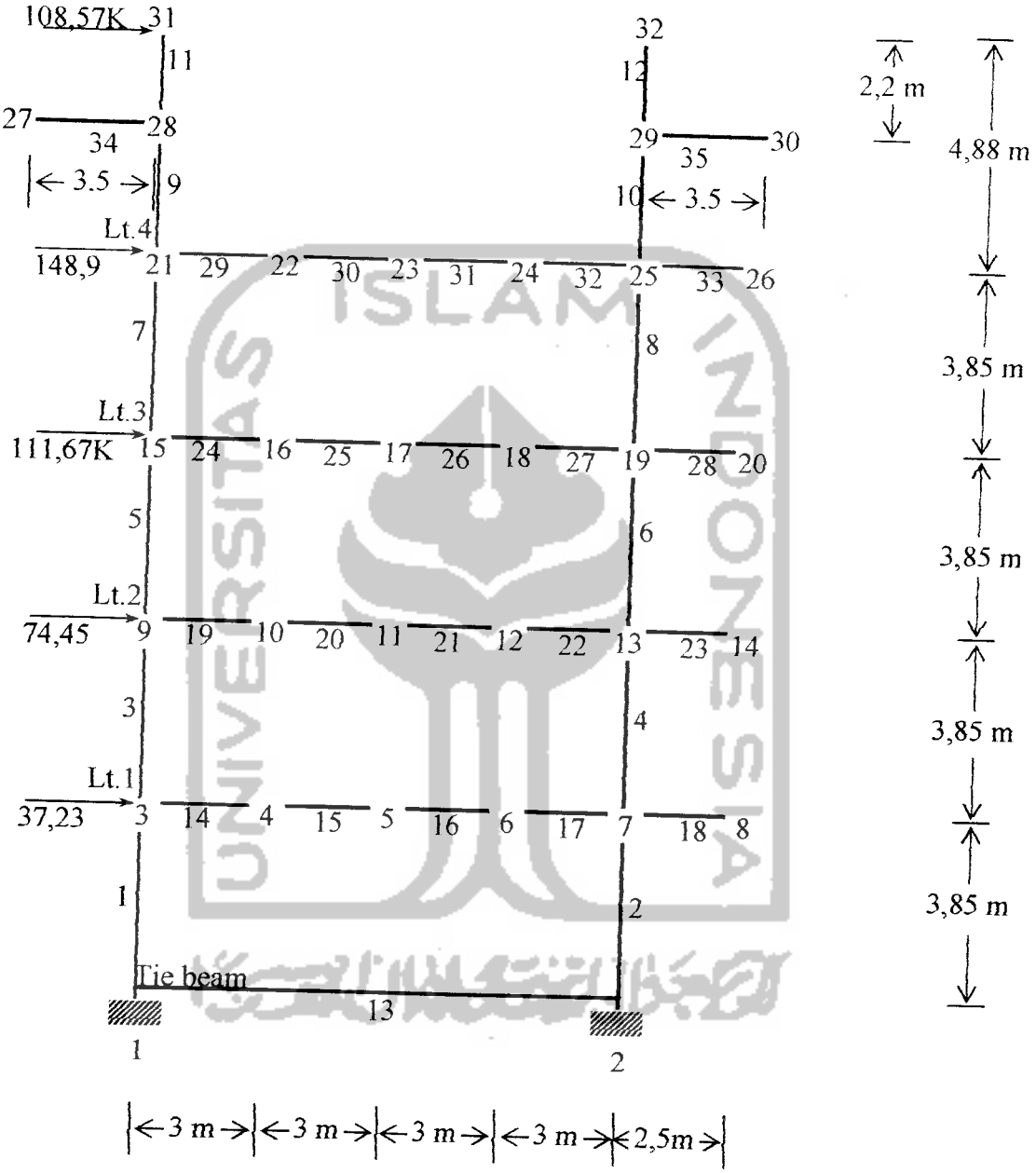
Gambar 4.9.b Pembebanan hidup Portal As. 9 dan As 10

c. Beban gempa kanan



Gambar 4.9.c Pembebanan gempa kanan Portal As. 9 dan As 10

d. Beban gempa kiri



Gambar 4.9.d Pembebanan gempa kiri Portal As. 9 dan As 10

a. Beban mati

- Beban terdistribusi merata elemen 14 s/d 17, 19 s/d 22, 24 s/d 27, 29 s/d 32

  Lantai : 2.2 / 3.1,5.4,26 = 8,52 KN/m

  Balok : 0,4.0,8.24 = 7,68 KN/m

  W_{D1} = 16,2 KN/m

- Beban terdistribusi merata elemen 18, 23, 28, 33

  Lantai : 2.2 / 3.1,25.4,26 = 7,10 KN/m

  Balok : 0,4.0,8.24 = 7,68 KN/m

  W_{D2} = 14,8 KN/m

- Beban terdistribusi merata elemen 34 & 35

  Lantai : 2.2 / 3.1,75.0,12.24 = 6,72 KN/m

  Balok : 0,4.0,8.24 = 7,68 KN/m

  W_{D3} = 14,40 KN/m

- Beban terpusat

  - Nodal 4 s/d 6, 10 s/d 12, 16 s/d 18, 22 s/d 24

    $P_{D1\ balok\ anak}$: 2.(2.1/2.3.1,5).4,26 + 0,25.0,4.24.6 = 52,74 KN

  - Nodal 31 & 32

    $P_{D2\ R\ perletakan\ atap}$ = 28,60 KN

  - Nodal 27 & 30

    $P_{D3\ penutup\ Lt\ 4}$: 1,75.(1,5 + 3).0,12.24 + 0,25.0,4.24,6 = 37,08 KN

  - Nodal 8, 14, 20, 26

    $P_{D4\ Lt\ selasar}$: 2.1,25.(1,5 + 3).0,12.24 + 0,25.0,4.24.6 = 46,8 KN

b. Beban hidup

- Beban terdistribusi merata elemen 14 s/d 17, 19 s/d 22, 24 s/d 27, 29 s/d 32

  W_{L1} = 2.2/3.1,5.2,5 = 5,0 KN/m

- Beban terdistribusi merata elemen 18, 23, 28, 33

  W_{L2} = 2.2/3.1,25.3 = 5,0 KN/m

- Beban terdistribusi merata elemen 34 & 35

  W_{L3} = 2.2/3.1,5.3 = 6,0 KN/m

- Beban terpusat

  - Nodal 4 s/d 6, 10 s/d 12, 16 s/d 18, 22 s/d 24

    $P_{L1\ R\ balok\ anak}$: 2.(2.1/2.3.1,5).2,5 = 22,50 KN

  - Nodal 31 & 32

    $P_{L2\ R\ perletakan\ atap}$: 7,166 + 6,304 = 13,46 KN

  - Nodal 27 & 30

    $P_{L3\ penutup\ Lt\ 4}$: 2.1,75.(1,5+3).3 = 47,25 KN

  - Nodal 8, 14, 20, 26

    $P_{L4\ Lt\ selasar}$: 2.1,25.(1,5+3).3 = 33,75 KN

c. Beban gempa

Reaksi atap	:	2. 28,6 = 57,20 KN
Plat penutup Lt.4	:	2.3,5.6.0,12.24 = 120,96 KN
Kolom	:	2.0,45.0,7.24.4,8 = 72,58 KN
Balok	:	2.0,4.0,8.24.12 = 184,38 KN
Balok	:	2.0,25.0,4.24.6 = 46,08 KN
Beban hidup tereduksi:		0,6.(2.3,5.6.3) = 75,60 KN
		Dibulatkan W_{atap} = 556,80 KN

- Berat lantai 4 (tipikal dengan lt. 3, 2,1)

Lantai	:	6.15.4,26 = 383,40 KN
Kolom	:	2.0,45.0,7.3,85.24 = 58,21 KN
Balok	:	2.0,4.0,8.24.12 = 184,32 KN
Balok	:	4.0,25.0,4.24.6 + 2.0,25.0,4.24.2,5 = 111,36 KN
Balok	:	2.0,25.0,4.24.12 = 92,16 KN
Tembok	:	2,5.3,85.12 = 115,50 KN
B.hidup tereduksi :		0,6(6.12.2,5 + 6.2,5.3) = 60,60 KN
		Dibulatkan W_4 = 1005,6 KN

W_{Total} : 556,8 + 4.1005,6 = 4579,2 KN

Gaya geser untuk tingkat daktilitas penuh (K=1)

$V = C.I.K.W_T$

$= 0{,}07.1{,}5.1{,}0.4579{,}2 = 480{,}82$ KN

distribusi gaya-gaya lateral akibat gempa

Tingkat	Wi (KN)	hi (m)	Wi hi (KNm)	Fi (KN)
Atap	556,8	20,28	11291,91	108,57
4	1005,6	15,40	15486,24	148,90
3	1005,6	11,55	11614,68	111,67
2	1005,6	7,70	7743,12	74,45
1	1005,6	3,85	3871,56	37,23
			50007,51	480,82

Gaya geser untuk tingkat daktilitas penuh (K=2)

$V = C.I.K.W_T$

$= 0{,}07.1{,}5.2{,}0.4579{,}2 = 961{,}64$ KN

distribusi gaya-gaya lateral akibat gempa

Tingkat	Wi (KN)	hi (m)	Wi hi (KNm)	Fi (KN)
Atap	556,8	20,28	11291,91	217,14
4	1005,6	15,40	15486,24	297,80
3	1005,6	11,55	11614,68	223,34
2	1005,6	7,70	7743,12	148,90
1	1005,6	3,85	3871,56	74,46
			50007,51	961,64

4.6 Perencanaan Penulangan Portal As 9 dan As 10 Daktilitas Penuh (K=1)

4.6.1 Penulangan lentur dan geser balok

tabel momen rencana balok didapat:

$M^{-}_{tumpuan}$ = 1196,13 KNm

$M^{+}_{tumpuan}$ = 397,08 KNm

$M_{lapangan}$ = 506,15 KNm

a. Pemeriksaan rasio tulangan apakah boleh dilakukan redistribusi momen

$$\rho_b = \frac{0,85.22,5}{350}.0,85.\left(\frac{600}{600+350}\right) = 0,0029 \qquad \text{(dari 3.3)}$$

$$R_n = \frac{1196,13.10^6}{0,8.400.750^2} = 5,316 \qquad \text{(dari 3.37)}$$

$$\rho = \frac{1}{18,3}\left(1-\sqrt{1-\frac{2.5,316.18,3}{350}}\right) = 0,018 \qquad \text{(dari 3.39)}$$

$$R_n = \frac{397,08.10^6}{0,8.400.750^2} = 1,76$$

$$\rho' = \frac{1}{18,3}\left(1-\sqrt{1-\frac{2.1,76.18,3}{350}}\right) = 0,0053$$

0,018-0,0053 = 0.0127 < 0,5.0,029 = 0,0145

maka redistribusi momen negatif boleh dilakukan

- faktor redistribusi maksimum

$$30.\left(1-\frac{4}{3}\frac{0,018-0,0053}{0,029}\right)\% = 12\ \% \qquad \text{(dari 3.3)}$$

- Redistribusi momen negatif pada pertemuan kolom tepi

∂M = 1196,13.12% = 143,06 KNm

- Momen balok rencana terredistribusi

$M^{-}_{tump} = 1196,13 - 143,06 = 1049,07$ KNm

$M^{+}_{tump} = 397,08 + 143,06 = 540,14$ KNm

$M_{lap} = 506,15 + 143,06 = 649,21$ KNm

- Perencanaan tulangan tumpuan negatif

$f'_c = 22,5$ MPa

$f_y = 350$ MPa

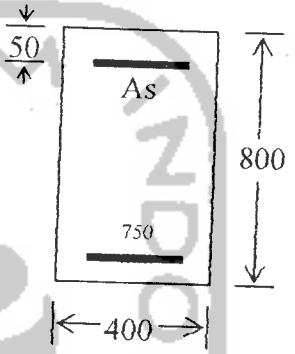
$d' = 50$ mm

$d = 800-50 = 750$ mm

$m = 18,3$

$\rho_{min} = 0,004$

$\rho_{max} = 0,022$



$$R_n = \frac{1049,07 \ .10^6}{0,8.400.750^2} = 4,66$$

$$\rho_{perlu} = \frac{1}{18,3}\left(1-\sqrt{1-\frac{2.4,66.18,3}{350}}\right) = 0,016$$

$As = 0,016.400.750 = 4721,90$ mm^2 (dari 3.40a)

$As' = 0,5.As = 0,5.\ 4721,90 = 2360,95$ mm^2 (dari 3.40b)

- Perencanaan tulangan tumpuan positif

$R_n = 2,40$

$$\rho_{perlu} = \frac{1}{18,3}\left(1-\sqrt{1-\frac{2.2,40.18,3}{350}}\right) = 0,0074$$

$As' = 0,0074.400.750 = 2206,12$ mm^2

Tulangan tumpuan terpasang berdasarkan luasan maksimum

$As = 0{,}016.400.750 = 4721{,}90\ mm^2$

Dipakai tulangan 10D25 = $4909{,}0\ mm^2$

$As' = 0{,}5.As = 0{,}5.\ 4721{,}90 = 2360{,}95\ mm^2$

Dipakai tulangan 5D25 = $2454{,}5\ mm^2$

- Perencanaan tulangan lapangan

$Rn = 2{,}88$

$\rho_{perlu} = 0{,}0089$

$As = 0{,}008.400.750 = 2694{,}65\ mm^2$

Dipakai tulangan 6D25 = $2945{,}4\ mm^2$

b. Momen kapasitas balok berdasarkan tulangan tarik terpasang (akibat gempa kiri)

$C_c = 0{,}85.22{,}5.400.a = 7650.a \quad N$ (dari 3.59c)

$C_s = 2454{,}5.(350 - 0{,}85.22{,}5) = 812132{,}69 \quad N$ (dari 3. 59d)

$T = 4909{,}0.350 = 1718150 \quad N$ (dari 3. 59e)

$$a = \frac{1718150 - 812132{,}69}{7650} = 118 \quad mm$$ (dari 3. 59g)

$C_c = 7650.118 = 906017{,}31 \quad N$

dari persamaan 3. 59h, didapat nilai:

$$M_{n,ak.b} = \left[906017{,}31.\left(750 - \frac{142}{2}\right) + 812132{,}69.(750 - 50)\right].10^{-6}$$

$$= 626{,}06 + 568{,}49 = 1194{,}55 \quad KNm$$

$M_{kap.b} = 1{,}25.1194{,}55 = 1492{,}96 \quad KNm$ (dari 3. 59a)

c. Momen kapasitas balok berdasarkan tulangan tekan terpasang (gempa kanan)

Perencanaan menggunakan anggapan bahwa tulangan tarik dan tulangan tekan berjumlah sama yaitu berdasarkan tulangan tekan terpasang momen positif akibat gempa kanan (gambar 4.6.1.c), sehingga didapat:

$C_c = 0{,}85.22{,}5.400.a = 7650.a \quad N$

$C_s = 2454{,}5.(350 - 0{,}85.22{,}5) = 812132{,}69 \quad N$

$T = 2454{,}5.350 = 859075 \quad N$

$$a = \frac{859075 - 812132{,}69}{7650} = 6{,}2 \quad mm$$

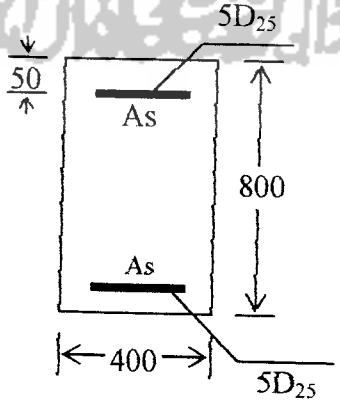
$C_c = 7650.6{,}2 = 46942{,}31 \quad N$

dari persamaan 3. 59h, didapat nilai:

$$M_{n,ak.b} = \left[46942{,}31.\left(750 - \frac{6{,}2}{2} \right) + 812132{,}69.(750 - 50) \right].10^{-6}$$

$$= 35{,}06 + 568{,}49 = 603{,}55 \quad KNm$$

$$M'_{kap.b} = 1{,}25.603{,}55 = 754{,}44 \quad KNm$$



Gambar 4.10 Anggapan penampang balok tulangan tekan terpasang

d. Tulangan geser balok

V_D = 188,58 KN

V_L = 71,30 KN

V_E = 112,54 KN

V_g = 188,58 + 71,30 = 259,88 KN

l_n = 12-0,70 =11,3 m

Gaya geser rencana:

$$V_{u,b} = 0,7.\left(\frac{192,96 + 754,44}{11,3}\right) + 1,05.229,92 = 425,74 \quad KN \qquad \text{(dari 3.60a)}$$

dari persamaan (dari 3.60) didapat gaya geser terpakai:

$$V_{u,b} = \left[229,92 - 0,7.\left(\frac{1492,96 + 754,44}{11,3}\right)\right] + \frac{11,3 - 0,7}{11,3}\left[425,74 - \left(229,92 - 0,7.\left(\frac{1492,96 + 754,44}{11,3}\right)\right)\right]$$

$$= 407,64 \quad KN$$

tidak perlu lebih dari

$$V_{u,b} = 1,05.\left(189.73 + 72.00 + \frac{4,0}{1}.91.71\right) = 626.59 \quad KN \qquad \text{(dari 3.60b)}$$

- Pada daerah sendi plastis ($V_c = 0$), (x = 2.750 = 1500 mm)

Vs = 407,64 /0,6 = 679,4 KN (dari 3.60m)

Dipakai sengkang 3D10 = 235,5 mm^2

$$s = \frac{235,5.350.750.10^{-3}}{679,4} = 90 \cdot mm \qquad \text{(dari 3.60j)}$$

$$s \le \frac{750}{4} = 187,5 \quad mm \qquad \text{(dari 3.60n)}$$

$s \leq 8.25 = 200 \quad mm$ (dari 3.60n)

$s \leq 24.10 = 240 \quad mm$

$$s \leq \frac{1600.350.157}{490,9.350} = 500 \quad mm$$

- Diluar daerah sendi plastis

$$V_u = \frac{6-1,5}{6}(396,79-184,20)+184,20 = 343,64 \quad KN$$

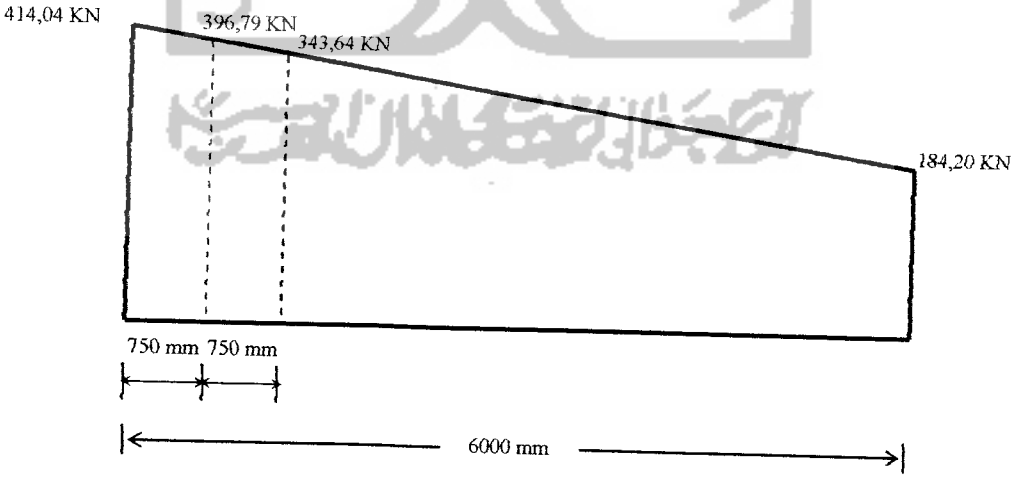
$V_c = .1/6.\sqrt{22,5}.400.750.10^{-3} = 237,17 \quad KN$ (dari 3.60e)

$V_s = 343,64/0,6 - 237,17 = 335,57\ KN$

$$s \leq \frac{235,5.350.750.10^{-3}}{335,57} = 150 \quad mm$$

$$s \leq \frac{750}{2} = 187,5 \quad mm$$

$s \leq 300 \quad mm$



4.6.2 Penulangan kolom akibat beban lentur dan aksial

$I_b = 1/12.0,40.0,8^3 = 0,0171\ m^4$

$I_k = 1/12.0,45.0,7^3 = 0,0141\ m^4$

$$K_{k.b} = \frac{E.I_k}{h_k} = \frac{E.0,0141}{3,85} = 0,003662.E \qquad \text{(dari 3.61c)}$$

$$K_{k.a} = \frac{E.I_k}{h_k} = \frac{E.0,0141}{3,85} = 0,003662.E$$

$$\Sigma K = K_{ka} + K_{kb} = 0,003662.E + 0,003662.E = 0,007324.E$$

$$\alpha_{ka} = \frac{K_k}{\Sigma K} = \frac{0,003662.E}{0,007324.E} = 0,5 \qquad \text{(dari 3.61d)}$$

a. Momen rencana kolom (dari 3.61b)

$$M_{u.k} = \frac{3,85}{3,05}.0,7.1,3.0,5.\left[\left(\frac{12}{11,3}.1492,96 + 0\right) + 0,3\left(\frac{6}{5,6}.310,82 + \frac{6}{5,6}.310,82\right)\right]$$

$$= 910,59 \quad \text{KNm}$$

tidak perlu lebih dari (pers. 3.62)

$$M_{u,k} = 1,05.(165,76 + 78,08 + 4/1.(346,96 + 0,3.185,78) = 1713,25 \quad \text{KNm}$$

b. Gaya aksial rencana kolom

n = 5 lantai

$R_v = 1,1 - 0,025.5 = 0,975$

$N_D = 662,88$ KN

$N_L = 318,05$ KN

Ng = 193,11 KN

$N_g = 662,88 + 318,05 = 980,93$ KN

dari persamaan 3.64a

$$N_{u.k} = 0,7.0,975\left[\left(\frac{910,59}{12} - 0\right) + 0,3\left(\frac{6}{5,6}.310,82 - \frac{6}{5,6}.310,82\right)\right] + 1,05.980,93$$
$$= 1081,76 \quad KN$$

tidak perlu lebih dari 3.64b

$$N_{u.k} = 1,05.(980,93 + 4,0/1.(193,11 + 0,3.73,38) = 1841,04 \quad KN$$

c. Perencanaan tulangan desak dan lentur kolom

Kontrol kelangsingan kolom

$$r = \sqrt{\frac{1,41.10^{10}}{3,15.10^{5}}} = 216,5 \quad mm = 0,22 \quad m \qquad \text{(dari 3.65a)}$$

$$\frac{kl}{r} = \frac{1,0.(3,85 - 0,8)}{0,22} = 14,1 < 22 \rightarrow \text{kolom} \quad \text{pendek} \qquad \text{(dari 3.65c)}$$

Tinjauan terhadap kondisi seimbang untuk luas tulangan 1% Ag

$$A_{st} = 0,01.450.700 = 3150 \text{ mm}^2 \qquad \text{(dari 3.65e)}$$

$$As = As' = 0,5.3150 = 1575 \text{ mm}^2$$

$$d = 700 - 50 = 650 \text{ mm}^2 \qquad \text{(dari 3.65f)}$$

$$c_b = \frac{600.650}{600 + 350} = 410 \quad mm \qquad \text{(dari 3.65g)}$$

$$a_b = 0,85.410 = 348 \quad mm \qquad \text{(dari 3.65h)}$$

$$f_s' = 200000.\left[0,003.\left(\frac{410 - 50}{410}\right)\right] = 526,8 \quad MPa > fy \qquad \text{(dari 3.65i)}$$

maka dianggap $f_s' = f_y$

$$f_s = 200000.\left[0,003.\left(\frac{650 - 410}{410}\right)\right] = 351,2 \quad MPa > fy \qquad \text{(dari 3.65j)}$$

maka dianggap fs = fy

$$C_{cb} = 0{,}85.22{,}5.348.450.10^{-3} = 2994{,}975 \quad KN \qquad \text{(dari 3.65k)}$$

$$C_{sb} = 1575.(350 - 0{,}85.22{,}5).10^{-3} = 521{,}128 \quad KN \qquad \text{(dari 3.65l)}$$

$$T_{sb} = 1575.350.10^{-3} = 551{,}25 \quad KN \qquad \text{(dari 3.65m)}$$

$$P_{nb} = (2994{,}975 + 521{,}128 - 551{,}25) = 2964{,}85 \quad KN$$

$$\phi P_{nb} = 0{,}65.2964{,}85 = 1927{,}15 \quad KN \qquad \text{(dari 3.65n)}$$

$$M_{nb} = \left[2994{,}975.\left(\frac{700-348}{2}\right) + 521{,}128(350-50) + 551{,}25(650-350)\right]10^{-3}$$

$$= 848{,}83 \quad KNm$$

$$\phi M_{nb} = 0{,}65.848{,}83 = 551{,}74 \quad KNm \qquad \text{(dari 3.65o)}$$

$$e_b = \frac{551{,}74}{1927{,}15}.10^3 = 286 \quad mm \qquad \text{(dari 3.65p)}$$

Dengan cara yang sama ditinjau kondisi patah desak

Diambil $c > c_b \rightarrow c = 500$ mm

$a = 0{,}85.500 = 425$ mm

$$f_s' = 200000.\left[0{,}003.\left(\frac{500-50}{500}\right)\right] = 529 \quad MPa > fy$$

maka dianggap $f_s' = f_y$

$$f_s = 200000.\left[0{,}003.\left(\frac{650-500}{500}\right)\right] = 240 \quad MPa < fy$$

maka digunakan f_s

$$C_c = 0{,}85.22{,}5.425.450.10^{-3} = 3657{,}66 \quad KN$$

$$C_s = 1575.(350 - 0{,}85.22{,}5).10^{-3} = 521{,}128 \quad KN$$

$$T_s = 1575.240.10^{-3} = 378 \quad KN$$

$$P_n = 3657{,}66 + 521{,}128 - 378 = 4556{,}79 \quad KN$$

$$\phi P_n = 0{,}65.4556{,}79 = 2961{,}91 \quad KN$$

$$M_n = \left[3657{,}66.\left(\frac{700-425}{2}\right) + 521{,}128.(350-50) + 378.(650-350)\right].10^{-3}$$

$$= 772{,}67 \quad KNm$$

$$\phi M_n = 0{,}65.772{,}67 = 502{,}24 \quad KNm$$

$$e = \frac{502{,}24}{2961{,}91}.10^3 = 170 \quad mm$$

Dengan cara yang sama ditinjau kondisi patah tarik

Diambil $c < c_b \rightarrow c = 300$ mm

$a = 0{,}85.300 = 255$ mm

$$f_s^{'} = 200000.\left[0{,}003.\left(\frac{300-50}{300}\right)\right] = 500 \quad MPa > fy$$

maka dianggap $f_s^{'} = f_y$

$$f_s = 200000.\left[0{,}003.\left(\frac{650-300}{300}\right)\right] = 800 \quad MPa > fy$$

maka dianggap $f_s = f_y$

$$C_c = 0{,}85.22{,}5.255.450.10^{-3} = 2194{,}59 \quad KN$$

$$C_s = 1575.(350 - 0{,}85.22{,}5).10^{-3} = 521{,}128 \quad KN$$

$$T_s = 1575.350.10^{-3} = 551{,}25 \quad KN$$

$$P_n = 2194,59 + 521,128 - 551,25 = 2164,47 \quad KN$$

$$\phi P_n = 0,65.2164,47 = 1406,91 \quad KN$$

$$M_n = \left[2194,59.\left(\frac{700-255}{2}\right) + 521,128.(350-50) + 551,25.(650-350) \right].10^{-3}$$

$$= 810,01 \quad KNm$$

$$\phi M_n = 0,65.810,01 = 526,51 \quad KNm$$

$$e = \frac{526,51}{1406,91} 10^3 = 374 \quad mm$$

Keruntuhan akibat beban sentris (aksial murni)

$$P_n = \{0,85.22,5.(315000 - 3150) + 3150.350\}.10^{-3}$$

$$= 7066,63 \text{ KN} \qquad \text{(dari 3.65q)}$$

$$\phi P_n = 0,65.\ 7066,63 = 4593,31 \text{ KN} \qquad \text{(dari 3.65r)}$$

Keruntuhan tanpa beban aksial (lentur murni)

Anggap tulangan baja desak belum luluh, keseimbangan gaya menjadi:

$$0,85.22,5.0.85_{,}.c^2.400 + (600.1575 - 1575.350)c - 600.1575.50 = 0$$

$$6502,5c^2 + 393750c - 47250000 = 0 \qquad \text{(dari 3.65s)}$$

didapat: c = 120 mm, a = 0,85.120 = 96 mm

$$M_n = [0,85.22,5.96.400.(650 - 96/2) + 1575.350.(650 - 50)]\,10^{-6}$$

$$= 830,93 \quad KNm$$

$$\phi M_n = 0,8.830,93 = 664,75 \text{ KN} \qquad \text{(dari 3.65u)}$$

Keruntuhan akibat beban sentris (aksial murni)

$$P_n = \{0,85.22,5.(315000 - 3150) + 3150.350\}.10^{-3}$$

$$= 7066,63 \text{ KN} \qquad \text{(dari 3.65q)}$$

$$\phi P_n = 0,65.\ 7066,63 = 4593,31 \text{ KN} \qquad \text{(dari 3.65r)}$$

Keruntuhan tanpa beban aksial (lentur murni)

Anggap tulangan baja desak belum luluh, keseimbangan gaya menjadi:

$$0,85.22,5.0.85_1.c^2.400 + (600.1575 - 1575.350)c - 600.1575.50 = 0$$

$$6502,5c^2 + 393750c - 47250000 = 0 \qquad \text{(dari 3.65s)}$$

didapat: c = 120 mm, a = 0,85.120 = 96 mm

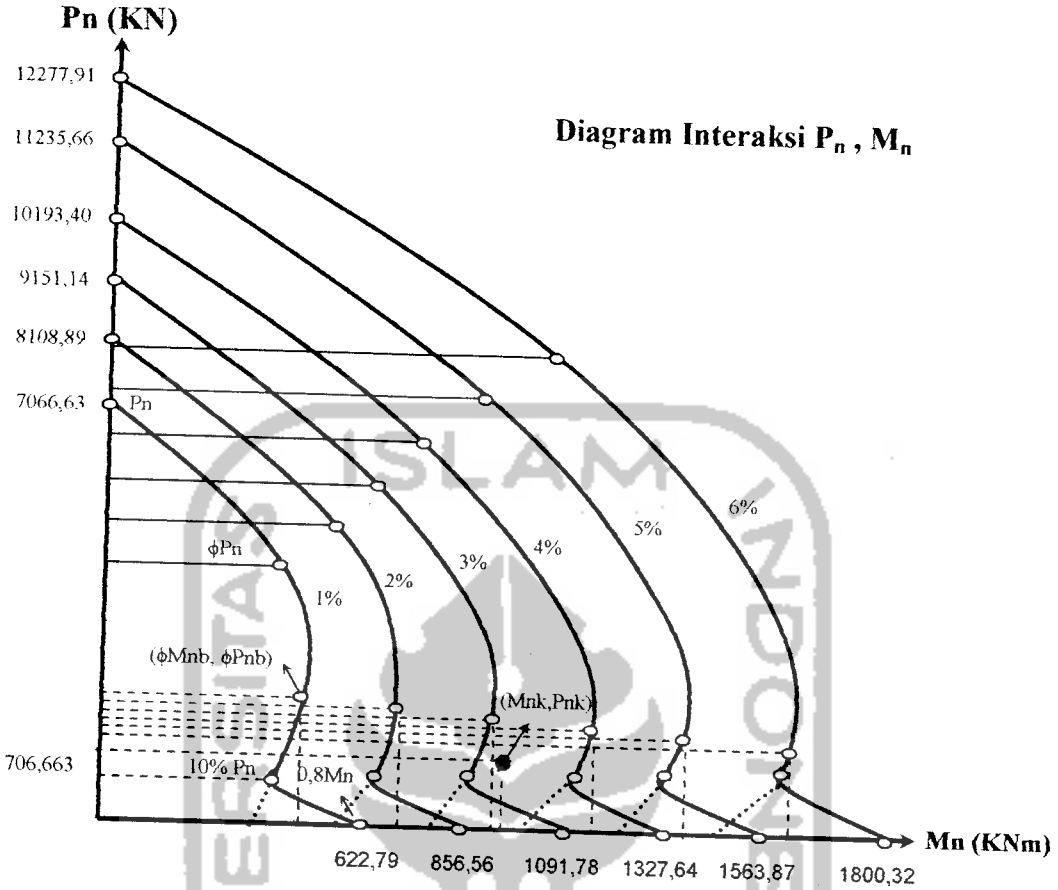
$$M_n = [0,85.22,5.96.400.(650 - 96/2) + 1575.350.(650 - 50)]\,10^{-6}$$
$$= 830,93 \text{ KNm}$$

$$\phi M_n = 0,8.830,93 = 664,75 \text{ KN} \qquad \text{(dari 3.65u)}$$

Dengan cara yang sama didapat diagram interaksi kolom 450/700 untuk luas tulangan 2%, 3%, 4%, 5%, 6%

Tabel 4.9 Interaksi Pn – Mn (kolom 450/700)

Luas tulangan	1%	2%	3%	4%	5%	6%
Ast	3150	6300	9450	12600	15750	18900
As = As'	1575	3150	4725	6300	7875	9450
$0.65.Pn_b$	1927.15	1907.58	1888.00	1868.42	1848.84	1829.26
$0.65.Mn_b$	551.74	760.85	969.97	1179.08	1388.19	1597.31
Pn	7066.63	8108.89	9151.14	10193.40	11235.66	12277.91
10%Pn	706.66	810.89	915.11	1019.34	1123.57	1227.79
0.65Pn	4593.31	5270.78	5948.24	6625.71	7303.18	7980.64
0.65Mn	506.02	695.96	**887.07**	**1078.71**	1270.64	1462.76
0.8Mn	622.79	856.56	1091.78	1327.64	1563.87	1800.32



Dari analisis momen dan aksial rencana kolom, didapat:

$M_{u.k} = 910,59$ KN

$N_{u.k} = 1081,76$ KN

$$e = \frac{910,59}{1081,76}.10^{-3} = 842 \text{ mm} > e_b = 286 \text{ mm (patah tarik)}$$

Rasio tulangan menurut diagram interaksi kolom, dilakukan interpolasi:

$$\rho = \frac{(0,04 - 0,03).(910,59 - 887.07)}{(1078.71 - 887.07)} + 0,03 = 0,031$$

$A_{st} = 3,1\%.Ag = 3,1\%.450.700 = 9836 \text{ mm}^2$

Dipakai tulangan 22D25 = 10799,8 mm^2

$As = 11.409,9 = 5399,9\ mm^2$

$As' = 11.409,9 = 5399,9\ mm^2$

Kontrol kapasitas kolom terhadap keruntuhan tarik

$m = 18,3$

$$\left(1-\frac{e'}{d}\right)=\frac{700-2.842}{2.650}=-0,757 \qquad \text{(dari 3.65w)}$$

$$\left(1-\frac{d'}{d}\right)=\left(1-\frac{50}{650}\right)=0,923$$

dari persamaan (dari 3.65x), didapat:

$$P_n = 0,85.22,5.450.650.\left[-0,757+\sqrt{(-0,757)^2+2.18,3.0,031.(0,923)}\right].10^{-3}$$

$$= 2885,99 \quad KN$$

$$\phi.P_n = 0,65.2885,99 = 1875,89 \quad KN > P_{n,k} = 1081,76 \quad KN$$

d. Perencanaan tulangan geser kolom

$M_{u,ka} = M_{u,kb} = 910,59\ KN$

$V_{D,k} = \quad 80,50\ KN$

$V_{L,k} = \quad 33,06\ KN$

$V_{E,k} = \ 201,14\ KN$

Gaya geser rencana kolom

$$V_{u,k}=\frac{910,59\ +910,59}{(3,85-0,8)}=597,11 \quad KN \qquad \text{(dari 3.66a)}$$

tidak perlu lebih dari

$$V_{u,k} = 1,05.(80,50+33,06+4/1.201,14) = 963,55 \quad KN \qquad \text{(dari 3.66b)}$$

Tulangan geser didaerah ujung kolom ($V_c = 0$)

$V_s = 597,11/0,6 - 0 = 995,18$ KN

Dipakai sengkang tertutup 4P10, $A_v = 314$ mm^2

$$s \le \frac{314.350.650.10^{-3}}{995,18} = 70 \quad \text{mm} \qquad \text{(dari 3.60k)}$$

$$s \le \frac{1}{4}.450 = 112,5 \quad \text{mm} \qquad \text{(dari 3.66d)}$$

$s \le 8.25 = 200$ mm (dari 3.66e)

$s \le 100$ mm (dari 3.66f)

Tulangan geser didaerah tengah bentang kolom

$$Vc = \left(1 + 1081,76/14.315000\right)\left(1/6.\sqrt{22,5}\right)450.650 10^{-3}$$

$= 232,24$ KN (dari 3.66c)

$Vs = 995,18 - 232,24 = 762,94$ KN

$$s = \frac{314.350.650.10^{-3}}{762,94} = 90 \quad \text{mm}$$

$s \le 100$ mm

Daerah-daerah yang berpotensi mengalami sendi plastis terletak sepanjang l_o dari muka yang ditinjau, dengan nilai l_o tidak boleh kurang dari:

h = 450 mm untuk $N_{u,k} < 0,3.A_g.f_c^{'}$

1,5.h untuk $N_{u,k} > 0,3.A_g.f_c^{'}$

1/6.l = 1/6.3050 = 508 mm

450 mm

4.6.3 Pertemuan balok kolom

$$V_{kol} = \frac{0,7.(12/11,3.1492,96)}{1/2.(3,85+3,85)} = 371,53 \quad KN \qquad \text{(dari 3.67a)}$$

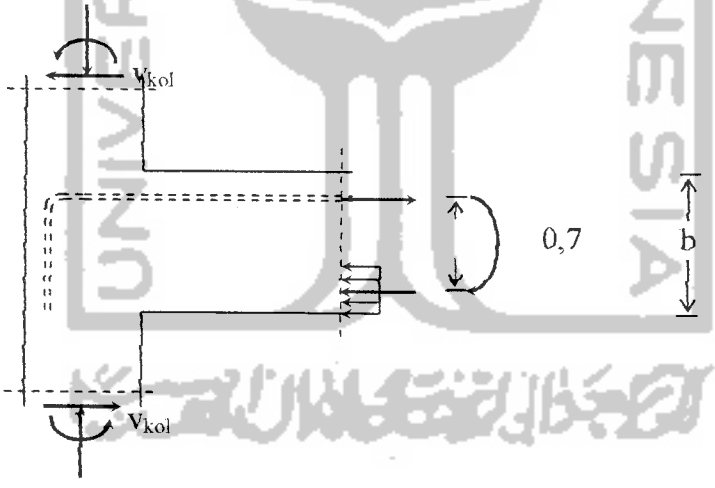
$$T = \frac{0,7.1492,96.10^3}{(650-348/2)} = 2195 \quad KN \qquad \text{(dari 3.67d)}$$

$$V_{j.h} = 2195 - 371,53 = 1423,47 \quad KN \qquad \text{(dari 3.67b)}$$

kontrol tegangan geser horizontal minimal

$$V_{j.h} = \frac{V_{j.h}}{b_j.h_c} = \frac{1423,47.10^3}{800.700} = 4,07 \quad MPa \qquad \text{(dari 3.67e)}$$

$$1,5.\sqrt{f_c'} = 1,5.\sqrt{22,5} = 7,12 \quad MPa > V_{j.h} = 4,07 \quad MPa \qquad \text{(dari 3.67f)}$$



Gambar 4.11 Join balok kolom

Penulangan geser horizontal (dari 3.67g)

$N_{u.k} = 1081,76$ KN

$$\frac{N_{uk}}{A_g} = \frac{1081,76 \ .10^3}{450.700} = 3,59 \quad MPa > 0,1.f_c' = 0,1.22,5 = 2,25 \quad MPa$$

maka sumbangan gaya geser beton horizonal adalah:

$$V_{c,h} = 2/3.\sqrt{\{(1130,95.10^3/450.700) - 0,1.22,5\}}.800.700.10^{-3}$$

$$= 563,25 \quad KN$$

sehingga:

$$V_{s,h} = 1423,47 - 563,25 = 860,22 \text{ KN} \qquad \text{(dari 3.67j)}$$

Luas tulangan geser horizontal

$$A_{j,h} = \frac{V_{s,h}}{fy} = \frac{860,22.10^3}{350} = 2457,77 \quad mm^2 \qquad \text{(dari 3.67l)}$$

luasan tersedia 2 sengkang tertutup P10 ($2A_v$) = 2.157 = 314 mm^2

jumlah lapis sengkang = 2457,77 /314 = 7,8 ≈ 8 lapis

Luas tulangan geser vertikal

$$A_s' = A_s$$

$$V_{c,v} = 6148,5.1423,47/6558,4.(0,6 + 1425,75/315.22,5)$$

$$= 1069,16 \quad KN \qquad \text{(dari 3.67o)}$$

$$V_{s,v} = 1423,47 - 1069,16 = 354.31 \quad KN \qquad \text{(dari 3.67n)}$$

$$A_{j,v} = \frac{354,3110^3}{350} = 1012,33 \quad mm^2 \qquad \text{(dari 3.67m)}$$

luasan tersedia 2 sengkang tertutup P10 ($2A_v$) = 2.157 = 314 mm^2

jumlah lapis sengkang = 1012,33/314 = 3,2 ≈ 4 lapis

Keperluan tulangan geser diatas sebenarnya sudah dapat ditahan oleh tulangan lentur balok maupun tulangan kolom terpasang.

Tabel 4.10.a Momen Rencana Balok Portal As 9-10 (K=1)

Elm	Jarak (m)	MD (KNm)	ML (KNm)	M.GEMPA (KNm)		1.2MD + 1.6ML (KNm)	0.9(MD ± ME) (KNm)		1.05(MD+0.6ML ± ME) (KNm)		KET
				KIRI	KANAN		KIRI	KANAN	KIRI	KANAN	
14	0	-319.34	-104.77	577.40	-577.94	-550.83	232.25	-614.43	204.95	-782.85	
	1.5	-87.16	-23.34	432.98	-433.52	-141.93	311.24	-411.17	348.41	-494.40	blk. lt.1
	3	108.57	46.85	288.57	-289.10	205.24	357.42	-218.03	**446.51**	-224.85	
15	0	108.57	46.85	288.57	-289.10	205.24	357.42	-218.03	446.51	-224.85	
	1.5	188.74	72.00	144.15	-144.69	341.68	299.60	-65.42	394.89	-30.96	blk. lt.1
	3	232.46	85.90	-0.27	-0.27	416.38	208.97	77.07	297.92	144.03	
16	0	232.46	85.90	-0.27	-0.27	416.38	208.97	77.07	297.92	144.03	
	1.5	160.61	54.77	-144.69	144.15	280.36	14.33	179.03	51.23	243.37	blk. lt.1
	3	52.32	12.39	-289.10	288.57	82.6	-213.10	270.86	-240.81	323.81	
17	0	52.32	12.39	-289.10	288.57	82.6	-213.10	270.86	-240.81	323.81	
	1.5	-171.53	-75.03	-433.52	432.98	-325.88	-544.54	322.16	-682.57	328.58	blk. lt.1
	3	-431.83	-173.69	-577.94	577.40	-796.09	-908.79	**363.33**	**-1169.68**	314.47	
18	0	-163.25	-100.00	0	0	-355.9	-146.93	-90.00	-234.41	-168.00	
	1.25	-70.06	-46.09	0	0	-157.83	-63.05	-41.48	-102.60	-77.43	blk. lt.1
	2.5	0	0	0	0	0	0	0	0	0	
19	0	-306.40	-96.54	677.01	-673.43	-522.14	333.54	-692.97	328.32	-869.28	
	1.5	-78.57	-17.77	508.20	-504.62	-122.72	386.67	-470.15	439.92	-559.70	blk. lt.2
	3	112.81	49.74	339.40	-335.82	214.96	406.98	-257.47	506.15	-269.04	
20	0	112.81	49.74	339.40	-335.82	214.96	406.98	-257.47	**506.15**	-269.04	
	1.5	188.63	72.23	170.60	-167.02	341.92	323.30	-85.31	422.69	-54.02	blk. lt.2
	3	228.00	83.46	1.79	1.79	407.14	206.81	76.73	293.86	142.09	
21	0	228.00	83.46	1.79	1.79	407.14	206.81	76.73	293.86	142.09	
	1.5	151.81	49.67	-167.02	170.60	261.64	-13.68	198.24	15.33	262.57	blk. lt.2
	3	39.17	4.63	-335.82	339.40	54.4	-266.98	309.62	-308.56	364.14	

Lanjutan Tabel 4.10.a Momen Rencana Balok Portal As 9-10 (K=1)

ELM	Jarak (m)	MD (KNm)	ML (KNm)	M.GEMPA (KNm)		1.2MD + 1.6ML (KNm)	0.9(MD ± ME) (KNm)		1.05(MD+0.6ML ± ME) (KNm)		KET
				KIRI	KANAN		KIRI	KANAN	KIRI	KANAN	
22	0	39.17	4.63	-335.82	339.40	54.4	-266.98	309.62	-308.56	364.14	blk. lt.2
	1.5	-189.03	-85.45	-504.62	508.20	-363.55	-624.29	380.48	-782.17	390.05	
	3	-453.68	-186.77	-673.43	677.01	-843.26	-1014.39	333.54	**-1196.13**	**397.08**	
23	0	-163.25	-100.00	0	0	-355.9	-146.93	-90.00	-234.41	-168.00	blk. lt.2
	1.25	-70.06	-46.09	0	0	-157.83	-63.05	-41.48	-102.60	-77.43	
	2.5	0	0	0	0	0	0	0	0	0.00	
24	0	-297.45	-87.02	600.28	-616.57	-496.17	272.55	-633.23	263.15	-793.59	blk. lt.3
	1.5	-70.95	-9.07	448.18	-464.46	-99.66	339.50	-426.18	390.37	-502.92	
	3	119.09	57.63	296.07	-312.36	235.11	373.64	-229.25	472.22	-231.15	
25	0	119.09	57.63	296.07	-312.36	235.11	373.64	-229.25	**472.22**	-231.15	blk. lt.3
	1.5	193.58	79.29	143.97	-160.25	359.16	303.79	-72.86	404.37	-35.06	
	3	231.61	89.71	-8.14	-8.14	421.47	201.12	73.41	291.16	142.17	
26	0	231.61	89.71	-8.14	-8.14	421.47	201.12	73.41	291.16	142.17	blk. lt.3
	1.5	154.09	55.10	-160.25	143.97	273.06	-5.54	179.16	28.25	243.73	
	3	40.11	9.24	-312.36	296.07	62.92	-245.02	274.78	-280.04	326.40	
27	0	40.11	9.24	-312.36	296.07	62.92	-245.02	274.78	-280.04	326.40	blk. lt.3
	1.5	-189.42	-81.65	-464.46	448.18	-357.96	-588.49	329.87	-738.01	333.41	
	3	-455.41	-183.80	-616.57	600.28	-840.57	-964.78	**324.83**	**-1141.37**	321.51	
28	0	-163.25	-100.00	0	0	-355.9	-146.93	-90.00	-234.41	-168.00	blk. lt.3
	1.25	-70.06	-46.09	0	0	-157.83	-63.05	-41.48	-102.60	-77.43	
	2.5	0	0	0	0	0	0	0	0	0.00	
29	0	-307.41	-111.97	585.88	-514.62	-548.04	250.62	-563.93	221.85	-728.46	blk. lt.4
	1.5	-81.29	-34.25	448.32	-377.06	-152.35	330.32	-370.18	363.80	-453.45	
	3	108.38	32.21	310.76	-239.50	181.6	377.22	-186.56	460.38	-197.36	
30	0	108.38	32.21	310.76	-239.50	181.6	377.22	-186.56	**460.38**	-197.36	blk. lt.4
	1.5	182.49	53.65	173.19	-101.94	304.83	320.11	-43.46	407.26	-16.90	
	3	220.15	63.84	35.63	35.63	366.31	230.20	89.52	308.79	144.66	

Lanjutan Tabel 4.10.a Momen Rencana Balok Portal As 9-10 (K=1)

ELM	Jarak (m)	MD (KNm)	ML (KNm)	M.GEMPA (KNm)		1.2MD+1.6ML (KNm)	0.9(MD+ME) (KNm)		1.05(MD+0.6ML+ME) (KNm)		KET
				KIRI	KANAN		KIRI	KANAN	KIRI	KANAN	
31	0	220.15	63.84	-35.63	35.63	366.31	166.07	89.52	233.97	144.66	blk. lt.4
	1.5	142.24	29.00	-101.94	173.19	217.08	36.27	181.97	60.59	230.57	
	3	27.89	-17.10	-239.50	310.76	6.11	-190.44	264.29	-232.96	297.56	
32	0	27.89	-17.10	-239.50	310.76	6.11	-190.44	264.29	-232.96	297.56	blk. lt.4
	1.5	-202.02	-108.22	-377.06	448.32	-415.58	-521.17	306.09	-676.21	288.92	
	3	-468.39	-210.59	-514.62	585.88	-899.01	-884.71	**337.76**	**-1164.83**	261.38	
33	0	-163.25	-100.00	0	0	-355.9	-146.93	-90.00	-234.41	-168.00	blk. lt.4
	1.25	-70.06	-46.09	0	0	-157.83	-63.05	-41.48	-102.60	-77.43	
	2.5	0	0	0	0	0	0	0	0	0	
34	0	0	0	0	0	0	0	0	0	0	blk. atap
	1.75	-86.94	-91.88	0	0	-251.33	-78.25	-82.69	-149.17	-154.36	
	3.5	-217.98	-202.13	0	0	**-584.98**	-196.18	-181.92	-356.22	-339.58	
35	0	-217.98	-202.13	0	0	-584.98	-196.18	-181.92	-356.22	-339.58	blk. atap
	1.75	-86.94	-91.88	0	0	-251.33	-78.25	-82.69	-149.17	-154.36	
	3.5	0	0	0	0	0	0	0	0	0	

Tabel 4.10.b Gaya Geser Rencana Balok Portal As.9 dan As.10 (K=1)

Elm	Jarak (m)	$V_{D,B}$ (KN)	$V_{L,B}$ (KN)	$V_{E,B}$ (KN)	$V_{G,B}$ (KN)	$M_{KAP,B}$	$M'_{KAP,B}$	V_{UB}= 0,7($M_{KAP,B}$ + $M'_{KAP,B}$)/Ln+1,05$V_{G,B}$ (KN)	$V_{ub\ terpakai}$ (KN)	V_{UB}=1,05($V_{D,B}$ + $V_{L,B}$+4. $V_{E,B}$) (KN)	KETERANGAN
14	0	166.94	58.04	96.28	224.97	1492.96	754.44	387.26	369.28	640.59	BALOK LT.1
	1.5	142.64	50.54	96.28	193.17	1492.96	754.44	352.20	334.32	607.20	
	3	118.34	43.04	96.28	161.37	1492.96	754.44	317.14	299.37	573.81	
15	0	65.60	20.52	96.28	86.112	1492.96	754.44	234.17	216.64	494.79	BALOK LT.1
	1.5	41.30	13.02	96.28	54.312	1492.96	754.44	199.11	181.68	461.40	
	3	17.00	5.52	96.28	22.512	1492.96	754.44	164.05	146.73	428.01	
16	0	35.75	17.00	96.28	52.748	1492.96	754.44	197.38	179.96	459.75	BALOK LT.1
	1.5	60.05	24.50	96.28	84.548	1492.96	754.44	232.44	214.91	493.14	
	3	84.35	32.00	96.28	116.35	1492.96	754.44	267.50	249.87	526.53	
17	0	137.09	54.52	96.28	191.61	1492.96	754.44	350.47	332.60	605.56	BALOK LT.1
	1.5	161.39	62.02	96.28	223.41	1492.96	754.44	385.53	367.55	638.95	
	3	185.69	69.52	96.28	255.21	1492.96	754.44	420.59	**402.51**	672.34	
18	0	83.80	46.25	0	130.05	1492.96	754.44	282.60	264.93	136.55	BALOK LT.1
	1.25	65.30	40.00	0	105.3	1492.96	754.44	255.31	237.72	110.57	
	2.5	46.80	33.75	0	80.55	1492.96	754.44	228.03	210.52	84.58	
19	0	164.04	56.26	112.54	220.3	1492.96	754.44	382.10	364.14	703.96	BALOK LT.2
	1.5	139.74	48.76	112.54	212.8	1492.96	754.44	347.04	329.18	696.08	
	3	115.44	41.26	112.54	181	1492.96	754.44	311.98	294.22	662.69	
20	0	62.70	18.74	112.54	134.18	1492.96	754.44	229.01	211.49	613.53	BALOK LT.2
	1.5	38.40	11.24	112.54	73.936	1492.96	754.44	193.95	176.54	550.28	
	3	14.10	3.74	112.54	42.136	1492.96	754.44	158.89	141.58	516.89	
21	0	38.64	18.78	112.54	32.876	1492.96	754.44	202.53	185.09	507.17	BALOK LT.2
	1.5	62.94	26.28	112.54	64.924	1492.96	754.44	237.58	220.05	540.82	
	3	87.24	33.78	112.54	96.724	1492.96	754.44	272.64	255.00	574.21	
22	0	139.98	56.30	112.54	143.54	1492.96	754.44	355.62	337.73	623.37	BALOK LT.2
	1.5	164.28	63.80	112.54	203.78	1492.96	754.44	390.68	372.69	686.62	
	3	188.58	71.30	112.54	235.58	1492.96	754.44	425.74	**407.64**	720.01	
23	0	83.80	46.25	0	234.83	1492.96	754.44	282.60	264.93	246.58	BALOK LT.2
	1.25	65.30	40.00	0	123.8	1492.96	754.44	255.31	237.72	129.99	
	2.5	46.80	33.75	0	99.05	1492.96	754.44	228.03	210.52	104.00	
24	0	163.15	55.72	101.40	102.52	1492.96	754.44	380.52	362.56	533.54	BALOK LT.3
	1.5	138.85	48.22	101.40	211.36	1492.96	754.44	345.46	327.61	647.83	
	3	114.55	40.72	101.40	179.56	1492.96	754.44	310.40	292.65	614.44	
25	0	61.81	18.20	101.40	132.74	1492.96	754.44	387.26	**369.28**	565.27	BALOK LT.3
	1.5	37.51	10.70	101.40	72.501	1492.96	754.44	352.20	334.32	502.02	
	3	13.21	3.20	101.40	40.701	1492.96	754.44	317.14	299.37	468.63	
26	0	39.53	19.33	101.40	32.531	1492.96	754.44	234.17	216.64	460.05	BALOK LT.3
	1.5	63.83	26.83	101.40	66.359	1492.96	754.44	199.11	181.68	495.57	
	3	88.13	34.33	101.40	98.159	1492.96	754.44	164.05	146.73	528.96	

Lanjutan Tabel 4.10.b Gaya Geser Rencana Balok Portal As.9 dan As.10 (K=1)

Elm	Jarak (m)	$V_{D,B}$ (KN)	$V_{L,B}$ (KN)	$V_{E,B}$ (KN)	$V_{G,B}$ (KN)	$M_{KAP,B}$	$M'_{KAP,B}$	V_{UB}= 0,7($M_{KAP,B}$ + $M'_{KAP,B}$)/Ln+1,05.$V_{G,B}$ (KN)	$V_{ub\ terpakai}$ (KN)	$V_{L,B}$=1,05($V_{D,B}$ + $V_{L,B}$+4. $V_{E,B}$) (KN)	KETERANGAN
27	0	140.87	56.85	101.40	144.98	1492.96	754.44	227.43	209.92	578.12	BALOK LT.3
	1.5	165.17	64.35	101.40	205.22	1492.96	754.44	192.37	174.97	641.38	
	3	189.47	71.85	101.40	237.02	1492.96	754.44	157.31	140.01	674.77	
28	0	83.80	46.25	0	235.72	1492.96	754.44	204.11	186.67	247.51	BALOK LT.3
	1.25	65.30	40.00	0	123.8	1492.96	754.44	239.17	221.63	129.99	
	2.5	46.80	33.75	0	99.05	1492.96	754.44	274.23	256.58	104.00	
29	0	162.90	55.56	91.71	102.36	1492.96	754.44	357.21	339.31	492.65	BALOK LT.4
	1.5	138.60	48.06	91.71	210.96	1492.96	754.44	392.27	374.27	606.68	
	3	114.30	40.56	91.71	179.16	1492.96	754.44	427.32	409.23	573 29	
30	0	61.56	18.04	91.71	132.34	1492.96	754.44	282.60	264.93	524 13	BALOK LT.4
	1.5	37.26	10.54	91.71	72.096	1492.96	754.44	255.31	237.72	460 87	
	3	12.96	3.04	91.71	40.296	1492.96	754.44	228.03	210.52	427 48	
31	0	39.79	19.48	91.71	32.434	1492.96	754.44	380.07	362.11	419 23	BALOK LT.4
	1.5	64.09	26.98	91.71	66.764	1492.96	754.44	345.01	327.16	455 28	
	3	88.39	34.48	91.71	98.564	1492.96	754.44	309.95	292.20	488.67	
32	0	141.13	57.00	91.71	145.38	1492.96	754.44	226.98	209.47	537.83	BALOK LT.4
	1.5	165.43	64.50	91.71	198.12	1492.96	754.44	191.92	174.52	593.20	
	3	189.73	72.00	91.71	229.92	1492.96	754.44	156.86	139.56	626.59	
33	0	83.80	46.25	0	261.72	1492.96	754.44	204.56	187.12	274.81	BALOK LT.4
	1.25	65.30	40.00	0	130.05	1492.96	754.44	239.62	222.08	136.55	
	2.5	46.80	33.75	0	105.3	1492.96	754.44	274.68	257.04	110.57	
34	0	37.08	47.25	0	0	0	0	357.66	339.77	84.58	BALOK ATAP
	1.75	62.28	57.75	0	0	0	0	392.72	374.72	88.55	
	3.5	87.48	68.25	0	0	0	0	427.78	409.68	126.03	
35	0	87.48	68.25	0	0	0	0	282.60	264.93	163.52	BALOK ATAP
	1.75	62.28	57.75	0	0	0	0	255.31	237.72	163.52	
	3.5	37.08	47.25	0	0	0	0	228.03	210.52	126.03	

Keterangan:

$$V_{u,b.terpakai} = \left[1{,}05.V_G - 0{,}7\left(\frac{M_{kap,b} + M'_{Kap,b}}{l_n}\right)\right] + \frac{ln - d}{ln}\left[V_{u,b} - \left[1{,}05.V_G - 0{,}7\left(\frac{M_{kap,b} + M'_{Kap,b}}{l_n}\right)\right]\right]$$

Tabel 4.10.c Momen Rencana Kolom Portal As.9 dan As.10 (K=1)

Elm	Jarak (m)	$M_{D,k}$ (KNm)	$M_{L,k}$ (KNm)	M_{Eki} (KNm)	M_{Eka} (KNm)	$M_{KAP,b\ kiri}$ (KNm)	$M_{KAP,b\ kanan}$ (KNm)	$M_{U,k} = \frac{h}{h_n}(0,7.\phi_d.0,5.(\frac{l}{l_n}M_{kap,b})$ (KNm)	$M_{U,k}$= $1.05(M_{D,k}+M_{L,k} \pm 4/1\ M_{E,k})$ (kiri) (KNm)	$M_{U,k}$= $1.05(M_{D,k}+M_{L,k} \pm 4/1.M_{E,k})$ (kanan) (KNm)	KETERANGAN
1	0	24.65	-3.37	-840.60	837.56	0	1492.96	910.59	-3508.18	3540.10	KOL BASEMEN
	1.925	-69.35	-32.87	-375.77	376.81	0	1492.96	910.59	-1685.57	1475.27	
	3.85	-163.35	-62.37	89.06	-83.94	0	1492.96	910.59	137.05	-589.55	
2	0	-98.92	-42.08	-837.56	840.60	1492.96	0	910.59	-3665.80	3382.47	KOL BASEMEN
	1.925	-4.92	-12.58	-376.81	375.77	1492.96	0	910.59	-1600.98	1559.86	
	3.85	89.07	16.92	83.94	-89.06	1492.96	0	910.59	463.84	-262.76	
3	0	155.99	42.40	-488.34	493.99	0	1492.96	910.59	-1842.72	2283.07	KOLOM LT.1
	1.925	-3.11	-2.46	-68.20	60.22	0	1492.96	910.59	-292.29	247.08	
	3.85	-162.21	-47.33	351.93	-373.56	0	1492.96	910.59	1258.09	-1788.97	
4	0	-179.51	-56.77	-493.99	488.34	1492.96	0	910.59	-2322.85	1802.93	KOLOM LT.1
	1.925	-20.41	-11.90	-60.22	68.20	1492.96	0	910.59	-286.85	252.51	
	3.85	138.69	32.96	373.56	-351.93	1492.96	0	910.59	1749.18	-1297.87	
5	0	144.18	49.21	-325.07	299.86	0	1492.96	910.59	-1162.23	1462.47	KOLOM LT.2
	1.925	-10.79	-14.43	62.11	-23.55	0	1492.96	910.59	234.38	-125.39	
	3.85	-165.76	-78.08	449.30	-346.96	0	1492.96	910.59	1631.03	-1713.26	
6	0	-151.74	-53.82	-299.86	325.07	1492.96	0	910.59	-1475.25	1149.46	KOLOM LT.2
	1.925	3.23	9.83	23.55	-62.11	1492.96	0	910.59	112.62	-247.15	
	3.85	158.20	73.48	346.96	-449.30	1492.96	0	910.59	1700.50	-1643.80	
7	0	131.69	8.94	-150.98	269.61	0	1492.96	910.59	-486.45	1280.02	KOLOM LT.3
	1.925	21.13	49.55	-47.46	-122.51	0	1492.96	910.59	-125.12	-440.33	
	3.85	-89.43	90.16	56.06	-514.62	0	1492.96	910.59	236.22	-2160.64	
8	0	-133.96	-10.32	-269.61	150.98	1492.96	0	910.59	-1283.86	482.62	KOLOM LT.3
	1.925	-23.40	-50.92	122.51	47.46	1492.96	0	910.59	436.51	121.30	
	3.85	87.16	-91.53	514.62	-56.06	1492.96	0	910.59	2156.82	-240.04	
9	0	217.98	202.13	-529.82	0.00	0	1492.96	910.59	-1784.13	441.12	KOLOM LT.4
	1.34	217.98	202.13	-384.34	0.00	0	1492.96	910.59	-1173.11	441.12	
	2.68	217.98	202.13	-238.85	0.00	0	1492.96	910.59	-562.05	441.12	
10	0	-217.98	-202.13	0	529.82	1492.96	0	910.59	-441.11	1996.37	KOLOM LT.4
	1.34	-217.98	-202.13	0	384.34	1492.96	0	910.59	-441.12	1784.13	
	2.68	-217.98	-202.13	0	238.85	1492.96	0	910.59	-441.12	1173.11	
11	0	0	0	-238.85	0	0	0	0	-1003.17	0	KOLOM LT.4
	1.1	0	0	-119.43	0	0	0	0	-501.61	0	
	2.2	0	0	0	0	0	0	0	0	0	
12	0	0	0	0	238.85	0	0	0	0	1003.17	KOLOM LT.4
	1.1	0	0	0	119.43	0	0	0	0	501.61	
	2.2	0	0	0	0	0	0	0	0	0	

Tabel 4.10.d Gaya Geser Rencana Kolom As.9 dan As.10 (K=1)

Elm	Jarak (m)	$V_{D,k}$ (KN)	$V_{L,k}$ (KN)	$V_{E,k}$ (KN)	$M_{U,k}$ atas (KN)	$M_{U,k}$ bawah (KN)	$Vu,k = (M_{U,k}a + M_{U,k}b)/h'_k$ (KN)	$V_{U,max} = 1{,}05(V_{D,k} + V_{L,k} + 4.V_{E,k})$ (KN)	KETERANGAN
1	0	48.83	15.32	241.47	910.59	910.59	597.11	946.81	KOL.BASEMEN
	1.925	48.83	15.32	241.47	910.59	910.59	597.11	946.81	
	3.85	48.83	15.32	241.47	910.59	910.59	597.11	946.81	
2	0	48.83	15.32	239.35	910.59	910.59	597.11	1072.63	KOL.BASEMEN
	1.925	48.83	15.32	239.35	910.59	910.59	597.11	1072.63	
	3.85	48.83	15.32	239.35	910.59	910.59	597.11	1072.63	
3	0	82.65	23.31	218.25	910.59	910.59	597.11	805.40	KOLOM LT.1
	1.925	82.65	23.31	218.25	910.59	910.59	597.11	805.40	
	3.85	82.65	23.31	218.25	910.59	910.59	597.11	805.40	
4	0	82.65	23.31	225.34	910.59	910.59	597.11	1057.68	KOLOM LT.1
	1.925	82.65	23.31	225.34	910.59	910.59	597.11	1057.68	
	3.85	82.65	23.31	225.34	910.59	910.59	597.11	1057.68	
5	0	80.50	33.06	201.14	910.59	910.59	597.11	725.53	KOLOM LT.2
	1.925	80.50	33.06	201.14	910.59	910.59	597.11	725.53	
	3.85	80.50	33.06	201.14	910.59	910.59	597.11	725.53	
6	0	80.50	33.06	168.00	910.59	910.59	597.11	824.86	KOLOM LT.2
	1.925	80.50	33.06	168.00	910.59	910.59	597.11	824.86	
	3.85	80.50	33.06	168.00	910.59	910.59	597.11	824.86	
7	0	57.43	21.10	53.78	910.59	910.59	597.11	308.33	KOLOM LT.3
	1.925	57.43	21.10	53.78	910.59	910.59	597.11	308.33	
	3.85	57.43	21.10	53.78	910.59	910.59	597.11	308.33	
8	0	57.43	21.10	203.70	910.59	910.59	597.11	893.67	KOLOM LT.3
	1.925	57.43	21.10	203.70	910.59	910.59	597.11	893.67	
	3.85	57.43	21.10	203.70	910.59	910.59	597.11	893.67	
9	0	0	0	108.57	910.59	910.59	597.11	455.99	KOLOM LT.4
	1.34	0	0	108.57	910.59	910.59	597.11	455.99	
	2.68	0	0	108.57	910.59	910.59	597.11	455.99	
10	0	0	0	108.57	910.59	910.59	597.11	455.99	KOLOM LT.4
	1.34	0	0	108.57	910.59	910.59	597.11	455.99	
	2.68	0	0	108.57	910.59	910.59	597.11	455.99	
11	0	0	0	108.57	910.59	910.59	597.11	455.99	KOLOM LT.4
	1.1	0	0	108.57	910.59	910.59	597.11	455.99	
	2.2	0	0	108.57	910.59	910.59	597.11	455.99	
12	0	0	0	108.57	910.59	910.59	597.11	455.99	KOLOM LT.4
	1.1	0	0	108.57	910.59	910.59	597.11	455.99	
	2.2	0	0	108.57	910.59	910.59	597.11	455.99	

4.7 Perencanaan Penulangan Portal As.9-10 Daktilitas Terbatas (K=2)

4.7.1 Penulangan Lentur dan Geser Balok

Dari tabel momen rencana balok didapat:

$M^{-}_{tumpuan} = 1808,22$ KNm

$M^{+}_{tumpuan} = 939,17$ KNm

$M_{lapangan} = 862,52$ KNm

a. Pemeriksaan rasio tulangan apakah boleh dilakukan redistribusi momen

$\rho_b = 0,029$

$R_n = 8,0$

$\rho = 0,032$, dipakai $\rho_{maks} = 0,022$

$R_n = 4,17$

$\rho' = 0,013$

$0,022-0,013 = 0.009 \quad < \quad 0,5.0,029 = 0,0145$

maka redistribusi momen negatif tidak boleh dilakukan

- faktor redistribusi maksimum

$$30.\left(1-\frac{4\ 0,009}{3\ 0,029}\right)\% = 12\ \% \qquad \text{(dari 3.3)}$$

- Redistribusi momen negatif pada pertemuan kolom tepi, ($\partial = 15\%$)

$\partial M = 1808,22.12\% = 180,82$ KNm

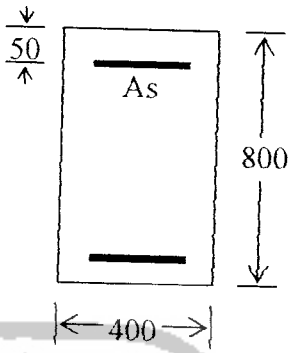
- Momen balok rencana terredistribusi

$M^{-}_{tump} = 1808,22 - 180,82 = 1627,40$ KNm

$M^{+}_{tump} = 939,17 + 180,82 = 1119,39$ KNm

$M_{lap} = 862,52 + 180,82 = 1042,74$ KNm

- Perencanaan tulangan tumpuan negatif



$f_c' = 22,5$ MPa

$f_y = 350$ MPa

d = 800-50 = 750 mm

m = 18,3

$\rho_{min} = 0,004$

$\rho_{perlu} = 0,022$

As = 0,020.400.750 = 6000 mm^2

As'= 0,5. 6000 = 3000 mm^2

- Perencanaan tulangan tumpuan positif

$R_n = 4,9\ 1119,39$

$\rho_{perlu} = 0,016$

As' = 0,016.400.750 = 4946,17 mm^2

Tulangan tumpuan terpasang berdasarkan luasan maksimum

As = 6000 mm^2

Dipakai tulangan 13D25 = 6381,7 mm^2

As'= 4946,17 mm^2

Dipakai tulangan 11D25 = 5399,9 mm^2

- Perencanaan tulangan lapangan

Rn = 4,63

$\rho_{perlu} = 0,015$

As = 0,015.400.750 = 4624,6 mm^2

Dipakai tulangan 10D25 = 4909 mm^2

b. Tulangan geser balok

V_D = 165.17KN

V_L = 64.35KN

V_E = 112,54 KN

V_g = 188,58 + 71,30 = 259,88 KN

l_n = 12-0,70 =11,3 m

$$V_{u.b} = 1{,}05.\left(165{,}17 + 72.0{,}0 + \frac{4{,}0}{2}.91{,}71\right) = 487{,}33 \quad KN$$

$$V_{u.b\ terpakai} = \frac{6-0{,}7}{6}.487{,}33 = 401{,}9 \quad KN$$

- Pada daerah sepanjang d = 700 mm

$$V_c = .1/6.\sqrt{22{,}5}.400.750.10^{-3} = 237{,}17 \quad KN$$

$½.V_c$ = 118,5 KN

Vs = 401,9 /0,6 – 118,5 = 551,3 KN

Dipakai sengkang 3D10 = 235,5 mm^2

$$s = \frac{235{,}5.350.750.10^{-3}}{551{,}3} = 110 \quad mm$$

$$s \le \frac{750}{4} = 187{,}5 \quad mm$$

- Diluar daerah d

V_s = 401,9/0,6 – 237,17 = 432,66 KN

$$s \le \frac{235{,}5.350.750.10^{-3}}{432{,}66} = 140 \quad mm$$

$$s \le \frac{750}{2} = 187{,}5 \quad mm$$

4.7.2 Penulangan kolom akibat beban lentur dan aksial

a. Momen rencana kolom

$$M_{u,k} = 1{,}05.(163{,}35 + 0{,}3.9{,}73 + 62{,}37 + 0{,}3.4{,}01 + 1{,}3.(83{,}94 + 0{,}3.357))$$

$$= 1291{,}32 \quad \text{KNm}$$

b. Gaya aksial rencana kolom

$$N_{u,k} = 1{,}05.(662{,}88 + 0{,}3.314{,}25 + 318{,}05 + 0{,}3.149{,}66 + 1{,}3.(1239{,}75 + 0{,}3.619{,}87))$$

$$= 2592{,}6 \quad \text{KN}$$

$$e = \frac{1291{,}32}{2592{,}6}.10^{-3} = 498 \quad \text{mm} > e_b = 286 \text{ mm} \quad \text{(patah tarik)}$$

Rasio tulangan menurut diagram interaksi kolom, dilakukan interpolasi:

$\rho = 0{,}04$

$A_{st} = 4\%.450.700 = 12600 \text{ mm}^2$

Dipakai tulangan 26D25 = 12763,4 mm^2

As = 13.409,9 = 6381,7 mm^2

As' = 13.409,9 = 6381,7 mm^2

Kontrol kapasitas kolom terhadap keruntuhan tarik

$$P_n = 0{,}85.22{,}5.450.650.\left[-0{,}227 + \sqrt{(-0{,}227)^2 + 2.18{,}3.0{,}04.(0{,}923)}\right].10^{-3}$$

$$= 5355{,}74 \quad \text{KN}$$

$$\phi.P_n = 0{,}65.5355{,}74 = 3481{,}2 \quad \text{KN} > P_{n,k} = 2592{,}6 \quad \text{KN}$$

c. Perencanaan tulangan geser kolom

$$V_{u,k} = 1{,}05.(82.65 + 23.31 + 1{,}3.225.34) = 418.85 \quad \text{KN} \qquad \text{(dari 3.66b)}$$

$$Vc = \left(1 + 2592{,}6 / 14.315000\right)\left(1/6.\sqrt{22{,}5}\right)450.650\,10^{-3} \qquad \text{(dari 3.66c)}$$

$$= 367{,}18 \quad KN$$

$$1/2.V_c = 183{,}59 \text{ KN}$$

Tulangan geser didaerah ujung kolom

$$V_s = 418{,}85/0{,}6 - 183{,}59 = 514{,}49 \text{ KN}$$

Dipakai sengkang tertutup 4P10, $A_v = 314 \text{ mm}^2$

$$s \le \frac{314.350.650.10^{-3}}{514{,}49} = 120 \quad \text{mm} \qquad \text{(dari 3.60k)}$$

$$s \le \frac{1}{4}.450 = 112{,}5 \quad \text{mm} \qquad \text{(dari 3.66d)}$$

$$s \le 8.25 = 200 \text{ mm} \qquad \text{(dari 3.66e)}$$

$$s \le 100 \text{ mm (menentukan)} \qquad \text{(dari 3.66f)}$$

Tulangan geser didaerah tengah bentang kolom

$$V_s = 418{,}85/0{,}6 - 367{,}18 = 330{,}9 \text{ KN}$$

$$s = \frac{314.350.650.10^{-3}}{330{,}9} = 210 \quad \text{mm}$$

$$s \le 200 \text{ mm (menentukan)}$$

Tabel 4.11.a Momen Rencana Balok Portal As 9-10 (K=2)

ELM	Jarak (m)	MD (KNm)	ML (KNm)	M.GEMPA (KNm)		1.2MD + 1.6ML (KNm)	0.9(MD ± ME) (KNm)		1.05(MD+0.6ML ± ME) (KNm)		KET
				KIRI	KANAN		KIRI	KANAN	KIRI	KANAN	
14	0	-319.34	-104.77	1154.79	-1155.87	-550.83	751.91	-1327.68	**811.23**	-1614.96	blk. lt.1
	1.5	-87.16	-23.34	865.96	-867.03	-141.93	700.92	-858.77	803.04	-1016.60	
	3	108.57	46.85	577.13	-578.20	205.24	617.13	-422.67	749.50	-463.60	
15	0	108.57	46.85	577.13	-578.20	205.24	617.13	-422.67	749.50	-463.60	blk. lt.1
	1.5	188.74	72.00	288.30	-289.37	341.68	429.33	-90.57	546.24	-60.31	
	3	232.46	85.90	-0.54	-0.54	416.38	208.73	208.73	297.63	297.63	
16	0	232.46	85.90	-0.54	-0.54	416.38	208.73	208.73	297.63	297.63	blk. lt.1
	1.5	160.61	54.77	-289.37	288.30	280.36	-115.88	404.02	-100.69	505.86	
	3	52.32	12.39	-578.20	577.13	82.60	-473.29	566.51	-544.37	668.73	
17	0	52.32	12.39	-578.20	577.13	82.60	-473.29	566.51	-544.37	668.73	blk. lt.1
	1.5	-171.53	-75.03	-867.03	865.96	-325.88	-934.71	624.99	-1137.76	681.89	
	3	-431.83	-173.69	-1155.87	1154.79	-796.09	-1428.93	650.67	**-1676.50**	649.69	
18	0	-163.25	-100.00	0	0	-355.90	-146.93	-146.93	-234.41	-234.41	blk. lt.1
	1.25	-70.06	-46.09	0	0	-157.83	-63.06	-63.06	-102.61	-102.61	
	2.5	0	0	0	0	0	0	0	0	0	
19	0	-306.40	-96.54	1354.01	-1346.85	-522.14	942.85	-1487.92	**939.17**	-1796.72	blk. lt.2
	1.5	-78.57	-17.77	1016.40	-1009.24	-122.72	844.05	-979.03	973.53	-1153.39	
	3	112.81	49.74	678.79	-671.63	214.96	712.44	-502.94	862.52	-555.42	
20	0	112.81	49.74	678.79	-671.63	214.96	712.44	-502.94	**862.52**	-555.42	blk. lt.2
	1.5	188.63	72.23	341.19	-334.03	341.92	476.84	-130.86	601.81	-107.16	
	3	226.00	83.46	3.58	3.58	407.14	206.42	206.42	295.74	295.74	
21	0	226.00	83.46	3.58	3.58	407.14	206.42	206.42	295.74	295.74	blk. lt.2
	1.5	151.81	49.67	-334.03	341.19	261.64	-164.00	443.70	-160.04	548.94	
	3	39.17	4.63	-671.63	678.79	54.40	-569.22	646.17	-661.17	756.77	
22	0	39.17	4.63	-671.63	678.79	54.40	-569.22	646.17	-661.17	756.77	blk. lt.2
	1.5	-189.03	-85.45	-1009.24	1016.40	-363.55	-1078.44	744.63	-1312.02	814.90	
	3	-453.68	-186.77	-1346.85	1354.01	-843.26	-1620.48	810.29	**-1808.22**	827.67	
23	0	-163.25	-100.00	0	0	-355.90	-146.93	-146.93	-234.41	-234.41	blk. lt.2
	1.25	-70.06	-46.09	0	0	-157.83	-63.06	-63.06	-102.61	-102.61	
	2.5	0	0	0	0	0	0	0	0	0	
24	0	-297.45	-87.02	1200.56	-1233.13	-496.17	812.81	-1377.52	**893.45**	-1661.93	blk. lt.3
	1.5	-70.95	-9.07	896.35	-928.92	-99.66	742.86	-899.88	860.95	-1055.58	
	3	119.09	57.63	592.14	-624.71	235.11	640.11	-455.05	783.10	-494.59	
25	0	119.09	57.63	592.14	-624.71	235.11	640.11	-455.05	783.10	-494.59	blk. lt.3
	1.5	193.58	79.29	287.93	-320.50	359.16	433.36	-114.23	555.54	-83.31	
	3	231.61	89.71	-16.28	-16.28	421.47	193.80	193.80	282.61	282.61	
26	0	231.61	89.71	-16.28	-16.28	421.47	193.80	193.80	282.61	282.61	blk. lt.3
	1.5	154.09	55.10	-320.50	287.93	273.06	-149.77	397.81	-140.02	498.83	
	3	40.11	9.24	-624.71	592.14	62.92	-526.14	569.03	-608.00	669.68	
27	0	40.11	9.24	-624.71	592.14	62.92	-526.14	569.03	-608.00	669.68	blk. lt.3
	1.5	-189.42	-81.65	-928.92	896.35	-357.96	-1006.51	636.23	-1225.70	690.83	
	3	-455.41	-183.80	-1233.13	1200.56	-840.57	-1519.69	670.64	**-1788.76**	666.62	
28	0	-163.25	-100.00	0	0	-355.90	-146.93	-146.93	-234.41	-234.41	blk. lt.3
	1.25	-70.06	-46.09	0	0	-157.83	-63.06	-63.06	-102.61	-102.61	
	2.5	0	0	0	0	0	0	0	0	0	
29	0	-307.41	-111.97	1171.76	-1029.24	-548.04	777.92	-1202.98	**837.03**	-1474.02	blk. lt.4
	1.5	-81.29	-34.25	896.63	-754.12	-152.35	733.61	-751.86	834.53	-898.75	
	3	108.38	32.21	621.51	-478.99	181.60	656.90	-333.55	786.68	-368.85	

Lanjutan Tabel 4.11.a Momen Rencana Balok Portal As 9-10 (K=2)

ELM	Jarak (m)	MD (KNm)	ML (KNm)	M.GEMPA (KNm)		1.2MD+1.6ML (KNm)	0.9(MD+ME) (KNm)		1.05(MD+0.6ML+ME) (KNm)		KET
				KIRI	KANAN		KIRI	KANAN	KIRI	KANAN	
30	0	108.38	32.21	621.51	-478.99	181.60	656.90	-333.55	786.68	-368.85	
	1.5	182.49	53.65	346.38	-203.87	304.83	475.98	-19.24	589.11	11.35	blk. lt.4
	3	220.15	63.84	71.26	71.26	366.31	262.26	262.26	346.19	346.19	
31	0	220.15	63.84	-71.26	71.26	366.31	134.00	262.26	196.55	346.19	
	1.5	142.24	29.00	-203.67	346.38	217.08	-55.46	439.76	-46.44	531.32	blk. lt.4
	3	27.89	-17.10	-478.99	621.51	6.11	-405.99	584.46	-484.43	671.10	
32	0	27.89	-17.10	-478.99	621.51	6.11	-405.99	584.46	-484.43	671.10	
	1.5	-202.02	-108.22	-754.12	896.63	-415.58	-860.52	625.15	-1072.12	661.16	blk. lt.4
	3	-468.39	-210.59	-1029.24	1171.76	-899.01	-1347.66	633.03	-1605.18	605.67	
33	0	-163.25	-100.00	0	0	-355.90	-146.93	-146.93	-234.41	-234.41	
	1.25	-70.06	-46.09	0	0	-157.83	-63.06	-63.06	-102.61	-102.61	blk. lt.4
	2.5	0	0	0	0	0	0	0	0	0	
34	0	0	0	0	0	0	0	0	0	0	
	1.75	-86.94	-91.88	0	0	-251.33	-78.25	-78.25	-149.17	-149.17	blk. atap
	3.5	-217.98	-202.13	0	0	-584.98	-196.18	-196.18	-356.22	-356.22	
35	0	-217.98	-202.13	0	0	-584.98	-196.18	-196.18	-356.22	-356.22	
	1.75	-86.94	-91.88	0	0	-251.33	-78.25	-78.25	-149.17	-149.17	blk. atap
	3.5	0	0	0	0	0	0	0	0	0	

Tabel 4.11.b Gaya Geser Rencana Balok Portal As.9-10 (K=2)

Elm	Jarak (m)	$V_{D.B}$ (KN)	$V_{L.B}$ (KN)	$V_{E.B}$ (KN)	$V_{UB}=1,05(V_{D.B}+V_{L.B}+4/2.V_{E.B})$ (KN)	KET
14	0	166.94	58.04	96.28	405.03	Blk LT.1
	1.5	142.64	50.54	96.28	371.64	
	3	118.34	43.04	96.28	292.61	
15	0	65.60	20.52	96.28	259.22	Blk LT.1
	1.5	41.30	13.02	96.28	225.83	
	3	17.00	5.52	96.28	257.58	
16	0	35.75	17.00	96.28	290.97	Blk LT.1
	1.5	60.05	24.50	96.28	324.36	
	3	84.35	32.00	96.28	403.38	
17	0	137.09	54.52	96.28	436.77	Blk LT.1
	1.5	161.39	62.02	96.28	**470.16**	
	3	185.69	69.52	96.28	136.55	
18	0	83.80	46.25	0	110.57	Blk LT.1
	1.25	65.30	40.00	0	84.58	
	2.5	46.80	33.75	0	467.65	
19	0	164.04	56.26	112.54	434.26	Blk LT.2
	1.5	139.74	48.76	112.54	400.87	
	3	115.44	41.26	112.54	321.85	
20	0	62.70	18.74	112.54	288.46	Blk LT.2
	1.5	38.40	11.24	112.54	255.07	
	3	14.10	3.74	112.54	296.63	
21	0	38.64	18.78	112.54	330.02	Blk LT.2
	1.5	62.94	26.28	112.54	363.41	
	3	87.24	33.78	112.54	442.43	
22	0	139.98	56.30	112.54	**475.82**	Blk LT.2
	1.5	164.28	63.80	112.54	509.21	
	3	188.58	71.30	112.54	136.55	
23	0	83.80	46.25	0	110.57	Blk LT.2
	1.25	65.30	40.00	0	84.58	
	2.5	46.80	33.75	0	442.75	
24	0	163.15	55.72	101.40	409.36	Blk LT.3
	1.5	138.85	48.22	101.40	375.97	
	3	114.55	40.72	101.40	296.95	
25	0	61.81	18.20	101.40	263.56	Blk LT.3
	1.5	37.51	10.70	101.40	230.17	
	3	13.21	3.20	101.40	274.74	
26	0	39.53	19.33	101.40	308.13	Blk LT.3
	1.5	63.83	26.83	101.40	341.52	
	3	88.13	34.33	101.40	420.55	
27	0	140.87	56.85	101.40	453.94	Blk LT.3
	1.5	165.17	64.35	101.40	**487.33**	
	3	189.47	71.85	101.40	136.55	
28	0	83.80	46.25	0	110.57	Blk LT.3
	1.25	65.30	40.00	0	84.58	
	2.5	46.80	33.75	0	405.03	
29	0	162.90	55.56	91.71	421.97	Blk LT.4
	1.5	138.60	48.06	91.71	388.58	
	3	114.30	40.56	91.71	355.19	
30	0	61.56	18.04	91.71	276.17	Blk LT.4
	1.5	37.26	10.54	91.71	242.78	
	3	12.96	3.04	91.71	209.39	
31	0	39.79	19.48	91.71	254.82	Blk LT.4
	1.5	64.09	26.98	91.71	288.21	
	3	88.39	34.48	91.71	321.60	
32	0	141.13	57.00	91.71	400.63	Blk LT.4
	1.5	165.43	64.50	91.71	434.02	
	3	189.73	72.00	91.71	**467.41**	
33	0	83.80	46.25	0	136.55	Blk LT.4
	1.25	65.30	40.00	0	110.57	
	2.5	46.80	33.75	0	84.58	

Tabel 4.11.c Momen Rencana Kolom Portal As.9-10 (K=2)

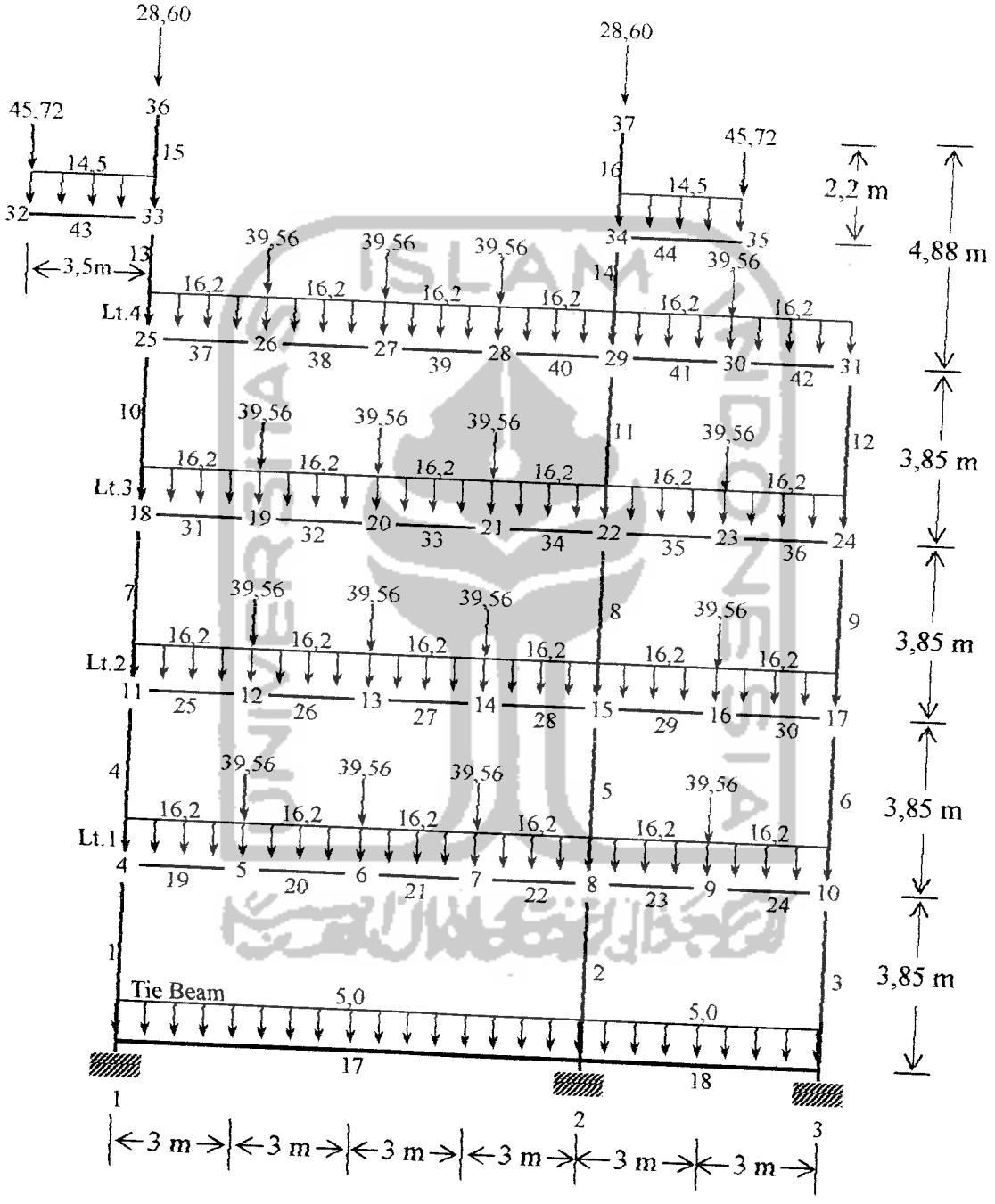
Elm	Jarak (m)	$M_{D,k}$ (KNm)	$M_{L,k}$ (KNm)	M_{Eki} (KNm)	M_{Eka} (KNm)	$M_{U,k}$= $1.05(M_{D,k}+M_{L,k} \pm \omega_d.M_{E,k})$ (KNm)	KETERANGAN
1	0	24.65	-3.37	-840.60	837.56	1165.61	KOL BASEMEN
	1.925	-69.35	-32.87	-375.77	376.81	407.01	
	3.85	-163.35	-62.37	89.06	-83.94	**-1291.32**	
2	0	-98.92	-42.08	-837.56	840.60	999.37	KOL BASEMEN
	1.925	-4.92	-12.58	-376.81	375.77	494.55	
	3.85	89.07	16.92	83.94	-89.06	-458.27	
3	0	155.99	42.40	-488.34	493.99	882.61	KOLOM LT.1
	1.925	-3.11	-2.46	-68.20	60.22	260.37	
	3.85	-162.21	-47.33	351.93	-373.56	-922.39	
4	0	-179.51	-56.77	-493.99	488.34	418.49	KOLOM LT.1
	1.925	-20.41	-11.90	-60.22	68.20	690.14	
	3.85	138.69	32.96	373.56	-351.93	-300.15	
5	0	144.18	49.21	-325.07	299.86	612.37	KOLOM LT.2
	1.925	-10.79	-14.43	62.11	-23.55	357.26	
	3.85	-165.76	-78.08	449.30	-346.96	-729.63	
6	0	-151.74	-53.82	-299.86	325.07	227.88	KOLOM LT.2
	1.925	3.23	9.83	23.55	-62.11	716.86	
	3.85	158.20	73.48	346.96	-449.30	-370.03	
7	0	131.69	8.94	-150.98	269.61	515.68	KOLOM LT.3
	1.925	21.13	49.55	-47.46	-122.51	-93.01	
	3.85	-89.43	90.16	56.06	-514.62	-701.69	
8	0	-133.96	-10.32	-269.61	150.98	89.19	KOLOM LT.3
	1.925	-23.40	-50.92	122.51	47.46	697.87	
	3.85	87.16	-91.53	514.62	-56.06	-282.09	
9	0	217.98	202.13	-529.82	0	441.12	KOLOM LT.4
	1.34	217.98	202.13	-384.34	0	441.12	
	2.68	217.98	202.13	-238.85	0	441.12	
10	0	-217.98	-202.13	0	529.82	282.09	KOLOM LT.4
	1.34	-217.98	-202.13	0	384.34	-441.12	
	2.68	-217.98	-202.13	0	238.85	-326.03	
11	0	0	0	-238.85	0	-163.02	KOLOM LT.4
	1.1	0	0	-119.43	0	0	
	2.2	0	0	0	0	0	
12	0	0	0	0	238.85	326.03	KOLOM LT.4
	1.1	0	0	0	119.43	163.02	
	2.2	0	0	0	0	0	

Tabel 4.11.d Gaya Geser Rencana Kolom As.9-10 (K=2)

Elm	Jarak (m)	$V_{D,k}$ (KN)	$V_{L,k}$ (KN)	$V_{E,k}$ (KN)	$VU,k = 1,05(V_{D,k} + V_{L,k} + \omega_d . V_{E,k})$ (KN)	KET
1	0	-48.83	-15.32	241.47	262.25	KOL BASEMEN
	1.925	-48.83	-15.32	241.47	262.25	
	3.85	-48.83	-15.32	241.47	262.25	
2	0	48.83	15.32	239.35	394.07	KOL BASEMEN
	1.925	48.83	15.32	239.35	394.07	
	3.85	48.83	15.32	239.35	394.07	
3	0	-82.65	-23.31	218.25	186.65	KOLOM LT.1
	1.925	-82.65	-23.31	218.25	186.65	
	3.85	-82.65	-23.31	218.25	186.65	
4	0	82.65	23.31	225.34	418.85	KOLOM LT.1
	1.925	82.65	23.31	225.34	418.85	
	3.85	82.65	23.31	225.34	418.85	
5	0	-80.50	-33.06	201.14	155.32	KOLOM LT.2
	1.925	-80.50	-33.06	201.14	155.32	
	3.85	-80.50	-33.06	201.14	155.32	
6	0	80.50	33.06	168.00	348.56	KOLOM LT.2
	1.925	80.50	33.06	168.00	348.56	
	3.85	80.50	33.06	168.00	348.56	
7	0	-57.43	21.10	53.78	35.26	KOLOM LT.3
	1.925	-57.43	21.10	53.78	35.26	
	3.85	-57.43	21.10	53.78	35.26	
8	0	57.43	-21.10	203.70	316.20	KOLOM LT.3
	1.925	57.43	-21.10	203.70	316.20	
	3.85	57.43	-21.10	203.70	316.20	
9	0	0	0	108.57	148.20	KOLOM LT.4
	1.34	0	0	108.57	148.20	
	2.68	0	0	108.57	148.20	
10	0	0	0	0	0	KOLOM LT.4
	1.34	0	0	0	0	
	2.68	0	0	0	0	
11	0	0	0	0	0	KOLOM LT.4
	1.1	0	0	0	0	
	2.2	0	0	0	0	
12	0	0	0	108.57	148.20	KOLOM LT.4
	1.1	0	0	108.57	148.20	
	2.2	0	0	108.57	148.20	

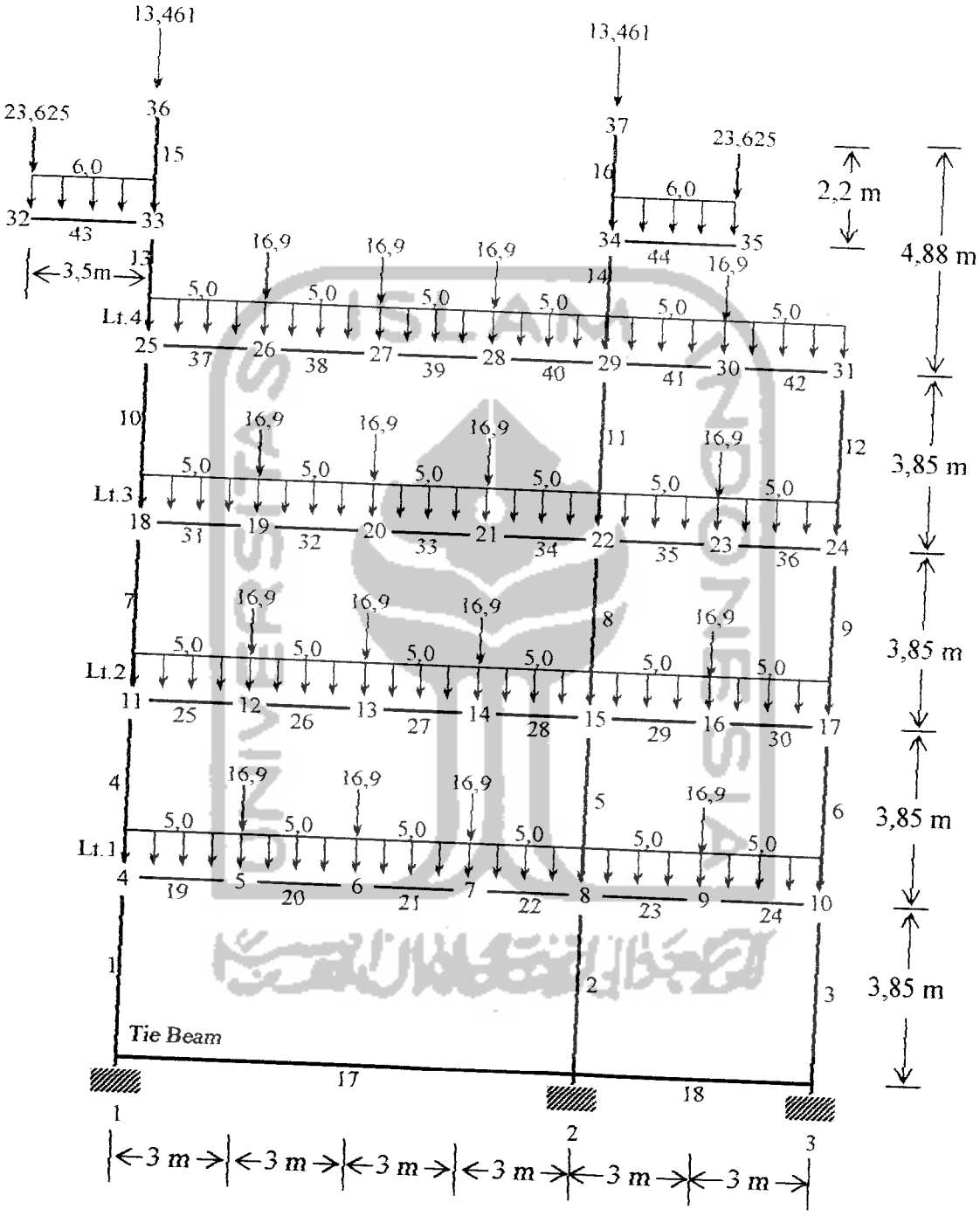
Pembebanan Portal As 6 dan As 7

a. Beban mati



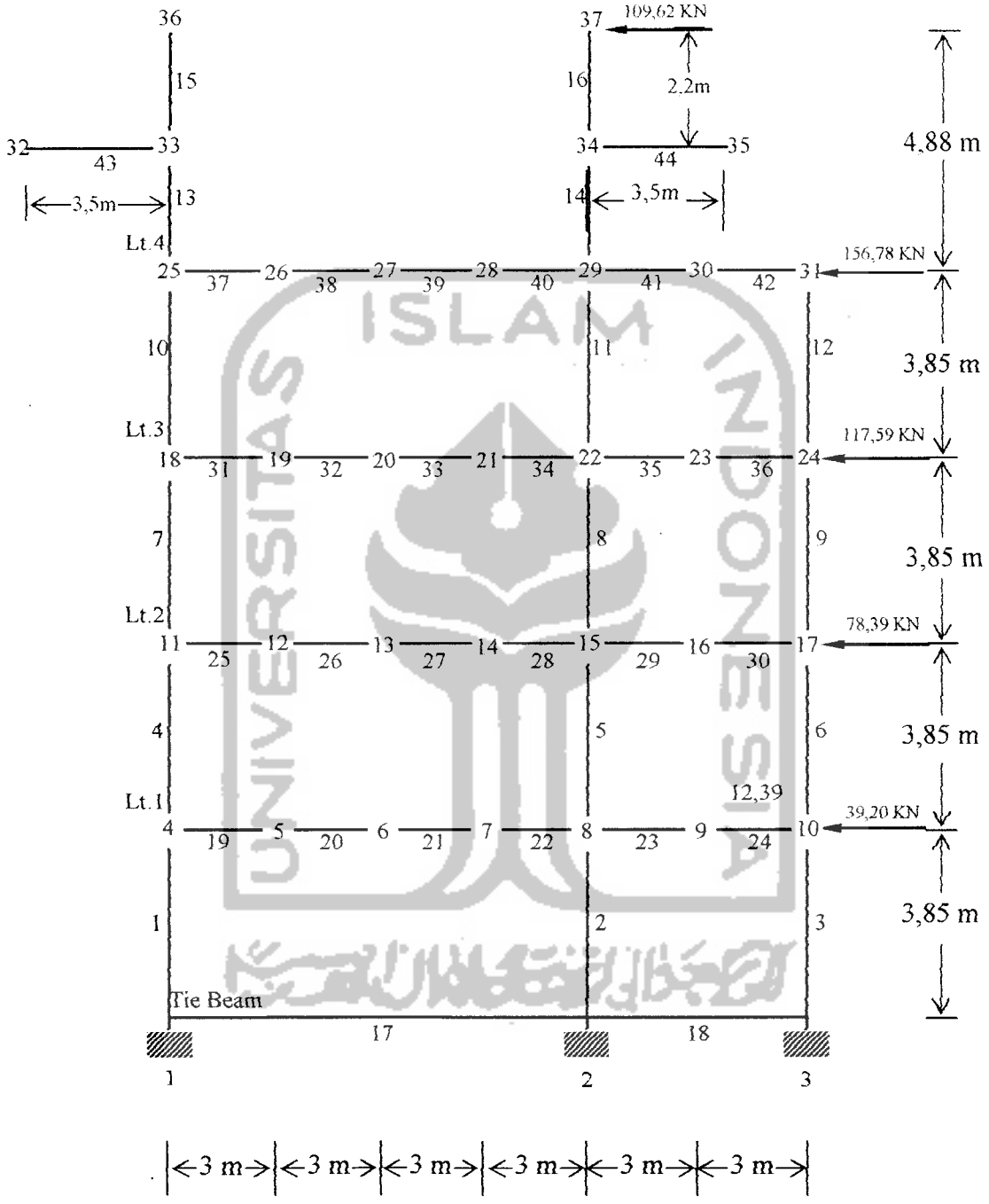
Gambar 4.12.a Pembebanan mati Portal As 6 dan As 7

b. Beban hidup



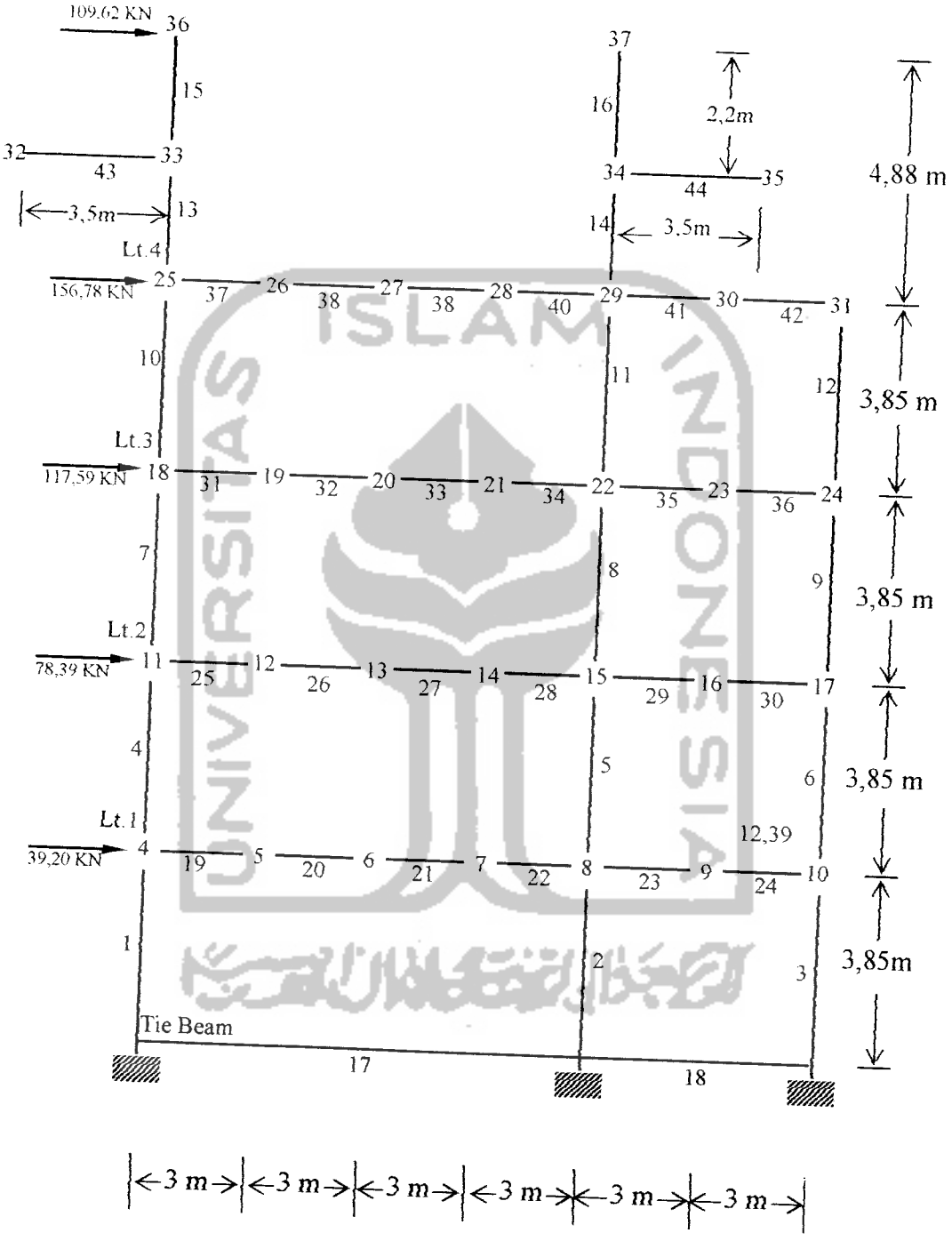
Gambar 4.12.b Pembebanan hidup Portal As 6 dan As 7

c. Beban gempa kanan



Gambar 4.12.c Pembebanan gempa kanan Portal As 6 dan As 7

d. Beban gempa kiri



Gambar 4.12.d Pembebanan gempa kiri Portal As 6 dan As 7

a Beban mati

- Beban terdistribusi merata elemen 19 s/d 42

  Lantai : 2.2/3.1,5.4,26 = 8,52 KN/m

  Balok : 0,4.0,8.24 = 7,68 KN/m

  W_{D1} = 16,2 KN/m

- Beban terdistribusi merata elemen 43 & 44

  Lantai : 2.2/3.1,75.0,12.24 = 5,86 KN/m

  Balok : 0,4.0,8.24 = 7,68 KN/m

  W_{D2} = 14,50 KN/m

- Beban terpusat nodal 5 s/d 30

  $P_{D1\ balok\ anak}$: 1,5.(2.1/2.3.1,5).4,26 + 0,25.0,40.24.4.5 = 39,56 KN

- Beban terpusat nodal 32 & 35

  $P_{D2\ R\ perletakan\ atap}$ = 28,60 KN

- Beban terpusat nodal 36 & 37

  $P_{D3\ penutup\ Lt\ 4}$: 1,75.(1,5+3).0,12.24 + 0,4.0,4.24,6 = 45,72 KN

b Beban hidup

- Beban terdistribusi merata elemen 19 s/d 42

  W_{L1} = 2.2/3.1,5.2,5 = 5,0 KN/m

- Beban terdistribusi merata elemen 43 & 44

  W_{L2} = 2.2/3.1,5.3 = 6,0 KN/m

- Beban terpusat 5 s/d 30

  $P_{L1\ R\ balok\ anak}$: 1,5.(2.1/2.3.1,5).2,5 = 10,622 KN

- Beban terpusat nodal 32 & 35

  $P_{1.2\ R\ perletakan\ atap}$: 7,166 + 6,304 = 13,461 KN

- Beban terpusat nodal 36 & 37

  $P_{1.3\ \ penutup\ Lt\ 4}$: 1,75.(1,5+3).3 = 23,625 KN

c Beban gempa

Reaksi atap : 2. 28,6 = 57,20 KN

Plat penutup Lt.4 : 2.3,5.6.0,12.24 = 120,96 KN

Kolom : 2.0,45.0,7.4,88.24 = 72,58 KN

Balok : 2.0,25.0,4.24.6 = 46,08 KN

Balok : 4.0,4.0,8.24.6 = 184,32 KN

Beban hidup tereduksi: 0,6.(2.3,5.6.3) = 75,60 KN

Dibulatkan W_{atap} = 559,74 KN

- Berat lantai 4 (tipikal dengan lt. 3, 2,1)

Lantai : 6.18.0,12.24 = 311,04 KN

Kolom : (2.0,45.0,7 + 0,45.0,45).3,85.24 = 76,92 KN

Balok : 11.0,25.0,4.24.6 = 158,40 KN

Balok : 0,4.0,8.24.30 = 230,40 KN

Tembok : 2,5.3,85.12 = 115,50 KN

B.hidup tereduksi : 0,6(6.18.2,5) = 162,00 KN

Dibulatkan W_4 = 1054,3 KN

W_{Total} : 559,74 + 4.1054,3 = 4776,94 KN

Gaya geser gempa untuk tingkat daktilitas penuh (K=1)

$V = C.I.K.W_T$

$= 0,07.1,5.1,0.4776,94 = 501,58$ KN

distribusi gaya-gaya lateral akibat gempa

Tingkat	Wi (KN)	hi (m)	Wi hi (KNm)	Fi (KN)
Atap	559,74	20,28	11351,53	109,62
4	1054,3	15,40	16236,22	156,78
3	1054,3	11,55	12177,17	117,59
2	1054,3	7,70	8118,11	78,39
1	1054,3	3,85	4059,06	39,20
			51942,08	501,58

Gaya geser gempa untuk tingkat daktilitas terbatas (K = 2)

$V = C.I.K.W_T$

$= 0,07.1,5.2,0.4887,4 = 1003,16$ KN

distribusi gaya-gaya lateral akibat gempa

Tingkat	Wi (KN)	hi (m)	Wi hi (KNm)	Fi (KN)
Atap	559,74	20,28	11351,53	219,14
4	1054,3	15,40	16236,22	313,56
3	1054,3	11,55	12177,17	235,18
2	1054,3	7,70	8118,11	156,78
1	1054,3	3,85	4059,06	78,40
			54128,59	1003,16

Tabel 4.12.a Momen Rencana Balok Portal As 6,7-8 (K=1)

Elm	Jarak (m)	MD (KNm)	ML (KNm)	M.GEMPA (KNm)		1.2MD+1.6ML (KNm)	0.9.(MD ± ME) (KNm)		1.05.(MD+0.6ML ± ME) (KNm)		KET
				KIRI	KANAN		KIRI	KANAN	KIRI	KANAN	
19	0	-297.1	-98.40	202.10	-200.29	-513.97	-85.51	-447.66	-161.75	-625.59	
	1.5	-105.5	-35.30	151.90	-150.36	-183.16	41.71	-230.33	26.42	-305.78	blk. lt.1
	3	49.54	16.55	101.69	-100.42	85.92	136.11	-45.79	169.22	-36.05	
20	0	49.54	16.55	101.69	-100.42	85.92	136.11	-45.79	169.22	-36.05	
	1.5	125.06	41.21	51.48	-50.48	216.00	158.89	67.12	211.33	121.58	blk. lt.1
	3	164.12	54.62	1.27	-0.54	284.34	148.85	147.22	208.07	229.11	
21	0	164.12	54.62	1.27	-0.54	284.34	148.85	147.22	208.07	229.11	
	1.5	123.59	40.85	-48.94	49.40	213.67	67.19	155.69	104.13	224.53	blk. lt.1
	3	46.61	15.83	-99.14	99.33	81.27	-47.28	131.35	-45.18	169.87	
22	0	46.61	15.83	-99.14	99.33	81.27	-47.28	131.35	-45.18	169.87	
	1.5	-109.9	-36.37	-149.35	149.27	-190.14	-233.38	35.38	-295.19	3.09	blk. lt.1
	3	-302.9	-99.82	-199.56	199.21	-523.29	-452.29	-93.39	-590.55	-213.77	
23	0	-75.99	-24.79	271.02	-272.29	-130.85	175.53	-313.45	189.16	-391.72	
	1.5	6.78	2.80	159.91	-160.53	15.02	151.82	-136.57	178.89	-156.39	blk. lt.1
	2.5	57.11	19.14	48.81	-48.78	99.16	95.32	7.49	123.27	28.84	
24	0	57.11	19.14	48.81	-48.78	99.16	95.32	7.49	123.27	28.84	
	1.5	25.84	8.30	-62.30	62.98	44.29	-32.82	79.93	-33.06	101.97	blk. lt.1
	3	-41.88	-13.79	-173.41	174.73	-72.32	-193.76	119.57	-234.74	125.02	
25	0	-297.6	-98.82	273.97	-272.13	-515.26	-21.29	-512.78	-87.10	-702.00	
	1.5	-105.9	-35.60	205.81	-204.49	-184.11	89.87	-279.40	82.42	-363.35	blk. lt.2
	3	49.28	16.36	137.64	-136.84	85.30	168.23	-78.81	206.57	-74.77	
26	0	49.28	16.36	137.64	-136.84	85.31	168.23	-78.80	206.57	-74.76	
	1.5	124.92	41.13	69.48	-69.20	215.72	174.96	50.15	230.03	101.70	blk. lt.2
	3	164.11	54.66	1.31	-1.55	284.39	146.66	146.30	208.13	226.06	
27	0	164.11	54.66	1.31	-1.55	284.39	148.88	146.30	208.13	228.08	
	1.5	123.71	41.01	-66.86	66.10	214.06	51.17	170.83	85.53	242.35	blk. lt.2
	3	46.86	16.10	-135.02	133.74	81.99	-79.35	162.54	-82.43	206.53	
28	0	46.86	16.10	-135.02	133.74	81.99	-79.35	162.54	-82.43	206.53	
	1.5	-109.5	-35.99	-203.19	201.39	-189.08	-281.49	92.63	-351.08	58.61	blk. lt.2
	3	-302.4	-99.33	-271.36	269.03	-521.88	-516.45	-30.10	-665.10	-139.40	
29	0	-60.76	-20.31	366.99	-361.35	-105.41	275.60	-379.90	308.74	-464.54	
	1.5	17.00	5.31	214.81	-211.51	28.89	208.63	-175.06	246.75	-198.66	blk. lt.2
	3	58.32	19.67	62.63	-61.66	101.45	108.85	-3.01	139.38	17.14	
30	0	58.32	19.67	62.63	-61.66	101.45	108.85	-3.01	139.38	17.14	
	1.5	20.05	6.85	-89.55	88.18	35.02	-62.56	97.41	-68.67	120.83	blk. lt.2
	3	-54.68	-17.22	-241.74	238.03	-93.16	-266.76	165.02	-322.09	174.44	
31	0	-296.9	-99.01	284.81	-281.19	-514.71	-10.90	-520.30	-75.09	-710.97	
	1.5	-105.2	-35.64	213.86	-211.47	-183.32	97.75	-285.05	91.59	-369.98	blk. lt.3
	2.5	49.97	16.48	142.90	-141.74	86.33	179.58	-82.59	212.90	-79.06	
32	0	49.97	16.48	142.90	-141.74	86.33	173.58	-82.59	212.90	-79.06	
	1.5	125.60	41.41	71.95	-72.01	216.98	177.79	48.23	233.51	99.75	blk. lt.3
	3	164.78	55.09	0.99	-2.29	285.89	149.20	146.24	208.77	228.47	
33	0	164.78	55.09	0.99	-2.29	285.89	149.20	146.24	208.77	228.47	
	1.5	124.38	41.60	-69.96	67.44	215.81	48.98	172.64	83.34	245.08	blk. lt.3
	3	47.52	16.85	-140.91	137.17	83.97	-84.05	166.22	-87.45	211.61	
34	0	47.52	16.85	-140.91	137.17	83.97	-84.05	166.22	-87.45	211.61	
	1.5	-108.9	-35.09	-211.87	206.89	-186.86	-288.72	88.16	-358.95	66.02	blk. lt.3
	3	-301.8	-98.27	-282.82	276.62	-519.43	-526.19	-22.69	-575.79	-129.66	
35	0	-80.46	-18.19	379.66	-369.59	-125.66	269.28	-405.05	302.70	-491.66	
	1.5	19.87	6.14	220.97	-213.30	33.67	216.76	-174.09	256.75	-196.65	blk. lt.3
	3	83.75	19.23	62.29	-57.00	131.26	131.44	24.08	165.45	48.28	
36	0	83.75	19.23	62.29	-57.00	131.26	131.44	24.08	165.45	48.28	
	1.5	25.15	5.13	-96.40	99.30	36.36	-64.13	112.00	-71.59	136.05	blk. lt.3
	3	-69.91	-20.22	-255.09	255.60	-116.25	-292.50	167.12	-353.99	173.74	
37	0	-300.2	-101.7	303.86	-274.68	-523.12	3.22	-517.46	-60.34	-710.54	
	1.5	-108.6	-38.34	231.49	-204.75	-191.69	110.57	-282.03	104.85	-369.30	blk. lt.4
	3	46.58	13.81	159.09	-134.83	78.00	185.11	-79.42	224.66	-78.16	
38	0	46.58	13.81	159.09	-134.83	78.00	185.11	-79.42	224.66	-78.16	
	1.5	122.20	38.78	86.70	-64.91	208.68	188.01	51.56	243.78	100.87	blk. lt.4
	3	161.37	52.50	14.32	5.01	277.64	158.12	149.74	217.54	229.82	
39	0	161.37	52.50	14.32	5.01	277.64	158.12	149.74	217.54	229.82	
	1.5	120.95	39.03	-58.07	74.93	207.59	56.59	176.30	90.61	246.66	blk. lt.4
	2.5	44.08	14.32	-130.46	144.86	75.80	-77.74	170.04	-81.68	213.42	
40	0	44.08	14.32	-130.46	144.86	75.80	-77.74	170.04	-81.68	213.42	
	1.5	-112.3	-37.58	-202.85	214.78	-194.99	-283.71	92.16	-354.67	68.06	blk. lt.4
	3	-305.3	-100.7	-275.23	284.70	-527.53	-522.48	-18.54	-673.02	-127.40	
41	0	-47.77	-11.95	286.79	-337.93	-76.44	215.12	-347.13	243.44	-417.53	
	1.5	30.02	12.42	179.58	-215.36	55.89	188.64	-166.81	227.90	-181.57	blk. lt.4
	3	71.36	25.53	72.36	-92.79	126.48	129.35	-19.29	166.99	4.31	
42	0	71.36	25.53	72.36	-92.79	126.48	129.35	-19.29	166.99	4.31	
	1.5	33.11	11.47	-34.85	29.78	58.08	-1.57	56.60	5.40	78.07	blk. lt.4
	3	-41.59	-13.85	-142.06	152.35	-72.07	-165.29	99.68	-201.56	101.75	
43	0	0	0	0	0	0	0	0	0	0	
	1.75	-102.2	-50.53	0	0	-203.50	-91.99	-91.99	-139.16	-160.38	blk. atap
	3.5	-248.8	-119.4	0	0	-489.70	-223.95	-223.95	-336.52	-386.68	
44	0	-248.8	-119.4	0	0	-489.70	-223.95	-223.95	-336.52	-386.68	
	1.75	-102.2	-50.53	0	0	-203.50	-91.99	-91.99	-139.16	-160.38	blk. atap
	3.5	0	0	0	0	0	0	0	0	0	

Tabel 4.12.b Gaya Geser Rencana Balok Portal As.6,7-8 (K=1)

Elm	Jarak (m)	VD,B (KN)	VL,B (KN)	VE,B (KN)	VG,B (KN)	MKAP,B	M'KAP,B	V_{UB}= 0,7(MKAP,B+M'KAP,B) /Ln+ 1,05.VG,B (KN)	Vub terpakai	V_{UB} maks (KN)	KET
19	0	139.85	45.82	33.29	185.67	911.86	426.37	277.85	261.98	334.77	
	1.5	115.55	38.32	33.29	153.87	911.86	426.37	244.46	228.59	301.38	blk. lt.1
	3	91.25	30.82	33.29	122.07	911.86	426.37	211.07	195.20	268.00	
20	0	62.49	20.19	33.29	82.68	911.86	426.37	169.72	153.85	226.64	
	1.5	38.19	12.69	33.29	50.88	911.86	426.37	136.33	120.46	193.25	blk. lt.1
	3	13.89	5.19	33.29	19.08	911.86	426.37	102.94	87.07	159.86	
21	0	14.87	5.43	33.29	20.30	911.86	426.37	104.21	88.34	161.14	
	1.5	39.17	12.93	33.29	52.10	911.86	426.37	137.60	121.73	194.53	blk. lt.1
	3	63.47	20.43	33.29	83.90	911.86	426.37	170.99	155.12	227.92	
22	0	92.23	31.05	33.29	123.28	911.86	426.37	212.34	196.47	269.27	
	1.5	116.53	38.55	33.29	155.08	911.86	426.37	245.73	229.86	302.66	blk. lt.1
	3	140.83	46.05	33.29	186.88	911.86	426.37	**279.12**	263.25	336.05	
23	0	68.67	22.15	74.50	90.61	911.86	426.37	176.25	162.38	406.27	
	1.5	44.37	14.65	74.50	59.01	911.86	426.37	144.86	128.99	374.88	blk. lt.1
	3	20.07	7.14	74.50	27.21	911.86	426.37	111.47	95.60	341.49	
24	0	8.69	3.48	74.50	12.17	911.86	426.37	95.68	79.81	325.70	
	1.5	33.00	10.98	74.50	43.97	911.86	426.37	129.07	113.20	359.09	blk. lt.1
	3	57.30	18.48	74.50	75.77	911.86	426.37	162.46	146.59	392.48	
25	0	139.94	45.89	45.10	185.83	911.86	426.37	278.02	262.15	384.53	
	1.5	115.64	38.39	45.10	154.03	911.86	426.37	244.63	228.76	351.14	blk. lt.2
	3	91.34	30.89	45.10	122.23	911.86	426.37	211.24	195.37	317.74	
26	0	62.58	20.27	45.10	82.84	911.86	426.37	169.89	154.02	276.39	
	1.5	38.28	12.77	45.10	51.04	911.86	426.37	136.50	120.63	243.00	blk. lt.2
	3	13.98	5.27	45.10	19.24	911.86	426.37	103.11	87.24	209.61	
27	0	14.78	5.35	45.10	20.14	911.86	426.37	104.04	88.17	210.55	
	1.5	39.08	12.85	45.10	51.94	911.86	426.37	137.43	121.56	243.94	blk. lt.2
	3	63.38	20.35	45.10	83.74	911.86	426.37	170.82	154.95	277.33	
28	0	92.14	30.98	45.10	123.12	911.86	426.37	212.17	196.30	318.68	
	1.5	116.44	38.48	45.10	154.92	911.86	426.37	245.56	229.69	352.07	blk. lt.2
	3	140.74	45.98	45.10	186.72	911.86	426.37	***278.95***	263.08	385.46	
29	0	63.99	20.83	99.90	84.82	911.86	426.37	171.96	156.09	508.62	
	1.5	39.69	13.33	99.90	53.02	911.86	426.37	138.57	122.70	475.23	blk. lt.2
	3	15.39	5.83	99.90	21.22	911.86	426.37	105.18	89.31	441.84	
30	0	13.37	4.80	99.90	18.16	911.86	426.37	101.97	86.10	438.63	
	1.5	37.67	12.30	99.90	49.96	911.86	426.37	135.36	119.49	472.02	blk. lt.2
	3	61.97	19.80	99.90	81.76	911.86	426.37	168.75	152.88	505.41	
31	0	139.93	45.99	46.48	185.92	1061.95	568.49	***296.22***	276.88	390.45	
	1.5	115.63	38.49	46.48	154.12	1061.95	568.49	262.83	243.49	357.06	blk. lt.3
	3	91.33	30.99	46.48	122.33	1061.95	568.49	229.44	210.10	323.67	
32	0	62.57	20.37	46.48	82.94	1061.95	568.49	188.09	168.75	282.32	
	1.5	38.27	12.87	46.48	51.14	1061.95	568.49	154.70	135.36	248.93	blk. lt.3
	3	13.97	5.37	46.48	19.34	1061.95	568.49	121.31	101.97	215.54	
33	0	14.79	5.25	46.48	20.04	1061.95	568.49	122.04	102.70	216.27	
	1.5	39.09	12.75	46.48	51.84	1061.95	568.49	155.43	136.09	249.66	blk. lt.3
	3	63.39	20.25	46.48	83.64	1061.95	568.49	188.82	169.48	283.05	
34	0	92.15	30.87	46.48	123.02	1061.95	568.49	230.17	210.83	324.40	
	1.5	116.45	38.37	46.48	154.82	1061.95	568.49	263.56	244.22	357.80	blk. lt.3
	3	140.75	-45.87	46.48	94.88	1061.95	568.49	200.62	181.28	294.85	

Lanjutan Tabel 4.12.b Gaya Geser Rencana Balok Portal As.6,7-8 (K=1)

Elm	Jarak (m)	VD,B (KN)	VL,B (KN)	VE,B (KN)	VG,B (KN)	MKAP,B	M'KAP,B	VUB= 0,7(MKAP,B + M'KAP,B) /Ln+ 1,05.VG,B (KN)	Vub terpakai	Vub maks (KN)	KET
35	0	79.04	19.97	104.20	99.01	1061.95	568.49	204.96	185.62	541.60	blk. lt.3
	1.5	54.74	12.47	104.20	67.21	1061.95	568.49	171.57	152.23	508.21	
	3	30.44	4.97	104.20	35.41	1061.95	568.49	138.18	118.84	474.82	
36	0	1.68	-5.65	104.20	-3.97	1061.95	568.49	96.83	77.49	433.47	blk. lt.3
	1.5	51.22	13.15	104.20	64.37	1061.95	568.49	168.59	149.25	505.23	
	3	75.52	20.65	104.20	96.17	1061.95	568.49	201.98	182.64	538.62	
37	0	168.52	46.02	46.62	214.54	1061.95	568.49	**326.26**	306.92	421.05	blk. lt.4
	1.5	115.62	38.52	46.62	154.14	1061.95	568.49	262.84	243.50	357.63	
	3	91.32	31.02	46.62	122.34	1061.95	568.49	229.46	210.12	324.24	
38	0	62.56	20.40	46.62	82.96	1061.95	568.49	188.11	168.77	282.89	blk. lt.4
	1.5	38.26	12.90	46.62	51.16	1061.95	568.49	154.72	135.38	249.50	
	3	13.96	5.40	46.62	19.36	1061.95	568.49	121.33	101.99	216.11	
39	0	14.80	5.23	46.62	9.57	1061.95	568.49	111.05	91.71	205.83	blk. lt.4
	1.5	39.10	12.73	46.62	51.83	1061.95	568.49	155.42	136.08	250.20	
	3	63.40	20.23	46.62	83.63	1061.95	568.49	188.61	169.47	283.59	
40	0	92.16	30.85	46.62	123.01	1061.95	568.49	230.16	210.62	324.94	blk. lt.4
	1.5	116.46	38.35	46.62	154.81	1061.95	568.49	263.55	244.21	358.33	
	3	140.76	45.85	46.62	186.61	1061.95	568.49	296.94	277.60	391.72	
41	0	64.01	19.99	81.71	84.00	1061.95	568.49	189.20	169.86	431.40	blk. lt.4
	1.5	39.71	12.49	81.71	52.20	1061.95	568.49	155.81	136.47	398.01	
	3	15.41	4.99	81.71	20.40	1061.95	568.49	122.43	103.09	364.62	
42	0	13.35	5.63	81.71	7.72	1061.95	568.49	109.11	89.77	351.30	blk. lt.4
	1.5	37.65	13.13	81.71	50.78	1061.95	568.49	154.32	134.98	396.51	
	3	61.95	20.63	81.71	82.58	1061.95	568.49	187.71	168.37	429.90	
43	0	45.72	23.63	0	69.35	0	0	72.81	72.81	72.81	blk. atap
	1.75	71.10	34.13	0	105.22	0	0	110.48	110.48	110.48	
	3.5	96.47	44.63	0	141.10	0	0	**148.15**	148.15	148.15	
44	0	96.47	44.63	0	141.10	0	0	148.15	148.15	148.15	blk. atap
	1.75	71.10	34.13	0	105.22	0	0	110.48	110.48	110.48	
	3.5	45.72	23.63	0	69.35	0	0	72.81	72.81	72.81	

Keterangan:

$$V_{u,b.terpakai} = \left[1{,}05.V_G - 0{,}7\left(\frac{M_{kap,b} + M'_{Kap,b}}{l_n}\right)\right] + \frac{ln - d}{ln}\left[V_{u,b} - \left[1{,}05.V_G - 0{,}7\left(\frac{M_{kap,b} + M'_{Kap,b}}{l_n}\right)\right]\right]$$

Tabel 4.12.c Momen Rencana Kolom Portal As.6,7-8 (K=1)

Elm	Jarak (m)	MD,k (KNm)	ML,k (KNm)	MEki (KNm)	MEka (KNm)	MKAP,b kiri (KNm)	MKAP,b kanan (KNm)	$M_{U,k}$	MU,k= 1.05 (MD,k+ML,k + 4/K.ME,k) (KNm)	KET
1	0	60.22	21.04	-1202.40	1177.00	0	911.86	556.16	5028.72	Kol.Basmen
	1.925	-45.85	-14.07	-799.38	786.14	0	911.86	556.16	3238.88	
	3.85	-151.91	-49.18	-396.40	395.29	0	911.86	556.16	1449.08	
2	0	-87.04	-27.92	-1272.30	1287.10	911.86	911.86	1112.33	-5464.37	Kol.Basmen
	1.925	5.89	2.87	-769.55	773.43	911.86	911.86	1112.33	3257.60	
	3.85	98.81	33.67	-266.75	259.77	911.86	911.86	1112.33	1230.14	
3	0	-9.48	-3.09	-65.02	66.40	911.86	0	556.16	265.66	Kol.Basmen
	1.925	3.66	1.22	-5.25	5.37	911.86	0	556.16	27.66	
	3.85	16.80	5.54	54.51	-55.67	911.86	0	556.16	252.39	
4	0	145.20	49.22	-598.50	595.58	0	911.86	556.16	2705.58	Kol Lt.1
	1.925	-4.05	-0.75	-281.17	288.22	0	911.86	556.16	1205.48	
	3.85	-153.30	-50.72	36.16	-19.13	0	911.86	556.16	-294.57	
5	0	-126.17	-41.36	-737.33	731.27	1061.95	1061.95	1295.42	-3274.60	Kol Lt.1
	1.925	-4.26	0.19	-280.33	264.59	1061.95	1061.95	1295.42	-1181.67	
	3.85	119.64	41.74	176.67	-202.09	1061.95	1061.95	1295.42	911.46	
6	0	-25.08	-8.25	-118.90	119.07	1061.95	0	647.71	-534.38	Kol Lt.1
	1.925	0.26	0.17	-3.15	3.02	1061.95	0	647.71	13.14	
	3.85	25.61	8.59	112.61	-113.03	1061.95	0	647.71	508.87	
7	0	144.33	48.09	-237.82	253.00	0	1061.95	647.71	1264.65	Kol Lt.2
	1.925	-12.00	-3.98	-40.34	41.15	0	1061.95	647.71	-186.21	
	3.85	-168.34	-56.06	157.14	-170.71	0	1061.95	647.71	-952.61	
8	0	-122.07	-37.28	-461.68	428.29	1061.95	1061.95	1295.42	1631.50	Kol Lt.2
	1.925	3.85	6.15	-47.73	23.88	1061.95	1061.95	1295.42	-189.96	
	3.85	129.77	49.57	366.23	-380.53	1061.95	1061.95	1295.42	1726.48	
9	0	-29.07	-8.63	-129.13	125.00	1061.95	0	647.71	-581.93	Kol Lt.2
	1.925	1.34	0.02	-1.38	2.09	1061.95	0	647.71	10.21	
	3.85	31.76	8.68	126.37	-120.82	1061.95	0	647.71	573.21	
10	0	128.58	42.94	-127.67	110.48	0	1061.95	647.71	644.11	Kol Lt..3
	1.925	38.57	30.32	-179.38	-82.10	0	1061.95	647.71	-681.07	
	3.85	-51.45	17.70	-231.08	-274.67	0	1061.95	647.71	-1189.06	
11	0	-91.60	-30.51	-296.26	265.68	1061.95	1061.95	1295.42	-1372.50	Kol Lt..3
	1.925	-41.45	-30.58	132.68	89.00	1061.95	1061.95	1295.42	482.46	
	3.85	8.69	-30.66	562.02	-87.68	1061.95	1061.95	1295.42	2337.42	
12	0	-38.15	-11.55	-128.71	134.77	1061.95	0	647.71	-592.76	Kol Lt..3
	1.925	1.72	1.15	6.68	-8.79	1061.95	0	647.71	-33.90	
	3.85	41.59	13.85	142.06	-152.35	1061.95	0	647.71	654.87	
13	0	248.83	119.44	-534.95	0	0	1061.95	647.71	-1860.11	Kol Lt.4
	1.14	248.83	119.44	-409.98	0	0	1061.95	647.71	-1335.23	
	2.28	248.83	119.44	-285.01	0	0	1061.95	647.71	-810.36	
14	0	-248.83	-119.44	0	534.94	1061.95	1061.95	1295.42	1860.06	Kol Lt.4
	1.14	-248.83	-119.44	0	409.98	1061.95	1061.95	1295.42	1335.23	
	2.28	-248.83	-119.44	0	285.02	1061.95	1061.95	1295.42	810.40	
15	0	0	0	-285.01	0	0	1061.95	647.71	-1197.04	Kol Lt.4
	1.3	0	0	-142.51	0	0	1061.95	647.71	-598.54	
	2.6	0	0	0	0	0	1061.95	647.71	0	
16	0	0	0	0	285.02	1061.95	1061.95	1295.42	1197.08	Kol Lt.4
	1.3	0	0	0	142.51	1061.95	1061.95	1295.42	598.54	
	2.6	0	0	0	0	1061.95	1061.95	1295.42	0	

Keterangan: $M_{U,k} = h / h_n \; 0{,}7.\omega_d \; .0{,}5(l_{ki} / l_{n.ki} . M_{kap,b.ki} + l_{ka} / l_{n.ka} . M_{kap,b.ka})$ KNm

Tabel 4.12.d Gaya Geser Rencana Kolom As.6,7-8 (K=1)

Elm	Jarak (m)	VD,k (KN)	VL,k (KN)	VE,k (KN)	MU, k bawah (KN)	MU,k atas (KN)	VU,k = (MU,k a + MU,k b)/ h_k (KN)	VU,k = 1,05(VD,k+ VL,k± 4/1 VE,k) (KN)	KET
1	0	55.10	18.24	209.34	911.86	911.89	597.95	956.23	Kol Basmen
	1.925	55.10	18.24	209.34	911.86	911.89	597.95	956.23	
	3.85	55.10	18.24	209.34	911.86	911.89	597.95	956.23	
2	0	48.27	16.00	261.19	911.86	911.89	597.95	1164.48	Kol Basmen
	1.925	48.27	16.00	261.19	911.86	911.89	597.95	1164.48	
	3.85	48.27	16.00	261.19	911.86	911.89	597.95	1164.48	
3	0	6.83	2.24	31.05	911.86	911.89	597.95	139.91	Kol Basmen
	1.925	6.83	2.24	31.05	911.86	911.89	597.95	139.91	
	3.85	6.83	2.24	31.05	911.86	911.89	597.95	139.91	
4	0	77.53	25.96	164.85	911.86	911.89	597.95	801.04	KOL LT.1
	1.925	77.53	25.96	164.85	911.86	911.89	597.95	801.04	
	3.85	77.53	25.96	164.85	911.86	911.89	597.95	801.04	
5	0	64.37	21.58	237.40	911.86	911.89	597.95	1087.33	KOL LT.1
	1.925	64.37	21.58	237.40	911.86	911.89	597.95	1087.33	
	3.85	64.37	21.58	237.40	911.86	911.89	597.95	1087.33	
6	0	13.17	4.38	60.13	911.86	911.89	597.95	270.98	KOL LT.1
	1.925	13.17	4.38	60.13	911.86	911.89	597.95	270.98	
	3.85	13.17	4.38	60.13	911.86	911.89	597.95	270.98	
7	0	81.21	27.05	102.59	911.86	1061.95	647.15	544.56	KOL LT.2
	1.925	81.21	27.05	102.59	911.86	1061.95	647.15	544.56	
	3.85	81.21	27.05	102.59	911.86	1061.95	647.15	544.56	
8	0	65.41	22.56	215.04	911.86	1061.95	647.15	995.54	KOL LT.2
	1.925	65.41	22.56	215.04	911.86	1061.95	647.15	995.54	
	3.85	65.41	22.56	215.04	911.86	1061.95	647.15	995.54	
9	0	15.80	4.49	66.36	911.86	1061.95	647.15	300.04	KOL LT.2
	1.925	15.80	4.49	66.36	911.86	1061.95	647.15	300.04	
	3.85	15.80	4.49	66.36	911.86	1061.95	647.15	300.04	
10	0	46.76	6.56	26.86	1061.95	1061.95	696.36	168.80	KOL LT.3
	1.925	46.76	6.56	26.86	1061.95	1061.95	696.36	168.80	
	3.85	46.76	6.56	26.86	1061.95	1061.95	696.36	168.80	
11	0	26.05	0.04	222.93	1061.95	1061.95	696.36	963.70	KOL LT.3
	1.925	26.05	0.04	222.93	1061.95	1061.95	696.36	963.70	
	3.85	26.05	0.04	222.93	1061.95	1061.95	696.36	963.70	
12	0	20.71	6.60	70.33	1061.95	1061.95	696.36	324.07	KOL LT.3
	1.925	20.71	6.60	70.33	1061.95	1061.95	696.36	324.07	
	3.85	20.71	6.60	70.33	1061.95	1061.95	696.36	324.07	
13	0	0	0	109.62	1061.95	1061.95	696.36	460.40	KOL LT.4
	1.925	0	0	109.62	1061.95	1061.95	696.36	460.40	
	3.85	0	0	109.62	1061.95	1061.95	696.36	460.40	
14	0	0	0	0	1061.95	1061.95	696.36	0	KOL LT.4
	1.925	0	0	0	1061.95	1061.95	696.36	0	
	3.85	0	0	0	1061.95	1061.95	696.36	0	
15	0	0	0	109.62	1061.95	1061.95	696.36	460.40	KOL LT.4
	1.925	0	0	109.62	1061.95	1061.95	696.36	460.40	
	3.85	0	0	109.62	1061.95	1061.95	696.36	460.40	
16	0	0	0	0	1061.95	1061.95	696.36	0	KOL LT.4
	1.925	0	0	0	1061.95	1061.95	696.36	0	
	3.85	0	0	0	1061.95	1061.95	696.36	0	

Tabel 4.13.a Momen Rencana Balok Portal As 6,7-8 (K=2)

Elm	Jarak (m)	MD (KNm)	ML (KNm)	M.GEMPA (KNm)		1.2MD+1.6ML (KNm)	0.9.(MD ± ME) (KNm)		1.05(MD+0.6ML±ME) (KNm)		KET
				KIRI	KANAN		KIRI	KANAN	KIRI	KANAN	
19	0	-297.11	-98.40	404.16	-400.54	-513.97	96.35	-627.89	50.41	**-835.85**	
	1.5	-105.56	-35.30	303.76	-300.68	-183.16	178.38	-365.62	185.87	-463.62	blk. lt.1
	3	49.54	16.55	203.35	-200.81	85.92	227.60	-136.14	275.96	-141.46	
20	0	49.54	16.55	203.35	-200.81	85.92	227.60	-136.14	275.96	-141.46	
	1.5	125.06	41.21	102.95	-100.95	216.00	205.21	21.70	265.37	68.58	blk. lt.1
	3	164.12	54.62	2.54	-1.08	284.34	150.00	146.73	209.41	228.54	
21	0	164.12	54.62	2.54	-1.08	284.34	150.00	146.73	209.41	228.54	
	1.5	123.59	40.85	-97.86	98.78	213.67	23.16	200.13	52.75	276.38	blk. lt.1
	3	46.61	15.83	-198.26	198.64	81.27	-136.48	220.73	-149.26	274.14	
22	0	46.61	15.83	-198.26	198.64	81.27	-136.48	220.73	-149.26	274.14	
	1.5	-109.96	-36.37	-298.67	298.51	-190.14	-367.77	169.70	-451.97	159.79	blk. lt.1
	3	-302.98	-99.82	-399.07	398.37	-523.29	-631.85	85.85	-800.04	-4.65	
23	0	-75.99	-24.79	541.98	-544.52	-130.85	419.39	-558.46	**473.67**	-677.57	
	1.5	8.78	2.80	319.79	-321.03	15.02	295.71	-281.02	346.77	-324.92	blk. lt.1
	2.5	57.11	19.14	97.60	-97.55	99.16	139.23	-36.40	174.50	-22.36	
24	0	57.11	19.14	97.60	-97.55	99.16	139.23	-36.40	174.50	-22.36	
	1.5	25.64	8.30	-124.59	125.94	44.29	-88.88	136.60	-98.46	168.08	blk. lt.1
	3	-41.86	-13.79	-346.76	349.43	-72.32	-349.79	276.60	-416.78	308.45	
25	0	-297.63	-98.82	547.87	-544.19	-515.26	225.22	-757.64	200.50	**-987.67**	
	1.5	-105.95	-35.60	411.56	-408.92	-184.11	275.05	-463.38	298.46	-578.00	blk. lt.2
	3	49.28	16.36	275.24	-273.65	85.30	292.07	-201.93	351.05	-218.42	
26	0	49.28	16.36	275.24	-273.65	85.31	292.07	-201.93	351.05	-218.41	
	1.5	124.92	41.13	138.93	-138.37	215.72	237.47	-12.11	302.96	29.07	blk. lt.2
	3	164.11	54.66	2.62	-3.10	284.39	150.05	144.91	209.50	226.46	
27	0	164.11	54.66	2.62	-3.10	284.39	150.05	144.91	209.50	226.46	
	1.5	123.71	41.01	-133.70	132.17	214.06	-8.99	230.29	15.34	311.73	blk. lt.2
	3	46.86	16.10	-270.01	267.45	81.99	-200.84	282.88	-224.17	346.93	
28	0	46.86	16.10	-270.01	267.45	81.99	-200.84	282.88	-224.17	346.93	
	1.5	-109.58	-35.99	-406.32	402.72	-189.08	-464.31	263.83	-564.37	270.01	blk. lt.2
	3	-302.47	-99.33	-542.64	537.99	-521.88	-760.60	211.97	-949.94	143.00	
29	0	-60.76	-20.31	733.88	-722.60	-105.41	605.80	-705.03	***693.98***	-843.86	
	1.5	17.00	5.31	429.56	-422.95	28.89	401.91	-365.35	472.23	-420.67	blk. lt.2
	3	58.32	19.67	125.24	-123.31	101.45	165.20	-58.49	205.13	-47.59	
30	0	58.32	19.67	125.24	-123.31	101.45	165.20	-58.49	205.13	-47.59	
	1.5	20.05	6.85	-179.08	176.34	35.02	-143.13	176.75	-162.67	213.40	blk. lt.2
	3	-54.68	-17.22	-483.40	475.99	-93.16	-484.27	379.18	-575.83	424.30	
31	0	-296.92	-99.01	569.52	-562.28	-514.71	245.34	-773.28	223.86	**-1006.12**	
	1.5	-105.25	-35.64	427.63	-422.86	-183.32	290.14	-475.30	316.05	-591.94	blk. lt.3
	2.5	49.97	16.48	285.75	-283.43	86.33	302.15	-210.11	362.89	-227.83	
32	0	49.97	16.48	285.75	-283.43	86.33	302.15	-210.11	362.89	-227.83	
	1.5	125.60	41.41	143.87	-144.00	216.98	242.52	-16.56	309.03	24.16	blk. lt.3
	3	164.76	55.09	1.99	-4.57	285.89	150.09	144.19	209.81	226.07	

Lanjutan Tabel 4.13.a Momen Rencana Balok Portal As 6,7-8 (K=2)

Elm	Jarak (m)	MD (KNm)	ML (KNm)	M.GEMPA (KNm)		1.2MD+1.6ML (KNm)	0.9.(MD ± ME) (KNm)		1.05(MD+0.6ML±ME) (KNm)		KET
				KIRI	KANAN		KIRI	KANAN	KIRI	KANAN	
33	0	164.78	55.09	1.99	-4.57	285.89	150.09	144.19	209.81	226.07	
	1.5	124.38	41.60	-139.90	134.86	215.81	-13.97	233.32	9.91	315.88	blk. lt.3
	3	47.52	16.85	-281.78	274.28	83.97	-210.84	289.62	-235.36	355.58	
34	0	47.52	16.85	121.79	274.28	83.97	152.38	289.62	188.39	355.58	
	1.5	-108.93	-35.09	-423.66	413.71	-186.86	-479.33	274.30	-581.32	283.18	blk. lt.3
	3	-301.83	-98.27	-565.54	553.14	-519.43	-780.63	226.18	-972.65	160.69	
35	0	-80.46	-18.19	759.18	-739.06	-125.66	610.85	-737.57	**701.19**	-879.60	
	1.5	19.87	6.14	441.86	-426.52	33.67	415.56	-365.98	488.69	-420.53	blk. lt.3
	3	83.75	19.23	124.55	-113.98	131.26	187.47	-27.20	230.83	-11.55	
36	0	83.75	19.23	124.55	-113.98	131.26	187.47	-27.20	230.83	-11.55	
	1.5	25.15	5.13	-192.77	198.56	38.38	-150.86	201.34	-172.77	240.27	blk. lt.3
	3	-69.91	-20.22	-510.08	511.10	-116.25	-521.99	397.07	-621.73	442.02	
37	0	-300.28	-101.74	607.58	-549.23	-523.12	276.57	-764.56	258.57	**-998.81**	
	1.5	-108.62	-38.34	462.84	-409.42	-191.69	318.80	-466.24	347.78	-584.20	blk. lt.4
	3	46.58	13.81	318.10	-269.61	78.00	328.22	-200.72	391.62	-219.68	
38	0	46.58	13.81	318.10	-269.61	78.00	328.22	-200.72	391.62	-219.68	
	1.5	122.20	38.78	173.36	-129.79	208.68	266.00	-6.83	334.77	32.75	blk. lt.4
	3	161.37	52.50	28.62	10.02	277.64	170.99	154.25	232.56	235.08	
39	0	161.37	52.50	28.62	10.02	277.64	170.99	154.25	232.56	235.08	
	1.5	120.95	39.03	-116.12	149.83	207.59	4.35	243.70	29.66	325.30	blk. lt.4
	2.5	44.08	14.32	-260.86	289.64	75.80	-195.10	300.35	-218.60	365.43	
40	0	44.08	14.32	-260.86	289.64	75.80	-195.10	300.35	-218.60	365.43	
	1.5	-112.38	-37.58	-405.60	429.46	-194.99	-466.18	285.37	-567.56	293.47	blk. lt.4
	3	-305.30	-100.73	-550.35	569.27	-527.53	-770.09	237.57	-961.89	171.40	
41	0	-47.77	-11.95	573.46	-675.69	-76.44	473.12	-651.11	**544.45**	-772.18	
	1.5	30.02	12.42	359.08	-430.61	55.89	350.19	-360.53	416.38	-407.58	blk. lt.4
	3	71.36	25.53	144.70	-185.53	126.48	194.45	-102.75	242.95	-93.07	
42	0	71.36	25.53	144.70	-185.53	126.48	194.45	-102.75	242.95	-93.07	
	1.5	33.11	11.47	-69.69	59.55	58.08	32.92	83.40	-31.18	109.33	blk. lt.4
	3	-41.59	-13.85	-284.07	304.63	-72.07	-293.09	236.74	-350.67	261.65	
43	0	0	0	0	0	0	0	0	0	0	
	1.75	-102.21	-50.53	0	0	-203.50	-91.99	-91.99	-139.16	-160.38	blk. atap
	3.5	-248.83	-119.44	0	0	-489.70	-223.95	-223.95	-336.52	-386.68	
44	0	-248.83	-119.44	0	0	**-489.70**	-223.95	-223.95	-336.52	-386.68	
	1.75	-102.21	-50.53	0	0	-203.50	-91.99	-91.99	-139.16	-160.38	blk. atap
	3.5	0	0	0	0	0	0	0	0	0	

Tabel 4.13.b Gaya Geser Rencana Balok Portal As.6,7-8 (K=2)

Elm	Jarak (m)	VD,B (KN)	VL,B (KN)	VE,B (KN)	VUB=1,05(VD,B + VL,B +1,3. VE,B) (KN)	KET
19	0	139.85	45.82	66.58	334.76	Blk LT.1
	1.5	115.55	38.32	66.58	301.37	
	3	91.25	30.82	66.58	267.98	
20	0	62.49	20.19	66.58	226.63	Blk LT.1
	1.5	38.19	12.69	66.58	193.24	
	3	13.89	5.19	66.58	159.85	
21	0	14.87	5.43	66.58	161.12	Blk LT.1
	1.5	39.17	12.93	66.58	194.51	
	3	63.47	20.43	66.58	227.90	
22	0	92.23	31.05	66.58	269.25	Blk LT.1
	1.5	116.53	38.55	66.58	302.64	
	3	140.83	46.05	66.58	336.03	
23	0	68.67	22.15	148.99	408.23	Blk LT.1
	1.25	44.37	14.65	148.99	374.84	
	2.5	20.07	7.14	148.99	341.45	
24	0	8.69	3.48	148.99	325.66	Blk LT.1
	1.5	33.00	10.96	148.99	359.05	
	3	57.30	18.48	148.99	392.44	
25	0	139.94	45.89	90.18	384.50	Blk LT.2
	1.5	115.64	38.39	90.18	351.11	
	3	91.34	30.89	90.18	317.72	
26	0	62.58	20.27	90.18	276.37	Blk LT.2
	1.5	38.28	12.77	90.18	242.98	
	3	13.98	5.27	90.18	209.59	
27	0	14.76	5.35	90.18	210.53	Blk LT.2
	1.5	39.08	12.85	90.18	243.92	
	3	63.38	20.35	90.18	277.31	
28	0	92.14	30.98	90.18	318.66	Blk LT.2
	1.25	116.44	38.48	90.18	352.04	
	2.5	140.74	45.98	90.18	385.43	
29	0	63.99	20.83	199.76	508.56	Blk LT.2
	1.5	39.69	13.33	199.76	475.17	
	3	15.39	5.83	199.76	441.78	
30	0	13.37	4.80	199.76	438.57	Blk LT.2
	1.5	37.67	12.30	199.76	471.96	
	3	61.97	19.80	199.76	505.35	
31	0	139.93	45.99	92.95	390.42	Blk LT.3
	1.5	115.63	38.49	92.95	357.03	
	3	91.33	30.99	92.95	323.64	
32	0	62.57	20.37	92.95	282.29	Blk LT.3
	1.5	38.27	12.87	92.95	248.90	
	3	13.97	5.37	92.95	215.51	
33	0	14.79	5.25	92.95	216.24	Blk LT.3
	1.5	39.09	12.75	92.95	249.63	
	3	63.39	20.25	92.95	283.02	
34	0	92.15	30.87	92.95	324.37	Blk LT.3
	1.5	116.45	38.37	92.95	357.76	
	3	140.75	-45.87	92.95	294.82	
35	0	79.04	19.97	208.36	541.52	Blk LT.3
	1.5	54.74	12.47	208.36	508.13	
	3	30.44	4.97	208.36	474.74	
36	0	1.68	-5.65	208.36	433.39	Blk LT.3
	1.5	51.22	13.15	208.36	505.15	
	3	75.52	20.65	208.36	538.54	

Lanjutan Tabel 4.13 Gaya Geser Rencana Balok Portal As.6,7-8

(K=2)

Elm	Jarak (m)	VD,B (KN)	VL,B (KN)	VE,B (KN)	VUB=1,05(VD,B + VL,B +1,3. VE,B) (KN)	KET
37	0	168.52	46.02	93.21	421.00	Blk LT.4
	1.25	115.62	38.52	93.21	357.58	
	2.5	91.32	31.02	93.21	324.19	
38	0	62.56	20.40	93.21	282.64	Blk LT.4
	1.5	38.26	12.90	93.21	249.45	
	3	13.96	5.40	93.21	216.06	
39	0	14.80	-5.23	93.21	205.79	Blk LT.4
	1.5	39.10	12.73	93.21	250.16	
	3	63.40	20.23	93.21	283.55	
40	0	92.16	30.85	93.21	324.90	Blk LT.4
	1.5	116.46	38.35	93.21	359.29	
	3	140.76	45.85	93.21	391.68	
41	0	64.01	19.99	163.39	431.32	Blk LT.4
	1.5	39.71	12.49	163.39	397.93	
	3	15.41	4.99	163.39	364.54	
42	0	13.35	-5.63	163.39	351.23	Blk LT.4
	1.25	37.65	13.13	163.39	396.44	
	2.5	61.95	20.63	163.39	429.83	
43	0	45.72	23.63	0	72.81	Blk atap
	1.75	71.10	34.13	0	110.48	
	3.5	96.47	44.63	0	148.15	
44	0	96.47	44.63	0	148.15	Blk atap
	1.75	71.10	34.13	0	110.48	
	3.5	45.72	23.63	0	72.81	

Tabel 4.13.c Momen Rencana Kolom Portal As.6,7-8 (K=2)

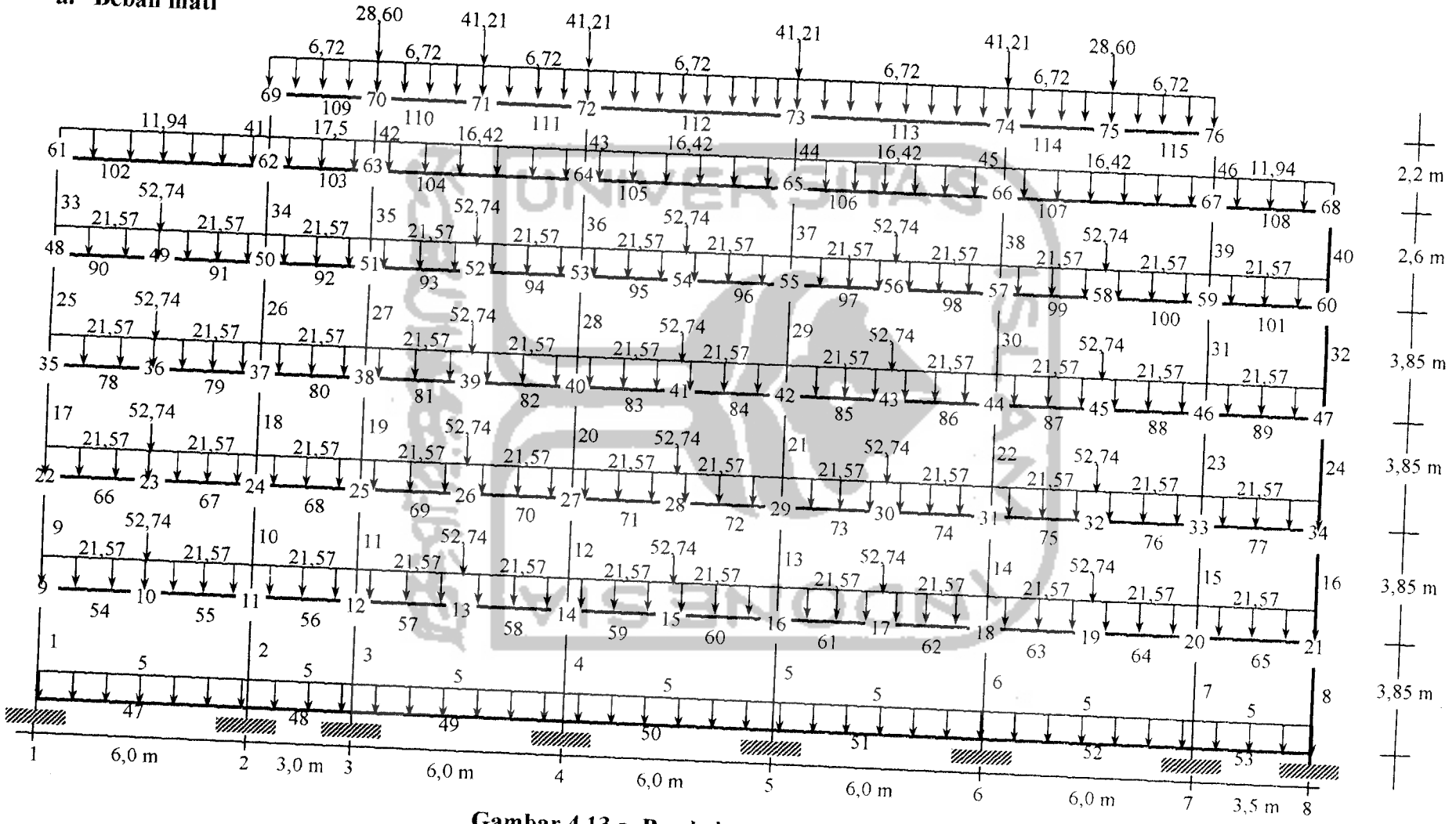
Elm	Jarak (m)	MD,k (KNm)	ML,k (KNm)	MEki (KNm)	MEka (KNm)	MU,k= 1.05(MD,k+ML,k+ωd ME,k) (KNm)	KETERANGAN
1	0	60.22	21.04	-961.562	956.403	1390.81	KOL BASEMEN
	1.92	-45.85	-14.07	-392.519	392.901	473.39	
	3.85	-151.91	-49.18	176.525	-170.601	-444.01	
2	0	-87.04	-27.92	-1132.06	1135.821	1429.69	KOL BASEMEN
	1.92	5.89	2.87	-302.961	301.335	420.52	
	3.85	98.81	33.67	526.141	-533.15	-588.65	
3	0	-9.48	-3.09	-727.672	728.626	981.38	KOL BASEMEN
	1.92	3.66	1.22	-194.928	195.723	272.29	
	3.85	16.80	5.54	337.817	-337.18	-436.79	
4	0	145.20	49.22	-382.788	388.417	734.33	KOLOM LT.1
	1.92	-4.05	-0.75	-23.622	11.903	11.21	
	3.85	-153.30	-50.72	335.545	-364.612	-711.92	
5	0	-128.17	-41.36	-890.199	878.91	1021.71	KOLOM LT.1
	1.92	-4.26	0.19	-19.981	29.487	35.98	
	3.85	119.64	41.74	850.238	-819.936	-949.76	
6	0	-25.08	-8.25	-565.603	566.237	737.92	KOLOM LT.1
	1.92	0.26	0.17	-15.017	12.204	17.11	
	3.85	25.61	8.59	535.569	-541.829	-703.69	
7	0	144.33	48.09	-258.813	222.428	505.66	KOLOM LT.2
	1.93	-12.00	-3.98	107.764	-52.349	-88.24	
	3.85	-168.34	-56.06	474.341	-327.125	-682.15	
8	0	-122.07	-37.28	-648.878	692.883	778.47	KOLOM LT.2
	1.93	3.85	6.15	20.347	-78.657	-96.87	
	3.85	129.77	49.57	689.572	-850.197	-972.21	
9	0	-29.07	-8.63	-420.94	414.449	526.14	KOLOM LT.2
	1.93	1.34	0.02	21.427	-17.403	-22.33	
	3.85	31.76	8.68	463.793	-449.256	-570.77	
10	0	128.58	42.94	0.867	166.231	407.00	KOLOM LT.3
	1.92	38.57	30.32	-220.013	-123.094	-95.69	
	3.65	-51.45	17.70	-440.893	-412.418	-598.39	
11	0	-91.60	-30.51	-650.02	358.288	360.85	KOLOM LT.3
	1.92	-41.45	-30.58	138.544	88.532	45.21	
	3.85	8.69	-30.66	927.107	-181.224	-270.44	
12	0	-38.15	-11.55	-395.678	363.061	443.39	KOLOM LT.3
	1.92	1.72	1.15	62.086	-103.305	-138.00	
	3.85	41.59	13.85	519.85	-569.672	-719.39	
13	0	248.83	119.44	-1069.4	1069.403	1846.42	KOLOM LT.4
	1.14	248.83	119.44	-775.756	775.756	1445.59	
	2.28	248.83	119.44	-482.108	482.108	1044.76	
14	0	-248.83	-119.44	0	0	-386.68	KOLOM LT.4
	1.14	-248.83	-119.44	0	0	-386.68	
	2.28	-248.83	-119.44	0	0	-386.68	
15	0	0	0	-482.108	482.108	658.08	KOLOM LT.4
	1.3	0	0	-241.054	241.054	329.04	
	2.6	0	0	0	0	0.00	
16	0	0	0	0	569.77	777.74	KOLOM LT.4
	1.3	0	0	0	284.88	388.86	
	2.6	0	0	0	0	0.00	

Tabel 4.13.d Gaya Geser Rencana Kolom Portal As.6,7-8 (K=2)

Elm	Jarak (m)	VD,k (KN)	VL,k (KN)	VE,k (KN)	VU,k = 1,05(VD,k+ VL,k+ ωd VE,k) (KN)	KETERANGAN
1	0	55.10	18.24	418.64	648.45	KOL BASEMEN
	1.92	55.10	18.24	418.64	648.45	
	3.85	55.10	18.24	418.64	648.45	
2	0	48.27	16.00	522.34	780.48	KOL BASEMEN
	1.92	48.27	16.00	522.34	780.48	
	3.85	48.27	16.00	522.34	780.48	
3	0	6.83	2.24	62.08	94.27	KOL BASEMEN
	1.92	6.83	2.24	62.08	94.27	
	3.85	6.83	2.24	62.08	94.27	
4	0	77.53	25.96	329.66	558.65	KOLOM LT.1
	1.92	77.53	25.96	329.66	558.65	
	3.85	77.53	25.96	329.66	558.65	
5	0	64.37	21.58	474.76	738.30	KOLOM LT.1
	1.92	64.37	21.58	474.76	738.30	
	3.85	64.37	21.58	474.76	738.30	
6	0	13.17	4.38	120.25	182.56	KOLOM LT.1
	1.92	13.17	4.38	120.25	182.56	
	3.85	13.17	4.38	120.25	182.56	
7	0	81.21	27.05	205.15	393.71	KOLOM LT.2
	1.93	81.21	27.05	205.15	393.71	
	3.85	81.21	27.05	205.15	393.71	
8	0	65.41	22.56	430.02	679.35	KOLOM LT.2
	1.93	65.41	22.56	430.02	679.35	
	3.85	65.41	22.56	430.02	679.35	
9	0	15.80	4.49	132.71	202.46	KOLOM LT.2
	1.93	15.80	4.49	132.71	202.46	
	3.85	15.80	4.49	132.71	202.46	
10	0	46.76	6.56	200.01	329.00	KOLOM LT.3
	1.92	46.76	6.56	200.01	329.00	
	3.85	46.76	6.56	200.01	329.00	
11	0	26.05	0.04	445.74	635.83	KOLOM LT.3
	1.92	26.05	0.04	445.74	635.83	
	3.85	26.05	0.04	445.74	635.83	
12	0	20.71	6.60	140.63	220.63	KOLOM LT.3
	1.92	20.71	6.60	140.63	220.63	
	3.85	20.71	6.60	140.63	220.63	
13	0	0	0	219.14	299.13	KOLOM LT.4
	1.14	0	0	219.14	299.13	
	2.28	0	0	219.14	299.13	
14	0	0	0	0	0	KOLOM LT.4
	1.14	0	0	0	0	
	2.28	0	0	0	0	
15	0	0	0	219.14	299.13	KOLOM LT.4
	1.3	0	0	219.14	299.13	
	2.6	0	0	219.14	299.13	
16	0	0	0	0	0	KOLOM LT.4
	1.3	0	0	0	0	
	2.6	0	0	0	0	

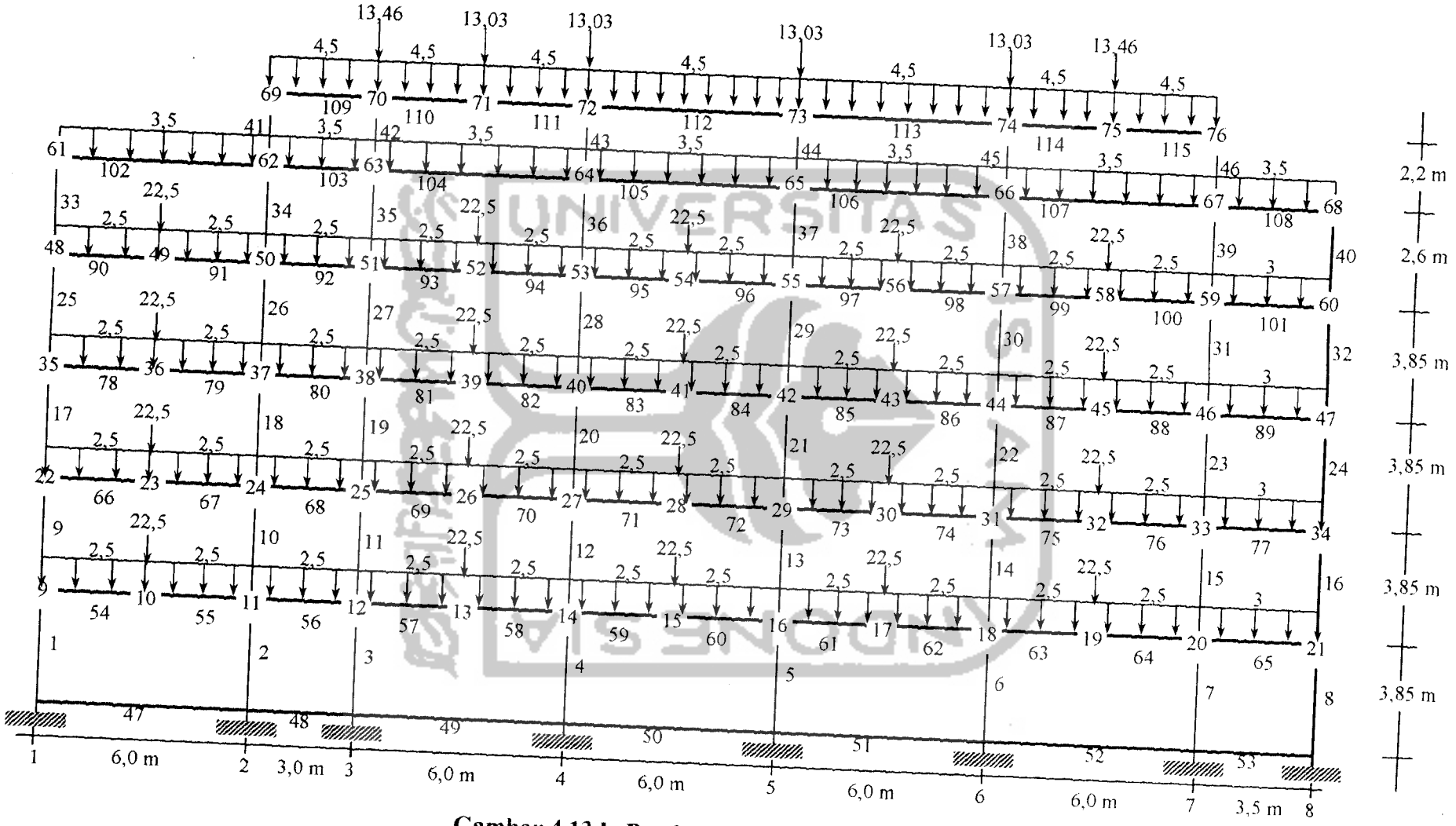
Pembebanan Poratal As A-D

a. Beban mati



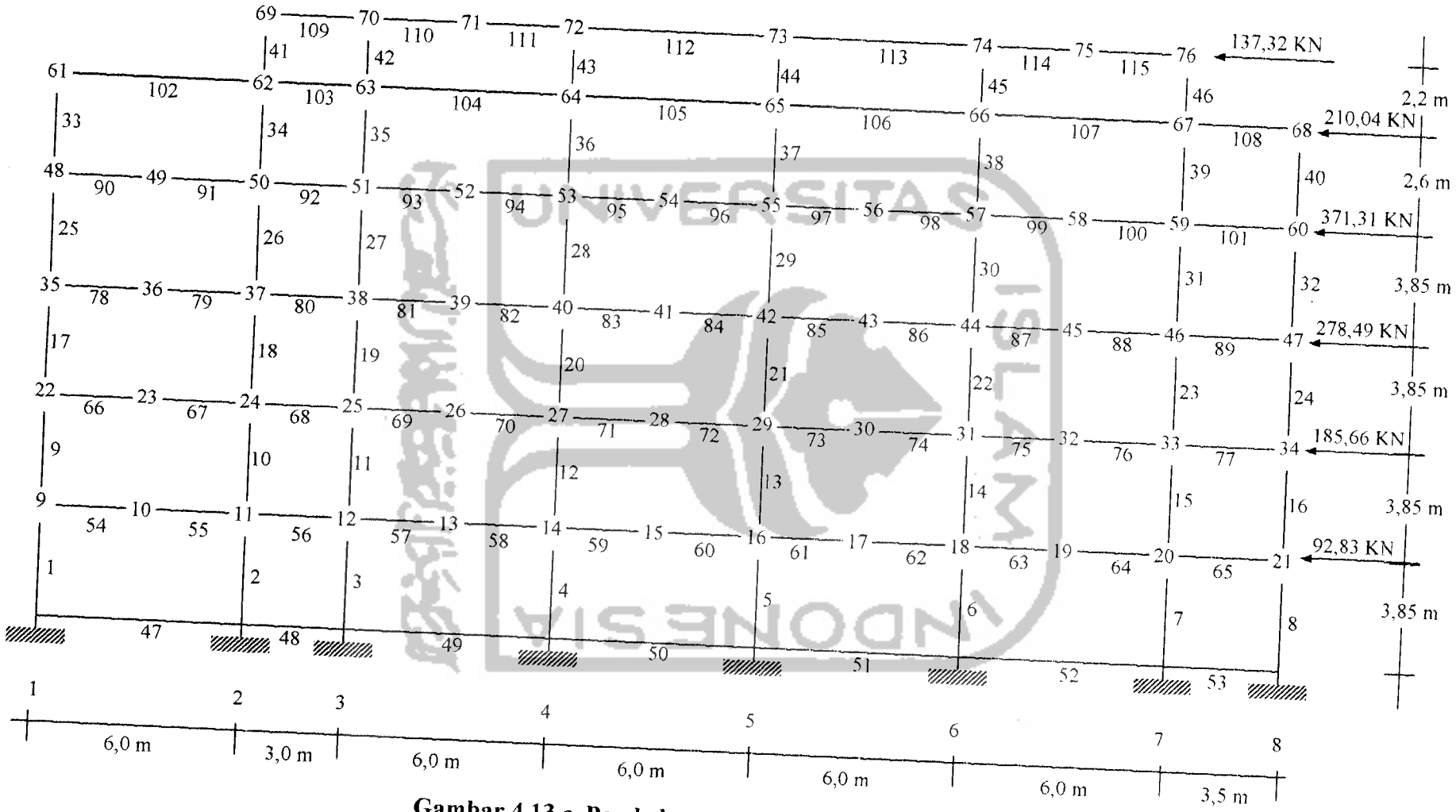
Gambar 4.13.a Pembebanan mati Poratal As A

b. Beban hidup



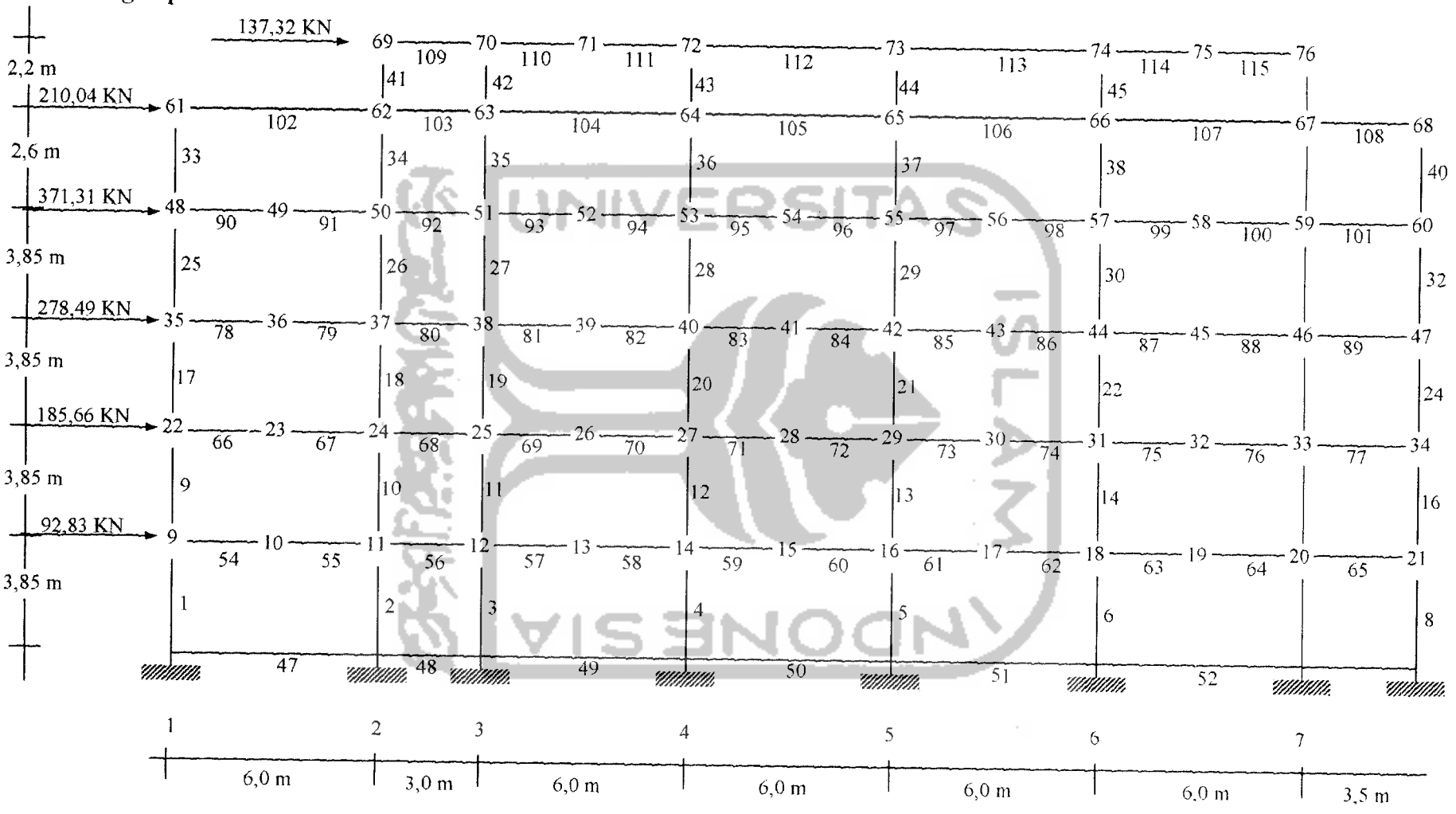
Gambar 4.13.b Pembebanan hidup Poratal As A

c. Beban gempa kanan



Gambar 4.13.c Pembebanan gempa kanan Poratal As A

d. Beban gempa kiri



Gambar 4.13.d Pembebanan gempa kiri Poratal As A

a. Beban mati

- Beban terdistribusi merata elemen 54 s/d 101

  Lantai : 2/3.1,5.4,26 = 4,26 KN/m

  Tembok: 2,5.3,85 = 9,63 KN/m

  Balok : 0,4.0,8.24 = 7,68 KN/m

  W_{D1} = 21,57 KN/m

- Beban terdistribusi merata elemen 102 & 108

  Lantai : 2/3.1,5.4,26 = 4,26 KN/m

  Balok : 0,4.0,8.24 = 7,68 KN/m

  W_{D2} = 11,94 KN/m

- Beban terdistribusi merata elemen 103 s/d 107

  Lantai : 2/3.1,5.4,26 = 4,26 KN/m

  Balok : 0,4.0,8.24 = 7,68 KN/m

  Tembok: 2,2.2,5 = 5,50 KN/m

  W_{D4} = 17,44 KN/m

- Beban terbagi merata elemen 109 s/d 115

  Lantai : 1,5.0,12.24 = 4,32 KN/m

  Balok : 0,25.0,4.24 = 2,40 KN/m

  W_{D5} = 6,72 KN/m

- Beban terpusat nodal 70, 75

  $P_{D1\ R\ KA3}$ = 28,5995 KN

- Beban terpusat nodal 71 s/d 74

  $P_{D2\ R\ KA1}$ = 41,2076 KN

- Beban terpusat nodal 10 s/d 19, 23 s/d 32, 36 s/d 45,49 s/d 56

  $P_{D3\ R\ balok\ anak}$ = 2.(2.1/2.3.1,5.4,26) + 0,25.0,4.24.6 = 52,74 KN

b. Beban hidup

- Beban terbagi merata elemen 54 s/d 64, 66 s/d 76, 78 s/d 88, 90 s/d 100

  W_{L1} = 2 / 3.1,5.2,5 = 2,5 KN/m

- Beban terbagi merata elemen 65, 77, 89, 101,

  W_{L2} = 2 / 3.1,5.3 = 3,0 KN/m

- Beban terbagi merata elemen 102 s/d 108

  W_{L3} = 2 / 3.1,75.3 = 3,5 KN/m

- Beban terbagi merata elemen 109 s/d 115

  W_{L4} = .1,5.3 = 4,5 KN/m

- Beban terpusat nodal 70, 75

  $P_{L1\ R\ KA3}$ = 13,4605 KN

- Beban terpusat nodal 71 s/d 74

  $P_{L2\ RKA1}$ = 13,0327 KN

- Beban terpusat nodal 10 s/d 19, 23 s/d 32, 36 s/d 45, 49 s/d 56

  $P_{L3\ R\ balok\ anak}$ = 2.(2.1/2.3.1,5.2,5) = 22,50 KN

c. Beban gempa

Reaksi atap : 4.41,2076 + 2.28,5995 = 222,03 KN

Plat atap : 1,5.27.0,12.24 = 116,64 KN

Balok ring : 0,4.0,8.9.3. 27 = 207,36 KN

Kolom : 6.0,45.0,7.2,6.24 = 99,79 KN

Beban hidup tereduksi: 0,6.(1,5.27.3) = 72,90 KN

Dibulatkan $W_{atap\ 1}$ = 718,72 KN

Plat atap (mangkok) : 3,5.36,5.0,12.24 = 367,92 KN

Kolom : 8.0,45.0,7.2,2.24 = 157,25 KN

Tembok : 2,5.2,6.30,5 = 198,25 KN

Balok ring : 0,4.0,8.36,5.24 = 280,32 KN

Beban hidup tereduksi: 0,6.(3,5.36,5.3) = 229,95 KN

Dibulatkan $W_{atap\ 2}$ = 1233,70 KN

- Berat lantai 4 (tipikal dengan lt. 3, 2,1)

Kolom : 8.0,45.0,7.3,85.24 = 232,85 KN

Lantai : 6.36,5.4,26 = 932,94 KN

Balok : 0,4.0,8.24.78,5 = 602,88 KN

Balok : 0,25.0,4.24.66 = 158,40 KN

Tembok : 2,5.3,85.30,5 = 293,56 KN

B.hidup tereduksi: 0,6(6.36,5.2,5) = 328,50 KN

. .

Dibulatkan W_4 = 2549,2 KN

W_{Total} : 718,72 + 1233,70 + 4.2549,20 = 12147,94 KN

Gaya geser untuk timgkat daktilitas penuh (K=1)

$V = C.I.K.W_T$

$= 0,07.1,5.1,0.12147,94 = 1275,64$ KN

distribusi gaya-gaya lateral akibat gempa

Tingkat	Wi (KN)	hi (m)	Wi hi (KNm)	Fi (KN)
Atap 1	718,72	20,20	14518,15	137,32
Atap 2	1233,70	18,00	22206,60	210,04
4	2549,20	15,40	39257,68	371,31
3	2549,20	11,55	29443,26	278,49
2	2549,20	7,70	19628,84	185,66
1	2549,20	3,85	9814,42	92,83
			134868,95	1275,64

Gaya geser untuk timgkat daktilitas terbatas (K=2)

$V = C.I.K.W_T$

$= 0,07.1,5.2,0.12147,94 = 2551,28$ KN

distribusi gaya-gaya lateral akibat gempa

Tingkat	Wi (KN)	hi (m)	Wi hi (KNm)	Fi (KN)
Atap 1	718,72	20,20	14518,15	274,44
Atap 2	1233,70	18,00	22206,60	420,08
4	2549,20	15,40	39257,68	742,62
3	2549,20	11,55	29443,26	556,98
2	2549,20	7,70	19628,84	371,32
1	2549,20	3,85	9814,42	185,66
			134868,95	2551,28

Tabel 4.14.a Momen Rencana Balok Portal As A - D (K=1)

ELM	Jarak (m)	MD (KNm)	ML (KNm)	M.GEMPA (KNm)		1.2MD + 1.6ML (KNm)	0.9(MD ± ME) (KNm)		1.05(MD+0.6ML ± ME) (KNm)		KET
				KIRI	KANAN		KIRI	KANAN	KIRI	KANAN	
54	0	-45.96	-13.51	204.45	-202.00	-76.77	142.64	-223.16	157.90	-268.87	blk. lt.1
	1.5	10.47	2.95	108.92	-107.55	17.27	107.45	-87.37	127.21	-100.08	
	3	35.24	10.97	13.39	-13.09	59.83	43.77	19.93	57.97	30.16	
55	0	35.24	10.97	13.39	-13.09	59.83	43.77	19.93	57.97	30.16	blk. lt.1
	1.5	8.17	2.41	-82.14	81.36	13.65	-66.57	80.58	-76.15	95.53	
	3	-50.56	-14.59	-177.67	175.82	-84.01	-205.40	112.73	-248.83	122.33	
56	0	-24.47	-5.38	265.01	-262.92	-37.98	216.48	-258.65	**249.17**	-305.16	blk. lt.1
	1.5	0.91	-0.64	-1.06	1.14	0.06	-0.13	1.84	-0.56	1.74	
	3	-27.02	-4.34	-267.12	265.19	-39.36	-264.73	214.36	**-311.58**	247.35	
57	0	-72.96	-13.62	165.15	-164.31	-109.34	82.97	-213.55	88.22	-257.72	blk. lt.1
	1.5	14.33	2.53	80.41	-79.94	21.25	85.26	-59.05	101.07	-67.29	
	3	48.31	10.24	-4.34	4.44	74.36	39.58	47.48	52.62	61.84	
58	0	48.31	10.24	-4.34	4.44	74.36	39.58	47.48	52.62	61.84	*blk. lt.1*
	1.5	6.79	1.37	-89.08	88.82	12.75	-72.26	87.65	-83.44	103.36	
	2.5	-84.04	-15.93	-173.83	173.19	-126.33	-232.08	80.24	-280.79	83.58	
59	0	-80.93	-15.23	178.42	-178.26	-121.48	87.74	-233.27	92.77	-281.74	blk. lt.1
	1.5	8.94	1.44	89.36	-89.22	13.03	88.48	-72.25	104.13	-83.38	
	3	45.50	9.67	0.31	-0.18	70.07	41.23	40.79	54.19	53.68	
60	0	45.50	9.67	0.31	-0.18	70.07	41.23	40.79	54.19	53.68	blk. lt.1
	1.5	8.56	1.32	-88.75	88.86	12.38	-72.17	87.68	-83.36	103.12	
	3	-81.69	-15.47	-177.80	177.90	-122.78	-233.54	86.59	-282.21	91.27	
61	0	-80.54	-15.20	177.51	-178.12	-120.97	87.28	-232.79	92.25	-281.17	blk. lt.1
	1.5	9.15	1.46	88.68	-88.91	13.31	88.05	-71.78	103.64	-82.83	
	3	45.53	9.68	-0.16	0.29	70.12	40.83	41.24	53.73	54.21	
62	0	45.53	9.68	-0.16	0.29	70.12	40.83	41.24	53.73	54.21	blk. lt.1
	1.5	8.41	1.32	-89.00	89.50	12.21	-72.53	88.12	-83.79	103.64	
	3	-82.02	-15.48	-177.84	178.71	-123.18	-233.87	87.02	-282.60	91.77	
63	0	-82.28	-15.45	173.65	-174.96	-123.46	82.23	-231.52	86.20	-279.83	blk. lt.1
	1.25	9.52	1.60	88.52	-89.13	13.99	88.24	-71.64	103.95	-82.57	
	2.5	46.01	10.22	3.38	-3.29	73.96	46.26	40.25	60.40	53.39	
64	0	46.01	10.22	3.38	-3.29	73.96	46.26	40.25	60.40	53.39	*blk. lt.1*
	1.5	13.01	2.25	-81.75	82.54	19.21	-61.87	85.99	-70.76	101.74	
	3	-75.31	-14.15	-166.89	168.37	-113.02	-217.98	83.76	-263.22	88.80	
65	0	-31.58	-4.51	243.64	-246.49	-45.10	190.86	-250.26	219.83	-294.81	blk. lt.1
	1.5	8.81	0.73	-2.18	2.34	11.73	5.97	10.03	7.42	12.16	
	3	-15.22	-2.08	-248.00	251.16	-21.59	-236.89	212.35	-277.68	246.43	
66	0	-48.02	-14.11	206.41	-204.28	-80.19	142.55	-227.06	157.42	-273.80	blk. lt.2
	1.75	8.96	2.51	108.72	-107.54	14.76	105.91	-88.73	125.14	-101.94	
	3.5	34.27	10.69	11.03	-10.81	58.22	40.77	21.12	54.30	31.37	
67	0	34.27	10.69	11.03	-10.81	58.22	40.77	21.12	54.30	31.37	blk. lt.2
	1.5	7.74	2.29	-86.66	85.93	12.95	-71.03	84.31	-81.42	99.80	
	3	-50.44	-14.55	-184.35	182.67	-83.81	-211.31	119.00	-255.70	129.67	
68	0	-26.11	-5.40	266.49	-264.56	-39.98	216.34	-261.60	248.99	**-308.60**	blk. lt.2
	1.25	2.30	-0.28	-0.53	0.62	2.31	1.59	2.63	1.68	2.89	
	2.5	-22.61	-3.59	-267.55	265.80	-32.88	-261.15	218.87	-306.93	**253.09**	
69	0	-75.11	-14.10	174.55	-173.73	-112.69	89.49	-223.96	95.53	-270.17	blk. lt.2
	1.5	13.11	2.26	85.58	-85.12	19.34	88.82	-64.81	105.04	-74.19	
	3	48.02	10.17	-3.40	3.50	73.90	40.16	46.36	53.26	60.50	

Lanjutan Tabel 4.14.a Momen Rencana Balok Portal As A-D (K=1)

ELM	Jarak (m)	MD (KNm)	ML (KNm)	M.GEMPA (KNm)		1.2MD + 1.6ML (KNm)	0.9(MD ± ME) (KNm)		1.05(MD+0.6ML ± ME) (KNm)		KET
				KIRI	KANAN		KIRI	KANAN	KIRI	KANAN	
70	0	48.02	10.17	-3.40	3.50	73.90	40.16	46.36	53.26	60.50	blk. lt.2
	1.5	9.43	1.51	-92.37	92.11	13.73	-74.65	91.38	-86.14	107.57	
	3	-82.48	-15.59	-181.35	180.72	-123.92	-237.44	88.42	-286.83	93.34	
71	0	-80.18	-15.07	182.30	-182.13	-120.34	91.91	-236.08	97.73	-284.93	blk. lt.2
	1.5	9.38	1.53	91.20	-91.05	13.70	90.52	-73.51	106.57	-84.80	
	3	45.63	9.69	0.09	0.03	70.26	41.14	41.09	54.11	54.04	
72	0	45.63	9.69	0.09	0.03	70.26	41.14	41.09	54.11	54.04	blk. lt.2
	1.5	8.38	1.28	-91.02	91.10	12.09	-74.38	89.53	-85.97	105.26	
	3	-82.19	-15.58	-182.12	182.18	-123.55	-237.88	90.00	-287.34	95.18	
73	0	-80.81	-15.31	181.89	-182.40	-121.47	90.97	-236.89	96.48	-286.01	blk. lt.2
	1.5	9.08	1.41	90.95	-91.15	13.15	90.03	-73.87	105.92	-85.29	
	3	45.64	9.70	0.02	0.10	70.30	41.10	41.17	54.06	54.14	
74	0	45.64	9.70	0.02	0.10	70.30	41.10	41.17	54.06	54.14	blk. lt.2
	1.5	8.72	1.41	-90.91	91.34	12.72	-73.97	90.05	-85.41	105.95	
	3	-81.53	-15.31	-181.84	182.59	-122.33	-237.03	90.96	-286.18	96.47	
75	0	-80.53	-14.99	180.37	-181.54	-120.61	89.86	-235.86	95.39	-284.61	blk. lt.2
	1.5	10.32	1.82	91.44	-91.97	15.30	91.58	-73.49	107.99	-84.59	
	3	47.86	10.18	2.50	-2.41	73.73	45.33	40.90	59.30	54.14	
76	0	47.86	10.18	2.50	-2.41	73.73	45.33	40.90	59.30	54.14	blk. lt.2
	1.5	11.90	1.97	-86.43	87.15	17.43	-67.08	89.15	-77.01	105.25	
	3	-77.38	-14.68	-175.36	176.72	-116.34	-227.46	89.41	-274.62	95.06	
77	0	-25.74	-3.26	241.89	-244.37	-36.11	194.54	-243.10	224.91	-265.67	blk. lt.2
	1.75	9.25	0.85	-2.53	2.67	12.46	6.05	10.73	7.59	13.05	
	3.5	-20.17	-3.08	-246.95	249.70	-29.12	-240.41	206.58	-282.42	239.07	
78	0	-48.63	-14.24	177.71	-175.40	-81.14	116.17	-201.63	126.56	-244.21	blk. lt.3
	1.5	8.70	2.46	93.56	-92.27	14.37	92.03	-75.21	108.92	-86.20	
	3	34.36	10.73	9.41	-9.13	58.40	39.39	22.71	52.72	33.25	
79	0	34.36	10.73	9.41	-9.13	58.40	39.39	22.71	52.72	33.25	blk. lt.3
	1.5	8.19	2.41	-74.74	74.01	13.69	-59.90	73.98	-68.36	87.83	
	3	-49.64	-14.34	-158.90	157.15	-82.51	-187.68	96.76	-226.00	103.65	
80	0	-29.64	-6.26	212.81	-211.03	-45.57	164.86	-216.60	188.39	-256.64	blk. lt.3
	1.5	1.93	-0.36	-0.55	0.63	1.73	1.24	2.30	1.22	2.45	
	3	-19.82	-2.91	-213.91	212.28	-28.44	-210.36	173.21	-247.25	**200.25**	
81	0	-75.73	-14.23	151.31	-150.51	-113.64	68.02	-203.62	70.40	-246.52	blk. lt.3
	1.5	12.90	2.21	74.43	-73.98	19.02	78.59	-54.97	93.09	-62.74	
	3	48.21	10.21	-2.46	2.56	74.20	41.18	45.69	54.48	59.74	
82	0	48.21	10.21	-2.46	2.56	74.20	41.18	45.69	54.48	59.74	blk. lt.3
	1.5	10.03	1.64	-79.34	79.09	14.66	-62.38	80.21	-71.74	94.61	
	3	-81.46	-15.38	-156.23	155.62	-122.36	-213.92	66.74	**-259.26**	68.18	
83	0	-79.99	-15.03	154.34	-154.19	-120.03	66.91	-210.76	68.60	-255.35	blk. lt.3
	1.5	9.47	1.55	77.17	-77.04	13.64	77.98	-60.81	91.95	-69.97	
	3	45.62	9.69	0.00	0.11	70.24	41.06	41.16	54.00	54.12	
84	0	45.62	9.69	0.00	0.11	70.24	41.06	41.16	54.00	54.12	blk. lt.3
	1.5	8.27	1.25	-77.16	77.26	11.91	-62.01	76.97	-71.56	90.59	
	3	-82.40	-15.63	-154.33	154.41	-123.89	-213.06	64.81	-258.41	65.76	
85	0	-80.88	-15.39	154.17	-154.72	-121.68	65.96	-212.04	67.26	-257.08	blk. lt.3
	1.5	9.04	1.38	77.12	-77.33	13.06	77.54	-61.46	91.33	-70.83	
	3	45.65	9.71	0.06	0.06	70.32	41.14	41.14	54.11	54.12	

Lanjutan Tabel 4.14.a Momen Rencana Balok Portal As A-D (K=1)

ELM	Jarak (m)	MD (KNm)	ML (KNm)	M.GEMPA (KNm)		1.2MD + 1.6ML (KNm)	0.9(MD ± ME) (KNm)		1.05(MD+0.6ML ± ME) (KNm)		KET
				KIRI	KANAN		KIRI	KANAN	KIRI	KANAN	
86	0	45.65	9.71	0.06	0.06	70.32	41.14	41.14	54.11	54.12	blk. lt.3
	1.5	8.76	1.46	-77.00	77.45	12.86	-61.41	77.59	-70.72	91.45	
	3	-81.44	-15.22	-154.06	154.84	-122.08	-211.94	66.06	-256.86	67.48	
87	0	-79.12	-14.62	154.63	-155.84	-118.34	67.95	-211.46	70.07	-255.92	blk. lt.3
	1.5	11.11	2.02	78.19	-78.75	16.55	80.36	-60.88	95.03	-69.75	
	3	48.02	10.22	1.75	-1.66	73.97	44.79	41.73	58.69	55.12	
88	0	48.02	10.22	1.75	-1.66	73.97	44.79	41.73	58.69	55.12	blk. lt.3
	1.5	11.44	1.84	-74.69	75.43	16.67	-56.93	78.19	-65.26	92.37	
	3	-78.45	-14.98	-151.13	152.53	-118.11	-206.63	66.66	-250.50	68.34	
89	0	-22.68	-2.55	193.47	-196.01	-31.30	153.71	-196.83	177.72	-231.24	blk. lt.3
	1.75	9.27	0.86	-2.82	2.97	12.50	5.81	11.01	7.32	13.39	
	3.5	-23.19	-3.77	-199.10	201.95	-33.85	-200.06	160.88	-235.78	185.32	
90	0	-50.01	-14.77	113.89	-113.86	-83.65	57.49	-147.49	57.76	-181.37	blk. lt.4
	1.5	7.71	2.10	59.05	-59.04	12.61	60.06	-46.20	71.42	-52.57	
	3	33.77	10.54	4.22	-4.22	57.39	34.19	26.59	46.53	37.67	
91	0	33.77	10.54	4.22	-4.22	57.39	34.19	26.59	46.53	37.67	blk. lt.4
	1.5	7.99	2.40	-50.62	50.60	13.43	-38.37	52.73	-43.25	63.03	
	3	-49.45	-14.17	-105.45	105.43	-82.02	-139.41	50.38	-171.58	49.84	
92	0	-31.07	-6.72	124.13	-124.48	-48.03	83.76	-139.99	93.48	-167.55	blk. lt.4
	1.5	2.51	-0.27	-0.02	0.01	2.58	2.24	2.26	2.44	2.47	
	3	-17.23	-2.26	-124.18	124.50	-24.29	-127.27	96.54	-149.90	111.20	
93	0	-76.76	-14.38	103.67	-103.61	-115.12	24.22	-162.33	19.20	-198.44	blk. lt.4
	1.5	12.39	2.16	51.41	-51.37	18.32	57.42	-35.08	68.35	-39.57	
	3	48.23	10.25	-0.86	0.87	74.28	42.63	44.19	56.20	58.01	
94	0	48.23	10.25	-0.86	0.87	74.28	42.63	44.19	56.20	58.01	blk. lt.4
	1.5	10.56	1.78	-53.13	53.11	15.51	-38.31	57.31	-43.57	67.97	
	3	-80.42	-15.14	-105.39	105.35	-120.73	-167.22	22.44	-204.64	16.64	
95	0	-79.87	-15.06	100.40	-100.41	-119.95	18.47	-162.26	12.06	-198.79	blk. lt.4
	1.5	9.52	1.52	50.09	-50.10	13.86	53.66	-36.52	63.56	-41.65	
	3	45.61	9.67	-0.21	0.21	70.20	40.86	41.23	53.76	54.20	
96	0	45.61	9.67	-0.21	0.21	70.20	40.86	41.23	53.76	54.20	blk. lt.4
	1.5	8.19	1.24	-50.51	50.52	11.82	-38.09	52.84	-43.65	62.43	
	3	-82.54	-15.63	-100.81	100.83	-124.05	-165.02	16.46	-202.36	9.36	
97	0	-81.04	-15.43	100.91	-100.92	-121.93	17.88	-163.76	11.15	-200.77	blk. lt.4
	1.5	8.97	1.35	50.52	-50.53	12.92	53.54	-37.40	63.31	-42.79	
	3	45.66	9.69	0.14	-0.14	70.28	41.21	40.97	54.18	53.89	
98	0	45.66	9.69	0.14	-0.14	70.28	41.21	40.97	54.18	53.89	blk. lt.4
	1.5	8.85	1.44	-50.25	50.25	12.93	-37.26	53.19	-42.56	62.96	
	3	-81.27	-15.24	-100.63	100.64	-121.91	-163.72	17.43	-200.60	10.73	
99	0	-78.00	-14.24	103.88	-103.87	-116.38	23.29	-163.68	18.20	-199.93	blk. lt.4
	1.5	11.71	2.24	52.12	-52.12	17.64	57.45	-36.37	68.44	-41.02	
	3	48.11	10.29	0.37	-0.37	74.19	43.62	42.96	57.37	56.60	
100	0	48.11	10.29	0.37	-0.37	74.19	43.62	42.96	57.37	56.60	blk. lt.4
	1.5	11.00	1.75	-51.39	51.38	16.01	-36.35	56.14	-41.30	66.61	
	3	-79.41	-15.22	-103.15	103.13	-119.64	-164.30	21.34	-201.27	15.32	
101	0	-19.76	-1.85	112.29	-112.05	-26.67	83.28	-118.62	95.99	-139.56	blk. lt.4
	1.75	8.96	0.69	-2.15	2.19	11.85	6.13	10.03	7.59	12.14	
	3.5	-26.74	-4.81	-116.58	116.43	-39.78	-128.99	80.72	-153.51	91.14	

Lanjutan Tabel 4.14.a Momen Rencana Balok Portal As A-D (K=1)

ELM	Jarak (m)	MD (KNm)	ML (KNm)	M.GEMPA (KNm)		1.2MD + 1.6ML (KNm)	0.9(MD ± ME) (KNm)		1.05(MD+0.6ML ± ME) (KNm)		KET
				KIRI	KANAN		KIRI	KANAN	KIRI	KANAN	
102	0	-28.52	-8.75	59.72	-61.01	-48.22	28.08	-80.57	27.25	-99.51	blk. nok
	3	18.76	5.79	0.59	-0.95	31.77	17.41	16.03	23.96	22.35	
	6	-32.25	-10.06	-58.55	59.11	-54.78	-81.71	24.18	-101.67	21.87	
103	0	-25.69	-7.79	47.82	-48.05	-43.30	19.92	-66.37	18.32	-82.34	blk. nok
	1.5	1.96	1.34	-0.58	0.60	4.51	1.25	2.31	2.30	3.54	
	3	2.61	0.36	-48.97	49.26	3.71	-41.72	46.69	-48.45	54.69	
104	0	-49.92	-10.69	63.26	-63.20	-77.00	12.01	-101.80	7.27	-125.50	blk. nok
	3	25.33	5.06	0.30	-0.29	38.49	23.06	22.54	30.09	29.48	
	6	-47.20	-9.57	-62.67	62.62	-71.95	-96.68	13.68	-121.39	10.16	
105	0	-46.18	-9.40	55.23	-55.23	-70.45	8.14	-91.27	3.58	-112.40	blk. nok
	3	25.19	5.22	-0.12	0.11	**39.58**	22.56	22.77	29.61	29.86	
	6	-51.22	-10.53	-55.46	55.46	-78.32	-96.02	3.81	-118.66	-2.19	
106	0	-50.78	-11.01	55.55	-55.54	-78.56	4.30	-95.69	-1.92	-118.57	blk. nok
	3	25.12	5.28	0.04	-0.05	38.58	22.64	22.56	29.74	29.65	
	6	-46.77	-8.81	-55.47	55.45	-70.22	-92.01	7.81	-112.90	3.57	
107	0	-45.04	-9.01	60.06	-60.06	-68.46	13.52	-94.58	10.10	-116.03	blk. nok
	3	25.16	4.92	-0.28	0.29	38.06	22.39	22.91	29.22	29.82	
	6	-52.43	-11.53	-60.62	60.64	-81.36	-101.74	7.39	**-125.96**	1.36	
108	0	-0.32	0.50	42.08	-41.21	0.42	37.59	-37.38	44.17	-43.29	blk. nok
	1.75	6.84	2.11	-1.68	1.30	11.58	4.65	7.33	6.75	9.88	
	3.5	-17.23	-4.32	-45.44	43.81	-27.60	-56.41	23.92	-68.53	25.19	
109	0	-9.56	-2.58	24.17	-23.04	-15.60	13.15	-29.34	13.71	-35.86	blk. atap
	1.5	0.03	0.19	5.23	-5.07	0.34	4.73	-4.53	5.64	-5.17	
	3	-19.00	-8.85	-13.71	12.91	-36.96	-29.44	-5.48	-39.92	-11.97	
110	0	-64.85	-23.37	37.74	-37.32	-115.20	-24.40	-91.94	-43.18	**-121.99**	blk. atap
	1.5	9.52	3.94	19.45	-19.22	17.74	26.08	-8.72	32.91	-7.69	
	3	55.27	19.44	1.17	-1.12	**97.43**	50.80	48.74	71.51	69.11	
111	0	55.27	19.44	1.17	-1.12	97.43	50.80	48.74	71.51	69.11	blk. atap
	1.5	10.59	3.58	-17.12	16.98	18.44	-5.68	24.81	-4.60	31.20	
	3	-62.72	-24.09	-35.40	35.08	-113.81	-88.30	-24.87	-118.20	-44.20	
112	0	-43.75	-17.96	26.77	-26.70	-81.23	-15.28	-63.40	-29.14	-85.28	blk. atap
	3	17.42	7.33	-0.37	0.42	32.63	15.35	16.06	22.52	23.35	
	6	-35.89	-14.64	-27.50	27.54	-66.49	-57.06	-7.51	-75.79	-17.99	
113	0	-36.74	-15.26	27.39	-27.65	-68.50	-8.41	-57.95	-19.43	-77.22	blk. atap
	3	18.02	7.28	0.40	-0.34	33.26	16.58	15.91	23.92	23.14	
	6	-41.70	-17.44	-26.59	26.96	-77.95	-61.47	-13.27	-82.70	-26.47	
114	0	-55.55	-25.29	33.69	-34.45	-107.14	-19.68	-81.00	-38.89	-110.44	blk. atap
	1.5	9.54	3.54	15.87	-16.17	17.11	22.87	-5.97	28.91	-4.73	
	3	46.02	20.55	-1.96	2.11	88.11	39.66	43.31	59.22	63.48	
115	0	46.02	20.55	-1.96	2.11	88.11	39.66	43.31	59.22	63.48	blk. atap
	1.5	10.98	5.57	-19.78	20.39	22.08	-7.92	28.23	-5.73	36.44	
	3	-52.69	-21.23	-37.60	38.67	-97.20	-81.26	-12.62	-108.18	-28.10	

Tabel 4.14.b Gaya Geser Rencana Balok Portal As.A-D (K=1)

Elm	Jarak (m)	$V_{D,B}$ (KN)	$V_{L,B}$ (KN)	$V_{E,B}$ (KN)	$V_{G,B}$ (KN)	$M_{KAP,B}$	$M'_{KAP,B}$	V_{UB}= 0,7($M_{KAP,B}$ + $M'_{KAP,B}$) /Ln+1,05.$V_{G,B}$ (KN)	$V_{U,b}$ terpakai	V_{UB} maks (KN)	KET
54	0	48.17	13.78	62.97	61.96	459.96	284.25	111.16	102.33	329.52	blk. lt.1
	1.5	27.07	8.16	62.97	35.23	459.96	284.25	83.09	74.26	301.46	
	3	5.96	2.53	62.97	8.50	459.96	284.25	55.02	46.19	273.39	
55	0	7.49	2.89	62.97	10.39	459.96	284.25	57.01	48.18	275.38	blk. lt.1
	1.5	28.60	8.52	62.97	37.12	459.96	284.25	85.08	76.25	303.44	
	3	49.70	14.14	62.97	63.85	459.96	284.25	113.14	104.31	331.51	
56	0	34.69	5.97	176.04	40.67	459.96	284.25	88.80	79.97	782.06	blk. lt.1
	1.5	0.85	0.35	176.04	1.20	459.96	284.25	47.36	38.53	740.62	
	3	36.39	5.28	176.04	41.67	459.96	284.25	89.85	81.02	783.11	
57	0	75.97	13.58	56.25	89.55	459.96	284.25	140.12	131.29	330.28	blk. lt.1
	1.5	40.43	7.95	56.25	48.38	459.96	284.25	96.90	88.07	287.05	
	3	4.88	2.33	56.25	7.21	459.96	284.25	53.67	44.84	243.82	
58	0	6.57	3.10	56.25	11.67	459.96	284.25	58.36	49.53	248.51	blk. lt.1
	1.5	44.12	8.73	56.25	52.84	459.96	284.25	101.58	92.75	291.74	
	3	79.66	14.35	56.25	94.01	459.96	284.25	144.81	135.98	334.96	
59	0	77.69	13.92	59.36	91.61	459.96	284.25	142.29	133.46	345.50	blk. lt.1
	1.5	42.14	8.30	59.36	50.44	459.96	284.25	99.07	90.24	302.27	
	3	6.60	2.67	59.36	9.28	459.96	284.25	55.84	47.01	259.05	
60	0	6.86	2.75	59.36	9.61	459.96	284.25	56.19	47.36	259.40	blk. lt.1
	1.5	42.40	8.38	59.36	50.78	459.96	284.25	99.42	90.59	302.62	
	3	77.94	14.00	59.36	91.94	459.96	284.25	142.64	133.81	345.85	
61	0	77.57	13.92	59.47	91.48	459.96	284.25	142.16	133.33	345.84	blk. lt.1
	1.5	42.02	8.29	59.47	50.32	459.96	284.25	98.93	90.10	302.61	
	3	6.48	2.67	59.47	9.15	459.96	284.25	55.71	46.88	259.38	
62	0	6.97	2.76	59.47	9.73	459.96	284.25	56.32	47.49	260.00	blk. lt.1
	1.5	42.52	8.39	59.47	50.90	459.96	284.25	99.55	90.72	303.23	
	3	78.06	14.01	59.47	92.07	459.96	284.25	142.77	133.94	346.45	
63	0	78.97	14.18	57.22	93.15	459.96	284.25	143.91	135.08	338.14	blk. lt.1
	1.5	43.43	8.56	57.22	51.99	459.96	284.25	100.69	91.86	294.92	
	3	7.89	2.93	57.22	10.82	459.96	284.25	57.46	48.63	251.69	
64	0	5.57	2.50	57.22	8.06	459.96	284.25	54.57	45.74	248.80	blk. lt.1
	1.5	41.11	8.12	57.22	49.23	459.96	284.25	97.79	88.96	292.02	
	3	76.65	13.75	57.22	90.40	459.96	284.25	141.02	132.19	335.25	
65	0	41.48	5.29	142.19	46.77	459.96	284.25	95.21	86.38	646.29	blk. lt.1
	1.5	4.67	0.69	142.19	5.37	459.96	284.25	51.74	42.91	602.82	
	3	32.13	3.90	142.19	36.03	459.96	284.25	83.94	75.11	635.02	
66	0	48.53	13.89	64.49	62.42	610.58	426.37	129.78	117.48	336.41	blk. lt.2
	1.5	27.43	8.27	64.49	35.69	610.58	426.37	101.71	89.41	308.34	
	3	6.32	2.64	64.49	8.96	610.58	426.37	73.65	61.35	280.27	
67	0	7.13	2.79	64.49	9.92	610.58	426.37	74.65	62.35	281.28	blk. lt.2
	1.5	28.24	8.41	64.49	36.65	610.58	426.37	102.72	90.42	309.34	
	3	49.34	14.04	64.49	63.38	610.58	426.37	130.78	118.48	337.41	
68	0	36.71	6.23	176.79	42.94	610.58	426.37	109.32	97.02	787.58	blk. lt.2
	1.5	1.17	0.60	176.79	1.77	610.58	426.37	66.10	53.80	744.36	
	3	34.38	5.02	176.79	39.40	610.58	426.37	105.60	93.30	783.86	
69	0	76.59	13.72	59.08	90.30	610.58	426.37	159.05	146.75	342.93	blk. lt.2
	1.5	41.04	8.09	59.08	49.13	610.58	426.37	115.83	103.53	299.71	
	3	5.50	2.47	59.08	7.97	610.58	426.37	72.60	60.30	256.48	

Lanjutan Tabel 4.14.b Gaya Geser Rencana Balok Portal As.A-D (K=1)

Elm	Jarak (m)	$V_{D,B}$ (KN)	$V_{L,B}$ (KN)	$V_{E,B}$ (KN)	$V_{G,B}$ (KN)	$M_{KAP,B}$	$M'_{KAP,B}$	V_{UB}= 0,7(MKAP,B + M'KAP,B) /Ln+1,05.VG,B (KN)	$V_{U,b}$ terpakai	V_{UB} maks (KN)	KET
70	0	7.96	2.96	59.08	10.92	610.58	426.37	75.70	63.40	259.58	blk. lt.2
	1.5	43.50	8.59	59.08	52.09	610.58	426.37	118.93	106.63	302.81	
	3	79.04	14.21	59.08	93.25	610.58	426.37	**162.15**	149.85	346.03	
71	0	77.48	13.88	60.72	91.36	610.58	426.37	160.16	147.86	350.95	blk. lt.2
	1.5	41.94	8.26	60.72	50.19	610.58	426.37	116.94	104.64	307.72	
	3	6.39	2.63	60.72	9.02	610.58	426.37	73.71	61.41	264.50	
72	0	7.06	2.80	60.72	9.86	610.58	426.37	74.59	62.29	265.37	blk. lt.2
	1.5	42.60	8.42	60.72	51.03	610.58	426.37	117.81	105.51	308.60	
	3	78.15	14.05	60.72	92.20	610.58	426.37	161.04	148.74	351.82	
73	0	77.69	13.96	60.83	91.66	610.58	426.37	160.48	148.18	351.73	blk. lt.2
	1.5	42.15	8.34	60.83	50.49	610.58	426.37	117.25	104.95	308.51	
	3	6.61	2.71	60.83	9.32	610.58	426.37	74.02	61.72	265.28	
74	0	6.85	2.71	60.83	9.56	610.58	426.37	74.27	61.97	265.53	blk. lt.2
	1.5	42.39	8.34	60.63	50.73	610.58	426.37	117.50	105.20	308.76	
	3	77.93	13.96	60.83	91.90	610.58	426.37	160.73	148.43	351.99	
75	0	78.34	14.02	59.71	92.35	610.58	426.37	161.21	148.91	347.75	blk. lt.2
	1.5	42.80	8.39	59.71	51.19	610.58	426.37	117.98	105.68	304.52	
	3	7.25	2.77	59.71	10.02	610.58	426.37	74.75	62.45	261.30	
76	0	6.20	2.66	59.71	8.87	610.58	426.37	73.55	61.25	260.09	blk. lt.2
	1.5	41.75	8.29	59.71	50.03	610.58	426.37	116.77	104.47	303.31	
	3	77.29	13.91	59.71	91.20	610.58	426.37	160.00	147.70	346.54	
77	0	38.40	4.65	141.16	43.05	610.58	426.37	109.43	97.13	638.09	blk. lt.2
	1.75	1.59	0.05	141.16	1.65	610.58	426.37	65.96	53.66	594.62	
	3.5	35.22	4.54	141.16	39.76	610.58	426.37	105.98	93.68	634.63	
78	0	48.77	13.95	55.43	62.72	459.96	284.25	111.95	103.12	298.64	blk. lt.3
	1.5	27.67	8.32	55.43	35.99	459.96	284.25	83.89	75.06	270.57	
	3	6.56	2.70	55.43	9.26	459.96	284.25	55.82	46.99	242.50	
79	0	6.90	2.73	55.43	9.63	459.96	284.25	56.21	47.38	242.89	blk. lt.3
	1.5	28.00	8.36	55.43	36.36	459.96	284.25	84.27	75.44	270.96	
	3	49.11	13.98	55.43	63.09	459.96	284.25	112.34	103.51	299.02	
80	0	38.81	6.74	141.10	45.56	459.96	284.25	93.94	85.11	640.46	blk. lt.3
	1.5	3.27	1.12	141.10	4.39	459.96	284.25	50.71	41.88	597.24	
	3	32.27	4.51	141.10	36.78	459.96	284.25	84.72	75.89	631.25	
81	0	76.86	13.77	51.02	90.63	459.96	284.25	141.26	132.43	309.46	blk. lt.3
	1.5	41.32	8.15	51.02	49.46	459.96	284.25	98.04	89.21	266.23	
	3	5.77	2.52	51.02	8.29	459.96	284.25	54.81	45.98	223.01	
82	0	7.68	2.91	51.02	10.59	459.96	284.25	57.22	48.39	225.42	blk. lt.3
	1.5	43.23	8.53	51.02	51.76	459.96	284.25	100.45	91.62	268.64	
	3	78.77	14.16	51.02	92.92	459.96	284.25	**143.67**	134.84	311.87	
83	0	77.41	13.86	51.43	91.27	459.96	284.25	141.94	133.11	311.86	blk. lt.3
	1.5	41.87	8.24	51.43	50.11	459.96	284.25	98.71	89.88	268.63	
	3	6.33	2.61	51.43	8.94	459.96	284.25	55.49	46.66	225.41	
84	0	7.13	2.82	51.43	9.95	459.96	284.25	56.54	47.71	226.47	blk. lt.3
	1.5	42.67	8.44	51.43	51.11	459.96	284.25	99.77	90.94	269.69	
	3	78.22	14.07	51.43	92.28	459.96	284.25	143.00	134.17	312.92	
85	0	77.72	13.99	51.59	91.71	459.96	284.25	142.40	133.57	312.99	blk. lt.3
	1.5	42.18	8.37	51.59	50.55	459.96	284.25	99.17	90.34	269.76	
	3	6.64	2.74	51.59	9.38	459.96	284.25	55.95	47.12	226.54	

Lanjutan Tabel 4.14.b Gaya Geser Rencana Balok Portal As.A-D (K=1)

Elm	Jarak (m)	$V_{D,B}$ (KN)	$V_{L,B}$ (KN)	$V_{E,B}$ (KN)	$V_{G,B}$ (KN)	$M_{KAP,B}$	$M'_{KAP,B}$	V_{UB}= 0,7($M_{KAP,B}$ + $M'_{KAP,B}$) /Ln+1,05.$V_{G,B}$ (KN)	$V_{U,b}$ terpakai	V_{UB} maks (KN)	KET
86	0	6.82	2.69	51.59	9.51	459.96	284.25	56.08	47.25	226.67	blk. lt.3
	1.5	42.36	8.31	51.59	50.67	459.96	284.25	99.31	90.48	269.90	
	3	77.91	13.94	51.59	91.84	459.96	284.25	142.53	133.70	313.12	
87	0	77.93	13.90	51.39	91.83	459.96	284.25	142.52	133.69	312.28	blk. lt.3
	1.5	42.38	8.28	51.39	50.66	459.96	284.25	99.30	90.47	269.05	
	3	6.84	2.65	51.39	9.49	459.96	284.25	56.07	47.24	225.82	
88	0	6.62	2.77	51.39	9.39	459.96	284.25	55.96	47.13	225.71	blk. lt.3
	1.5	42.16	8.40	51.39	50.56	459.96	284.25	99.19	90.36	268.94	
	3	77.70	14.02	51.39	91.73	459.96	284.25	142.41	133.58	312.17	
89	0	36.66	4.25	113.70	40.91	459.96	284.25	89.05	80.22	520.51	blk. lt.3
	1.75	0.15	0.35	113.70	0.49	459.96	284.25	46.62	37.79	478.07	
	3.5	36.95	4.94	113.70	41.69	459.96	284.25	90.09	81.26	521.54	
90	0	49.03	14.06	36.55	63.10	310.82	284.25	103.11	96.05	219.75	blk. lt.4
	1.5	27.93	8.44	36.55	36.37	310.82	284.25	75.05	67.99	191.68	
	3	6.82	2.81	36.55	9.64	310.82	284.25	46.98	39.92	163.62	
91	0	6.63	2.61	36.55	9.25	310.82	284.25	46.57	39.51	163.21	blk. lt.4
	1.5	27.74	8.24	36.55	35.98	310.82	284.25	74.64	67.58	191.28	
	3	48.84	13.86	36.55	62.71	310.82	284.25	102.71	95.65	219.35	
92	0	40.15	7.11	82.99	47.27	310.82	284.25	86.49	79.43	398.19	blk. lt.4
	1.5	4.61	1.49	82.99	6.10	310.82	284.25	43.27	36.21	354.97	
	3	30.93	4.14	82.99	35.07	310.82	284.25	73.68	66.62	385.38	
93	0	77.20	13.84	34.83	91.04	310.82	284.25	132.45	125.39	241.87	blk. lt.4
	1.5	41.66	8.21	34.83	49.87	310.82	284.25	89.23	82.17	198.64	
	3	6.12	2.59	34.83	8.71	310.82	284.25	46.00	38.94	155.41	
94	0	7.34	2.84	34.83	10.18	310.82	284.25	47.55	40.49	156.96	blk. lt.4
	1.5	42.88	8.47	34.83	51.35	310.82	284.25	90.78	83.72	200.19	
	3	78.42	14.09	34.83	92.51	310.82	284.25	**134.00**	126.94	243.41	
95	0	77.37	13.87	33.54	91.24	310.82	284.25	132.66	125.60	236.67	blk. lt.4
	1.5	41.83	8.25	33.54	50.07	310.82	284.25	89.44	82.38	193.44	
	3	6.28	2.62	33.54	8.90	310.82	284.25	46.21	39.15	150.22	
96	0	7.17	2.81	33.54	9.98	310.82	284.25	47.34	40.28	151.35	blk. lt.4
	1.5	42.71	8.43	33.54	51.15	310.82	284.25	90.57	83.51	194.57	
	3	78.26	14.06	33.54	92.32	310.82	284.25	133.79	126.73	237.80	
97	0	77.77	14.00	33.59	91.77	310.82	284.25	133.22	126.16	237.45	blk. lt.4
	1.5	42.23	8.37	33.59	50.60	310.82	284.25	89.99	82.93	194.22	
	3	6.69	2.75	33.59	9.43	310.82	284.25	46.77	39.71	151.00	
98	0	6.77	2.68	33.59	9.45	310.82	284.25	46.79	39.73	151.01	blk. lt.4
	1.5	42.31	8.31	33.59	50.62	310.82	284.25	90.01	82.95	194.24	
	3	77.85	13.93	33.59	91.79	310.82	284.25	133.24	126.18	237.46	
99	0	77.58	13.80	34.50	91.36	310.82	284.25	132.81	125.75	240.84	blk. lt.4
	1.5	42.04	8.18	34.50	50.21	310.82	284.25	89.58	82.52	197.62	
	3	6.49	2.55	34.50	9.04	310.82	284.25	46.36	39.30	154.39	
100	0	6.96	2.88	34.50	9.84	310.82	284.25	47.19	40.13	155.23	blk. lt.4
	1.5	42.51	8.50	34.50	51.01	310.82	284.25	90.42	83.36	198.45	
	3	78.05	14.13	34.50	92.18	310.82	284.25	133.65	126.59	241.68	
101	0	34.81	3.75	65.28	38.56	310.82	284.25	77.35	70.29	314.65	blk. lt.4
	1.75	1.99	0.85	65.28	2.84	310.82	284.25	39.84	32.78	277.15	
	3.5	38.80	5.44	65.28	44.24	310.82	284.25	83.32	76.26	320.62	

Lanjutan Tabel 4.14.b Gaya Geser Rencana Balok Portal As.A-D (K=1)

Elm	Jarak (m)	$V_{D,B}$ (KN)	$V_{L,B}$ (KN)	$V_{E,B}$ (KN)	$V_{G,B}$ (KN)	$M_{KAP,B}$	$M'_{KAP,B}$	V_{UB}= 0,7($M_{KAP,B}$ + $M'_{KAP,B}$) /Ln+1,05.$V_{G,B}$ (KN)	$V_{U,b}$ terpakai	V_{UB} maks (KN)	KET
102	0	32.14	9.91	20.02	42.05	310.82	284.25	81.01	73.95	128.23	blk. nok
	3	0.62	0.22	20.02	0.84	310.82	284.25	37.74	30.68	84.96	
	6	33.38	10.34	20.02	43.73	310.82	284.25	82.77	75.71	129.99	
103	0	27.43	9.47	32.44	36.90	310.82	284.25	75.61	68.55	174.99	blk. nok
	1.5	9.43	2.72	32.44	12.15	310.82	284.25	49.62	42.56	149.00	
	3	8.57	4.03	32.44	12.60	310.82	284.25	50.09	43.03	149.47	
104	0	49.71	10.31	20.97	60.02	310.82	284.25	99.89	92.83	151.10	blk. Nok
	3	0.45	0.19	20.97	0.64	310.82	284.25	37.53	30.47	88.74	
	6	48.81	9.94	20.97	58.75	310.82	284.25	98.55	91.49	149.76	
105	0	48.42	9.94	18.45	58.36	310.82	284.25	98.14	91.08	138.75	blk. Nok
	3	0.84	0.19	18.45	1.03	310.82	284.25	37.94	30.88	78.56	
	6	50.10	10.32	18.45	60.42	310.82	284.25	100.30	93.24	140.92	
106	0	49.93	10.49	18.50	60.42	310.82	284.25	100.30	93.24	141.14	blk. Nok
	3	0.67	0.37	18.50	1.04	310.82	284.25	37.95	30.89	78.78	
	6	48.59	9.76	18.50	58.35	310.82	284.25	98.13	91.07	138.96	
107	0	48.03	9.71	20.12	57.73	310.82	284.25	97.48	90.42	145.11	blk. Nok
	3	1.23	0.42	20.12	1.65	310.82	284.25	38.60	31.54	86.22	
	6	50.49	10.54	20.12	61.04	310.82	284.25	**100.95**	93.69	148.58	
108	0	13.02	3.22	24.29	16.23	310.82	284.25	53.91	46.85	119.08	blk. Nok
	1.75	4.83	1.38	24.29	6.21	310.82	284.25	43.38	36.32	108.55	
	3.5	22.68	5.97	24.29	28.66	310.82	284.25	66.95	59.89	132.12	
109	0	15.94	5.78	11.98	21.72	310.82	284.25	59.67	52.61	73.13	blk. atap
	1.5	3.15	2.09	11.98	5.24	310.82	284.25	42.36	35.30	55.82	
	3	22.23	9.97	11.98	32.19	310.82	284.25	70.66	63.60	84.12	
110	0	59.12	22.15	12.07	81.26	310.82	284.25	**122.19**	115.13	136.00	blk. Atap
	1.5	40.04	14.27	12.07	54.31	310.82	284.25	93.89	86.83	107.70	
	3	20.96	6.40	12.07	27.35	310.82	284.25	65.58	58.52	79.40	
111	0	20.25	6.64	12.07	26.89	310.82	284.25	65.09	58.03	78.91	blk. Atap
	1.5	39.33	14.51	12.07	53.84	310.82	284.25	93.40	86.34	107.21	
	3	58.41	22.39	12.07	80.80	310.82	284.25	121.70	114.64	135.51	
112	0	39.47	16.30	9.04	55.77	310.82	284.25	95.42	88.36	96.53	blk. Atap
	3	1.31	0.55	9.04	1.86	310.82	284.25	38.82	31.76	39.92	
	6	36.85	15.20	9.04	52.05	310.82	284.25	91.51	84.45	92.62	
113	0	37.33	15.39	9.10	52.72	310.82	284.25	92.22	85.16	93.58	blk. atap
	3	0.83	0.36	9.10	1.19	310.82	284.25	38.11	31.05	39.47	
	6	38.99	16.11	9.10	55.10	310.82	284.25	94.72	87.66	96.08	
114	0	52.94	23.16	12.19	76.10	310.82	284.25	116.76	109.70	131.08	blk. Atap
	1.5	33.86	15.28	12.19	49.14	310.82	284.25	88.46	81.40	102.78	
	3	14.78	7.41	12.19	22.19	310.82	284.25	60.16	53.10	74.48	
115	0	13.82	6.05	12.19	19.88	310.82	284.25	57.73	50.67	72.05	blk. atap
	1.5	32.90	13.93	12.19	46.83	310.82	284.25	86.03	78.97	100.35	
	3	51.98	21.80	12.19	73.79	310.82	284.25	114.34	107.28	128.66	

Tabel 4.14.c Momen Rencana Kolom Portal As.A-D (K=1)

Elm	Jarak (m)	MD,k (KNm)	ML,k (KNm)	MEki (KNm)	Meka (KNm)	MKAP,b kiri (KNm)	MKAP,b kanan (KNm)		MU,k= 1.05 (MD,k+ML,k ± 4/K.ME,k) (KNm)	KET
1	0	9.54	2.77	-242.34	238.62	0	459.96	280.54	1015.12	Kol.Basmen
	1.925	-5.23	-1.53	-75.28	74.29	0	459.96	280.54	304.90	
	3.85	-20.01	-5.83	91.77	-90.04	0	459.96	280.54	-405.31	
2	0	-5.40	-1.92	-290.32	287.37	459.96	459.96	561.08	1199.26	Kol.Basmen
	1.925	2.62	0.94	-49.28	48.87	459.96	459.96	561.08	208.98	
	3.85	10.63	3.79	191.76	-189.63	459.96	459.96	561.08	-781.31	
3	0	9.09	1.81	-287.91	285.74	459.96	459.96	561.08	1211.57	Kol.Basmen
	1.925	-5.13	-1.05	-50.31	49.97	459.96	459.96	561.08	203.39	
	3.85	-19.35	-3.91	187.30	-185.60	459.96	459.96	561.08	-804.79	
4	0	-0.99	-0.25	-271.04	270.35	459.96	459.96	561.08	1134.16	Kol.Basmen
	1.925	0.07	0.01	-58.73	58.59	459.96	459.96	561.08	246.17	
	3.85	1.13	0.27	153.58	-153.16	459.96	459.96	561.08	-641.83	
5	0	-0.81	-0.20	-271.40	272.08	459.96	459.96	561.08	1141.68	Kol.Basmen
	1.925	-0.19	-0.05	-58.13	58.25	459.96	459.96	561.08	244.38	
	3.85	0.43	0.11	155.14	-155.59	459.96	459.96	561.08	-652.92	
6	0	-0.75	-0.20	-270.34	272.39	459.96	459.96	561.08	1143.06	Kol.Basmen
	1.925	-0.39	-0.08	-58.45	58.82	459.96	459.96	561.08	246.53	
	3.85	-0.03	0.03	153.44	-154.76	459.96	459.96	561.08	-650.00	
7	0	-9.73	-2.16	-282.50	286.09	459.96	459.96	561.08	1189.11	Kol.Basmen
	1.925	4.24	0.93	-51.88	52.42	459.96	459.96	561.08	225.60	
	3.85	18.20	4.01	178.74	-181.25	459.96	459.96	561.08	-737.92	
8	0	-3.66	-0.55	-178.58	181.39	459.96	0	280.54	757.40	Kol.Basmen
	1.925	1.32	0.15	-34.94	35.40	459.96	0	280.54	150.23	
	3.85	6.29	0.65	108.71	-110.56	459.96	0	280.54	-456.95	
9	0	25.95	7.68	-112.68	111.96	0	610.58	372.41	505.53	KOL LT.1
	1.925	0.84	0.27	1.14	-0.98	0	610.58	372.41	-2.95	
	3.85	-24.27	-7.14	114.96	-113.92	0	610.58	372.41	-511.43	
10	0	-15.45	-5.42	-250.92	249.11	610.58	610.58	744.81	1024.33	KOL LT.1
	1.925	-1.04	-0.27	-3.45	3.46	610.58	610.58	744.81	13.15	
	3.85	13.38	4.89	244.01	-242.19	610.58	610.58	744.81	-998.03	
11	0	26.59	5.37	-244.98	243.71	610.58	610.58	744.81	1057.12	KOL LT.1
	1.925	0.31	0.09	-2.95	2.96	610.58	610.58	744.81	12.84	
	3.85	-25.98	-5.19	239.09	-237.79	610.58	610.58	744.81	-1031.45	
12	0	-1.98	-0.44	-198.67	198.29	610.58	610.58	744.81	830.26	KOL LT.1
	1.925	-0.26	-0.05	-1.12	1.13	610.58	610.58	744.81	4.40	
	3.85	1.46	0.34	196.43	-196.04	610.58	610.58	744.81	-821.46	
13	0	-0.72	-0.16	-200.18	200.42	610.58	610.58	744.81	840.86	KOL LT.1
	1.925	-0.02	0.00	-1.54	1.52	610.58	610.58	744.81	6.37	
	3.85	0.67	0.16	197.10	-197.38	610.58	610.58	744.81	-828.12	
14	0	0.24	0.00	-198.05	198.90	610.58	610.58	744.81	835.64	KOL LT.1
	1.925	0.19	0.05	-1.18	1.14	610.58	610.58	744.81	5.03	
	3.85	0.15	0.10	195.68	-196.63	610.58	610.58	744.81	-825.58	
15	0	-25.53	-5.64	-231.79	233.62	610.58	610.58	744.81	948.46	KOL LT.1
	1.925	-0.10	-0.01	-2.89	2.85	610.58	610.58	744.81	11.84	
	3.85	25.32	5.62	226.00	-227.92	610.58	610.58	744.81	-924.78	
16	0	-8.93	-1.23	-139.29	140.58	610.58	0	372.41	579.77	KOL LT.1
	1.925	0.26	0.08	-2.12	2.07	610.58	0	372.41	9.06	
	3.85	9.44	1.39	135.06	-136.44	610.58	0	372.41	-561.65	

Lanjutan Tabel 4.14.c Momen Rencana Kolom Portal As.A-D (K=1)

Elm	Jarak (m)	MD,k (KNm)	ML,k (KNm)	ME,ki (KNm)	ME,ka (KNm)	MKAP,b kiri (KNm)	MKAP,b kanan (KNm)	[illegible]	MU,k= 1.05 (MD,k+ML,k± 4/K ME,k) (KNm)	KET
17	0	23.75	6.97	-91.45	90.36	0	459.96	280.54	411.77	KOL LT 2
	1.925	-0.21	-0.06	10.58	-10.68	0	459.96	280.54	-45.12	
	3.85	-24.16	-7.10	112.61	-111.71	0	459.96	280.54	-502.02	
18	0	-10.96	-4.26	-206.82	205.03	459.96	459.96	561.08	845.15	KOL LT 2
	1.925	-0.02	0.01	7.44	-7.42	459.96	459.96	561.08	-31.18	
	3.85	10.91	4.28	221.70	-219.87	459.96	459.96	561.08	-907.51	
19	0	26.53	5.31	-203.02	201.74	459.96	459.96	561.08	860.74	KOL LT 2
	1.925	-0.38	-0.07	7.42	-7.42	459.96	459.96	561.08	-31.62	
	3.85	-27.29	-5.46	217.86	-216.57	459.96	459.96	561.08	-943.98	
20	0	-0.84	-0.17	-167.22	166.82	459.96	459.96	561.08	699.59	KOL LT 2
	1.925	0.00	0.01	9.25	-9.24	459.96	459.96	561.08	-38.81	
	3.85	0.84	0.19	185.72	-185.31	459.96	459.96	561.08	-777.21	
21	0	-0.71	-0.11	-166.91	167.21	459.96	459.96	561.08	701.40	KOL LT 2
	1.925	-0.02	0.00	9.08	-9.07	459.96	459.96	561.08	-38.13	
	3.85	0.68	0.11	185.08	-185.35	459.96	459.96	561.08	-777.66	
22	0	-0.85	-0.23	-166.53	167.50	459.96	459.96	561.08	702.36	KOL LT 2
	1.925	-0.01	0.02	9.16	-9.14	459.96	459.96	561.08	-38.38	
	3.85	0.84	0.26	184.84	-185.78	459.96	459.96	561.08	-779.12	
23	0	-26.32	-5.80	-191.25	193.17	459.96	459.96	561.08	777.57	KOL LT 2
	1.925	0.31	0.08	7.69	-7.68	459.96	459.96	561.08	-31.83	
	3.85	26.93	5.95	206.63	-208.52	459.96	459.96	561.08	-841.24	
24	0	-10.73	-1.69	-111.89	113.27	459.96	0	280.54	462.69	KOL LT 2
	1.925	0.21	0.06	4.74	-4.72	459.96	0	280.54	-19.52	
	3.85	11.14	1.81	121.37	-122.70	459.96	0	280.54	-501.74	
25	0	24.47	7.14	-65.10	63.69	0	310.82	189.58	300.70	KOL LT 3
	1.925	0.60	0.23	24.32	-23.39	0	310.82	189.58	-97.36	
	3.85	-23.27	-6.69	113.74	-110.47	0	310.82	189.58	-495.41	
26	0	-9.09	-3.81	-150.01	148.30	310.82	310.82	379.15	609.33	KOL LT 3
	1.925	-0.56	-0.13	14.24	-13.85	310.82	310.82	379.15	-58.90	
	3.85	7.97	3.56	176.49	-176.01	310.82	310.82	379.15	-727.13	
27	0	26.62	5.66	-147.36	146.22	310.82	310.82	379.15	650.33	KOL LT 3
	1.925	0.00	-0.04	14.75	-14.45	310.82	310.82	379.15	-60.73	
	3.85	-28.62	-5.94	176.86	-175.13	310.82	310.82	379.15	-771.80	
28	0	-0.64	-0.17	-124.84	124.51	310.82	310.82	379.15	522.09	KOL LT 3
	1.925	0.03	0.04	17.85	-17.73	310.82	310.82	379.15	-74.37	
	3.85	0.69	0.25	160.55	-159.96	310.82	310.82	379.15	-670.83	
29	0	-0.84	-0.14	-123.42	123.78	310.82	310.82	379.15	516.84	KOL LT 3
	1.925	0.01	0.01	17.44	-17.54	310.82	310.82	379.15	-73.64	
	3.85	0.86	0.16	158.30	-158.85	310.82	310.82	379.15	-666.12	
30	0	-1.48	-0.34	-123.85	124.90	310.82	310.82	379.15	522.67	KOL LT 3
	1.925	0.02	-0.04	17.59	-17.93	310.82	310.82	379.15	-75.31	
	3.85	1.51	0.25	159.03	-160.75	310.82	310.82	379.15	-673.29	
31	0	-28.84	-6.48	-137.97	140.02	310.82	310.82	379.15	551.00	KOL LT 3
	1.925	0.16	0.10	14.91	-15.43	310.82	310.82	379.15	-64.50	
	3.85	29.20	6.68	167.79	-170.88	310.82	310.82	379.15	-680.02	
32	0	-12.05	-1.96	-77.73	79.25	310.82	0	189.58	318.13	KOL LT 3
	1.925	-0.11	-0.06	10.07	-10.48	310.82	0	189.58	-44.21	
	3.85	11.83	1.83	97.87	-100.21	310.82	0	189.58	-406.55	

Lanjutan Tabel 4.14.c Momen Rencana Kolom Portal As.A-D (K=1)

Elm	Jarak (m)	MO.k (KNm)	ML.k (KNm)	Mek (KNm)	MEka (KNm)	MKAP.b kiri (KNm)	MKAP.b kanan (KNm)	[illegible]	MU.k= 1.05 (MD.k+ML.k ± 4/K ME.k) (KNm)	KET
33	0	26.74	6.09	-0.15	3.40	0	310.82	189.58	50.63	KOL LT 4
	1.34	-0.89	-0.33	29.79	-28.80	0	310.82	189.58	-122.26	
	2.68	-28.52	-8.75	59.72	-61.01	0	310.82	189.58	-295.35	
34	0	-10.42	-3.90	-51.09	53.90	310.82	310.82	379.15	211.34	KOL LT 4
	1.34	-1.45	-0.69	19.35	-19.40	310.82	310.82	379.15	-83.72	
	2.68	7.53	2.53	89.78	-92.70	310.82	310.82	379.15	-378.78	
35	0	30.91	6.19	-50.99	52.96	310.82	310.82	379.15	261.47	KOL LT 4
	1.34	4.08	1.23	16.55	-16.55	310.82	310.82	379.15	-72.33	
	2.68	-22.76	-3.73	88.10	-90.07	310.82	310.82	379.15	-406.12	
36	0	0.15	0.17	-45.24	45.81	310.82	310.82	379.15	192.73	KOL LT 4
	1.34	-1.36	-0.39	21.87	-21.88	310.82	310.82	379.15	-93.72	
	2.68	-2.87	-0.94	88.98	-89.56	310.82	310.82	379.15	-380.16	
37	0	-0.65	-0.04	-43.42	42.89	310.82	310.82	379.15	-183.07	KOL LT 4
	1.34	0.32	0.15	22.13	-22.15	310.82	310.82	379.15	93.46	
	2.68	1.29	0.34	87.69	-87.19	310.82	310.82	379.15	369.99	
38	0	-1.76	-0.74	-45.48	43.76	310.82	310.82	379.15	-193.65	KOL LT 4
	1.34	1.66	0.79	21.87	-21.88	310.82	310.82	379.15	94.41	
	2.68	5.08	2.32	89.22	-87.51	310.82	310.82	379.15	382.48	
39	0	-30.46	-6.69	-47.65	44.29	310.82	310.82	379.15	-239.13	KOL LT.4
	1.34	-3.92	-1.33	20.02	-19.98	310.82	310.82	379.15	78.55	
	2.68	22.61	4.02	87.68	-84.25	310.82	310.82	379.15	396.22	
40	0	-14.91	-2.98	-18.71	16.22	310.82	0	189.58	-97.35	KOL LT.4
	1.34	1.16	0.67	13.37	-13.80	310.82	0	189.58	58.07	
	2.68	17.23	4.32	45.44	-43.81	310.82	0	189.58	213.50	
41	0	0.97	0.26	-16.58	14.46	0	310.82	189.58	-68.33	KOL LT.4
	1.1	-4.30	-1.16	3.80	-4.29	0	310.82	189.58	10.22	
	2.2	-9.56	-2.58	24.17	-23.04	0	310.82	189.58	88.76	
42	0	29.77	7.32	-24.13	22.38	310.82	310.82	379.15	-62.40	KOL LT.4
	1.1	-8.04	-3.60	13.66	-13.92	310.82	310.82	379.15	45.15	
	2.2	-45.85	-14.52	51.45	-50.22	310.82	310.82	379.15	152.71	
43	0	-3.69	-1.12	-26.91	26.29	310.82	310.82	379.15	-126.66	KOL LT.4
	1.1	7.54	2.51	16.63	-16.74	310.82	310.82	379.15	60.39	
	2.2	18.97	6.13	62.17	-61.77	310.82	310.82	379.15	287.47	
44	0	0.85	0.82	-23.33	23.81	310.82	310.82	379.15	-96.25	KOL LT.4
	1.1	0.00	0.10	15.78	-15.69	310.82	310.82	379.15	66.38	
	2.2	-0.85	-0.62	54.89	-55.19	310.82	310.82	379.15	229.02	
45	0	3.35	2.53	-26.32	28.00	310.82	310.82	379.15	-104.36	KOL LT.4
	1.1	-5.25	-2.66	16.99	-16.70	310.82	310.82	379.15	63.03	
	2.2	-13.85	-7.85	60.29	-61.41	310.82	310.82	379.15	230.41	
46	0	-29.49	-8.01	-15.02	17.60	310.82	310.82	379.15	-102.48	KOL LT.4
	1.1	11.60	6.61	11.29	-10.53	310.82	310.82	379.15	66.53	
	2.2	52.69	21.23	37.60	-38.67	310.82	310.82	379.15	235.54	

Tabel Gaya 4.14.d Geser Rencana Kolom Portal As.A-D (K=1)

Elm	Jarak (m)	VD,k (KN)	VL,k (KN)	VE,k (KN)	MU, k bawah (KN)	MU,k atas (KN)	VU,k = (MU,k a + MU,k b)// h_k (KN)	VU,k = 1,05(VD,k+ VL,k± 4/1. VE,k) (KN)	KET
1	0	7.68	2.24	86.78	459.96	459.96	301.61	374.89	Kol Basmen
	1.925	7.68	2.24	86.78	459.96	459.96	301.61	374.89	
	3.85	7.68	2.24	86.78	459.96	459.96	301.61	374.89	
2	0	4.17	1.48	125.21	459.96	459.96	301.61	531.83	Kol Basmen
	1.925	4.17	1.48	125.21	459.96	459.96	301.61	531.83	
	3.85	4.17	1.48	125.21	459.96	459.96	301.61	531.83	
3	0	7.39	1.49	123.43	459.96	459.96	301.61	527.72	Kol Basmen
	1.925	7.39	1.49	123.43	459.96	459.96	301.61	527.72	
	3.85	7.39	1.49	123.43	459.96	459.96	301.61	527.72	
4	0	0.55	0.13	110.29	459.96	459.96	301.61	463.93	Kol Basmen
	1.925	0.55	0.13	110.29	459.96	459.96	301.61	463.93	
	3.85	0.55	0.13	110.29	459.96	459.96	301.61	463.93	
5	0	0.32	0.08	110.79	459.96	459.96	301.61	465.74	Kol Basmen
	1.925	0.32	0.08	110.79	459.96	459.96	301.61	465.74	
	3.85	0.32	0.08	110.79	459.96	459.96	301.61	465.74	
6	0	0.19	0.06	110.07	459.96	459.96	301.61	462.56	Kol Basmen
	1.925	0.19	0.06	110.07	459.96	459.96	301.61	462.56	
	3.85	0.19	0.06	110.07	459.96	459.96	301.61	462.56	
7	0	7.26	1.60	119.80	459.96	459.96	301.61	512.47	Kol Basmen
	1.925	7.26	1.60	119.80	459.96	459.96	301.61	512.47	
	3.85	7.26	1.60	119.80	459.96	459.96	301.61	512.47	
8	0	2.58	0.37	74.62	459.96	459.96	301.61	316.50	Kol Basmen
	1.925	2.58	0.37	74.62	459.96	459.96	301.61	316.50	
	3.85	2.58	0.37	74.62	459.96	459.96	301.61	316.50	
9	0	13.04	3.85	59.13	459.96	610.58	351.00	266.07	KOL LT.1
	1.925	13.04	3.85	59.13	459.96	610.58	351.00	266.07	
	3.85	13.04	3.85	59.13	459.96	610.58	351.00	266.07	
10	0	7.49	2.68	128.55	459.96	610.58	351.00	550.60	KOL LT.1
	1.925	7.49	2.68	128.55	459.96	610.58	351.00	550.60	
	3.85	7.49	2.68	128.55	459.96	610.58	351.00	550.60	
11	0	13.66	2.74	125.73	459.96	610.58	351.00	545.28	KOL LT.1
	1.925	13.66	2.74	125.73	459.96	610.58	351.00	545.28	
	3.85	13.66	2.74	125.73	459.96	610.58	351.00	545.28	
12	0	0.89	0.20	102.62	459.96	610.58	351.00	432.16	KOL LT.1
	1.925	0.89	0.20	102.62	459.96	610.58	351.00	432.16	
	3.85	0.89	0.20	102.62	459.96	610.58	351.00	432.16	
13	0	0.36	0.08	103.19	459.96	610.58	351.00	433.85	KOL LT.1
	1.925	0.36	0.08	103.19	459.96	610.58	351.00	433.85	
	3.85	0.36	0.08	103.19	459.96	610.58	351.00	433.85	
14	0	0.02	0.03	102.27	459.96	610.58	351.00	429.58	KOL LT.1
	1.925	0.02	0.03	102.27	459.96	610.58	351.00	429.58	
	3.85	0.02	0.03	102.27	459.96	610.58	351.00	429.58	
15	0	13.21	2.93	118.91	459.96	610.58	351.00	516.35	KOL LT.1
	1.925	13.21	2.93	118.91	459.96	610.58	351.00	516.35	
	3.85	13.21	2.93	118.91	459.96	610.58	351.00	516.35	
16	0	4.77	0.68	71.26	459.96	610.58	351.00	305.01	KOL LT.1
	1.925	4.77	0.68	71.26	459.96	610.58	351.00	305.01	
	3.85	4.77	0.68	71.26	459.96	610.58	351.00	305.01	

LanjutanTabel 4.14.d Gaya Geser Rencana Kolom Portal As.A-D (K=1)

Elm	Jarak (m)	VD,k (KN)	VL,k (KN)	VE,k (KN)	MU, k bawah (KN)	MU,k atas (KN)	VU,k = (MU,k a + MU,k b)// h_k (KN)	VU,k = 1.05(VD,k+ VL,k± 4/1. VE,k) (KN)	KET
17	0	12.44	3.66	53.00	459.96	610.58	351.00	239.51	Kol Basmen
	1.925	12.44	3.66	53.00	459.96	610.58	351.00	239.51	
	3.85	12.44	3.66	53.00	459.96	610.58	351.00	239.51	
18	0	5.68	2.22	111.30	459.96	610.58	351.00	475.77	Kol Basmen
	1.925	5.68	2.22	111.30	459.96	610.58	351.00	475.77	
	3.85	5.68	2.22	111.30	459.96	610.58	351.00	475.77	
19	0	13.98	2.60	109.32	459.96	610.58	351.00	476.76	Kol Basmen
	1.925	13.98	2.60	109.32	459.96	610.58	351.00	476.76	
	3.85	13.98	2.60	109.32	459.96	610.58	351.00	476.76	
20	0	0.44	0.09	91.67	459.96	610.58	351.00	385.58	Kol Basmen
	1.925	0.44	0.09	91.67	459.96	610.58	351.00	385.58	
	3.85	0.44	0.09	91.67	459.96	610.58	351.00	385.58	
21	0	0.36	0.06	91.43	459.96	610.58	351.00	384.42	Kol Basmen
	1.925	0.36	0.06	91.43	459.96	610.58	351.00	384.42	
	3.85	0.36	0.06	91.43	459.96	610.58	351.00	384.42	
22	0	0.44	0.13	91.26	459.96	610.58	351.00	383.90	Kol Basmen
	1.925	0.44	0.13	91.26	459.96	610.58	351.00	383.90	
	3.85	0.44	0.13	91.26	459.96	610.58	351.00	383.90	
23	0	13.83	3.05	103.35	459.96	610.58	351.00	451.78	Kol Basmen
	1.925	13.83	3.05	103.35	459.96	610.58	351.00	451.78	
	3.85	13.83	3.05	103.35	459.96	610.58	351.00	451.78	
24	0	5.68	0.91	60.59	459.96	610.58	351.00	261.38	Kol Basmen
	1.925	5.68	0.91	60.59	459.96	610.58	351.00	261.38	
	3.85	5.68	0.91	60.59	459.96	610.58	351.00	261.38	
25	0	12.40	3.59	46.45	610.58	459.96	351.00	211.89	KOL LT.1
	1.925	12.40	3.59	46.45	610.58	459.96	351.00	211.89	
	3.85	12.40	3.59	46.45	610.58	459.96	351.00	211.89	
26	0	4.43	1.91	85.33	610.58	459.96	351.00	365.03	KOL LT.1
	1.925	4.43	1.91	85.33	610.58	459.96	351.00	365.03	
	3.85	4.43	1.91	85.33	610.58	459.96	351.00	365.03	
27	0	14.67	3.07	84.21	610.58	459.96	351.00	372.51	KOL LT.1
	1.925	14.67	3.07	84.21	610.58	459.96	351.00	372.51	
	3.85	14.67	3.07	84.21	610.58	459.96	351.00	372.51	
28	0	0.34	0.11	74.13	610.58	459.96	351.00	311.81	KOL LT.1
	1.925	0.34	0.11	74.13	610.58	459.96	351.00	311.81	
	3.85	0.34	0.11	74.13	610.58	459.96	351.00	311.81	
29	0	0.44	0.08	73.18	610.58	459.96	351.00	307.88	KOL LT.1
	1.925	0.44	0.08	73.18	610.58	459.96	351.00	307.88	
	3.85	0.44	0.08	73.18	610.58	459.96	351.00	307.88	
30	0	0.78	0.15	73.47	610.58	459.96	351.00	309.57	KOL LT.1
	1.925	0.78	0.15	73.47	610.58	459.96	351.00	309.57	
	3.85	0.78	0.15	73.47	610.58	459.96	351.00	309.57	
31	0	15.07	3.42	79.42	610.58	459.96	351.00	352.97	KOL LT.1
	1.925	15.07	3.42	79.42	610.58	459.96	351.00	352.97	
	3.85	15.07	3.42	79.42	610.58	459.96	351.00	352.97	
32	0	6.20	0.99	45.61	610.58	459.96	351.00	199.12	KOL LT.1
	1.925	6.20	0.99	45.61	610.58	459.96	351.00	199.12	
	3.85	6.20	0.99	45.61	610.58	459.96	351.00	199.12	

Lanjutan Tabel 4.14.d Gaya Geser Rencana Kolom Portal As.A-D (K=1)

Elm	Jarak (m)	VD,k (KN)	VL,k (KN)	VE,k (KN)	MU, k bawah (KN)	MU,k atas (KN)	VU,k = (MU,k a + MU,k b)/ h_k (KN)	VU,k = 1,05(VD,k+ VL,k± 4/1. VE,k) (KN)	KET
33	0	21.25	6.48	23.03	459.96	310.82	252.71	125.83	Kol Basmen
	1.34	21.25	6.48	23.03	459.96	310.82	252.71	125.83	
	2.68	21.25	6.48	23.03	459.96	310.82	252.71	125.83	
34	0	6.90	2.47	54.18	459.96	310.82	252.71	237.40	Kol Basmen
	1.34	6.90	2.47	54.18	459.96	310.82	252.71	237.40	
	2.68	6.90	2.47	54.18	459.96	310.82	252.71	237.40	
35	0	20.64	3.81	53.50	459.96	310.82	252.71	250.36	Kol Basmen
	1.34	20.64	3.81	53.50	459.96	310.82	252.71	250.36	
	2.68	20.64	3.81	53.50	459.96	310.82	252.71	250.36	
36	0	1.16	0.43	51.62	459.96	310.82	252.71	218.48	Kol Basmen
	1.34	1.16	0.43	51.62	459.96	310.82	252.71	218.48	
	2.68	1.16	0.43	51.62	459.96	310.82	252.71	218.48	
37	0	0.75	0.15	50.42	459.96	310.82	252.71	212.72	Kol Basmen
	1.34	0.75	0.15	50.42	459.96	310.82	252.71	212.72	
	2.68	0.75	0.15	50.42	459.96	310.82	252.71	212.72	
38	0	2.63	1.18	51.81	459.96	310.82	252.71	221.59	Kol Basmen
	1.34	2.63	1.18	51.81	459.96	310.82	252.71	221.59	
	2.68	2.63	1.18	51.81	459.96	310.82	252.71	221.59	
39	0	20.41	4.12	52.05	459.96	310.82	252.71	244.37	Kol Basmen
	1.34	20.41	4.12	52.05	459.96	310.82	252.71	244.37	
	2.68	20.41	4.12	52.05	459.96	310.82	252.71	244.37	
40	0	12.37	2.81	24.67	459.96	310.82	252.71	119.56	Kol Basmen
	1.34	12.37	2.81	24.67	459.96	310.82	252.71	119.56	
	2.68	12.37	2.81	24.67	459.96	310.82	252.71	119.56	
41	0	4.79	1.29	18.52	310.82	310.82	203.82	84.17	KOL LT 1
	1.1	4.79	1.29	18.52	310.82	310.82	203.82	84.17	
	2.2	4.79	1.29	18.52	310.82	310.82	203.82	84.17	
42	0	34.37	9.92	34.35	310.82	310.82	203.82	190.80	KOL LT 1
	1.1	34.37	9.92	34.35	310.82	310.82	203.82	190.80	
	2.2	34.37	9.92	34.35	310.82	310.82	203.82	190.80	
43	0	10.39	3.30	41.40	310.82	310.82	203.82	188.25	KOL LT.1
	1.1	10.39	3.30	41.40	310.82	310.82	203.82	188.25	
	2.2	10.39	3.30	41.40	310.82	310.82	203.82	188.25	
44	0	0.77	0.65	35.56	310.82	310.82	203.82	150.83	KOL LT.1
	1.1	0.77	0.65	35.56	310.82	310.82	203.82	150.83	
	2.2	0.77	0.65	35.56	310.82	310.82	203.82	150.83	
45	0	7.82	4.72	39.36	310.82	310.82	203.82	176.49	KOL LT.1
	1.1	7.82	4.72	39.36	310.82	310.82	203.82	176.49	
	2.2	7.82	4.72	39.36	310.82	310.82	203.82	176.49	
46	0	37.35	13.29	23.92	310.82	310.82	203.82	153.65	KOL LT.1
	1.1	37.35	13.29	23.92	310.82	310.82	203.82	153.65	
	2.2	37.35	13.29	23.92	310.82	310.82	203.82	153.65	

Tabel 4.15.a Momen Rencana Balok Portal As A - D (K=2)

ELM	Jarak (m)	MD (KNm)	ML (KNm)	M.GEMPA (KNm)		1.2MD + 1.6ML (KNm)	0.9(MD ± ME) (KNm)		1.05(MD+0.6ML ± ME) (KNm)		KET
				KIRI	KANAN		KIRI	KANAN	KIRI	KANAN	
54	0	-45.96	-13.51	408.90	-404.00	-76.77	326.65	-404.96	372.58	-480.97	blk. lt.1
	1.5	10.47	2.95	217.85	-215.09	17.27	205.48	-184.16	241.58	-213.00	
	3	35.24	10.97	26.79	-26.18	59.83	55.82	8.15	72.03	16.42	
55	0	35.24	10.97	26.79	-26.18	59.83	55.82	8.15	72.03	16.42	blk. lt.1
	1.5	8.17	2.41	-164.27	162.73	13.65	-140.49	153.81	-162.39	180.96	
	3	-50.56	-14.59	-355.33	351.63	-84.01	-365.30	270.97	-435.38	306.94	
56	0	-24.47	-5.38	530.02	-525.84	-37.98	454.99	-495.28	**527.43**	-581.22	blk. lt.1
	1.5	0.91	-0.64	-2.11	2.27	0.06	-1.08	2.86	-1.67	2.94	
	3	-27.02	-4.34	-534.24	530.39	-39.36	-505.14	453.03	**-592.06**	525.80	
57	0	-72.96	-13.62	330.30	-328.63	-109.34	231.61	-361.43	261.63	-430.25	blk. lt.1
	1.5	14.33	2.53	160.81	-159.87	21.25	157.63	-130.99	185.50	-151.22	
	3	48.31	10.24	-8.68	8.88	74.36	35.67	51.47	48.07	66.50	
58	0	48.31	10.24	-8.68	8.88	74.36	35.67	51.47	48.07	66.50	blk. lt.1
	1.5	8.79	1.37	-178.17	177.63	12.75	-152.44	167.79	-176.98	196.62	
	2.5	-84.04	-15.93	-347.66	346.39	-126.33	-388.52	236.12	-463.31	265.43	
59	0	-80.93	-15.23	356.84	-356.51	-121.48	248.32	-393.70	280.11	-468.91	blk. lt.1
	1.5	8.94	1.44	178.73	-178.44	13.03	168.90	-152.54	197.96	-177.06	
	3	45.50	9.67	0.62	-0.36	70.07	41.51	40.63	54.51	53.49	
60	0	45.50	9.67	0.62	-0.36	70.07	41.51	40.63	54.51	53.49	blk. lt.1
	1.5	8.56	1.32	-177.50	177.72	12.38	-152.04	167.65	-176.55	196.43	
	3	-81.69	-15.47	-355.61	355.80	-122.78	-393.57	246.70	-468.91	278.07	
61	0	-80.54	-15.20	355.03	-356.24	-120.97	247.04	-393.10	278.64	-468.19	blk. lt.1
	1.5	9.15	1.46	177.35	-177.82	13.31	167.85	-151.80	196.75	-176.19	
	3	45.53	9.68	-0.33	0.59	70.12	40.68	41.51	53.56	54.52	
62	0	45.53	9.68	-0.33	0.59	70.12	40.68	41.51	53.56	54.52	blk. lt.1
	1.5	8.41	1.32	-178.01	179.00	12.21	-152.63	168.67	-177.24	197.62	
	3	-82.02	-15.48	-355.68	357.41	-123.18	-393.93	247.85	-469.34	279.41	
63	0	-82.28	-15.45	347.30	-349.92	-123.46	238.52	-388.98	268.53	-463.54	blk. lt.1
	1.25	9.52	1.60	177.03	-178.25	13.99	167.90	-151.85	196.89	-176.15	
	2.5	48.01	10.22	6.77	-6.58	73.96	49.30	37.29	63.95	49.94	
64	0	48.01	10.22	6.77	-6.58	73.96	49.30	37.29	63.95	49.94	blk. lt.1
	1.5	13.01	2.25	-163.50	165.08	19.21	-135.44	160.28	-156.60	188.41	
	3	-75.31	-14.15	-333.77	336.75	-113.02	-368.17	235.29	-438.45	265.59	
65	0	-31.58	-4.51	487.28	-492.98	-45.10	410.13	-472.10	475.65	-553.62	blk. lt.1
	1.5	8.81	0.73	-4.36	4.67	11.73	4.01	12.13	5.13	14.61	
	3	-15.22	-2.08	-495.99	502.32	-21.59	-460.09	438.39	-538.08	510.15	
66	0	-48.02	-14.11	412.81	-408.56	-80.19	328.32	-410.92	374.15	-488.29	blk. lt.2
	1.75	8.96	2.51	217.43	-215.09	14.76	203.75	-185.52	239.29	-214.86	
	3.5	34.27	10.69	22.06	-21.61	58.22	50.69	11.39	65.87	20.02	
67	0	34.27	10.69	22.06	-21.61	58.22	50.69	11.39	65.87	20.02	blk. lt.2
	1.5	7.74	2.29	-173.32	171.86	12.95	-149.02	161.64	-172.42	190.03	
	3	-50.44	-14.55	-368.70	365.33	-83.81	-377.23	283.40	-449.27	321.47	
68	0	-26.11	-5.40	532.97	-529.11	-39.98	456.17	-499.70	**528.80**	-586.39	blk. lt.2
	1.25	2.30	-0.28	-1.07	1.24	2.31	1.11	3.19	1.11	3.54	
	2.5	-22.61	-3.59	-535.11	531.60	-32.88	-501.94	458.09	**-587.86**	532.17	
69	0	-75.11	-14.10	349.10	-347.46	-112.69	246.59	-380.32	278.81	-452.58	blk. lt.2
	1.5	13.11	2.26	171.15	-170.23	19.34	165.83	-141.41	194.89	-163.56	
	3	48.02	10.17	-6.60	6.99	73.90	37.10	49.51	49.69	64.17	

Lanjutan Tabel 4.15.a Momen Rencana Balok Portal As A-D (K=2)

ELM	Jarak (m)	MD (KNm)	ML (KNm)	M.GEMPA (KNm)		1.2MD + 1.6ML (KNm)	0.9(MD ± ME) (KNm)		1.05(MD+0.6ML ± ME) (KNm)		KET
				KIRI	KANAN		KIRI	KANAN	KIRI	KANAN	
70	0	48.02	10.17	-6.80	6.99	73.90	37.10	49.51	49.69	64.17	blk. lt.2
	1.5	9.43	1.51	-184.74	184.22	13.73	-157.78	174.28	-183.13	204.28	
	3	-82.48	-15.59	-362.69	361.45	-123.92	-400.65	251.07	-477.25	283.10	
71	0	-80.18	-15.07	364.61	-364.27	-120.34	255.98	-400.00	289.15	-476.17	blk. lt.2
	1.5	9.38	1.53	182.39	-182.11	13.70	172.59	-155.46	202.32	-180.40	
	3	45.63	9.69	0.18	0.05	70.26	41.23	41.11	54.20	54.07	
72	0	45.63	9.69	0.18	0.05	70.26	41.23	41.11	54.20	54.07	blk. lt.2
	1.5	8.38	1.28	-182.03	182.21	12.09	-156.29	171.52	-181.54	200.92	
	3	-82.19	-15.58	-364.25	364.37	-123.55	-401.79	253.96	-478.57	286.47	
73	0	-80.61	-15.31	363.77	-364.60	-121.47	254.67	-401.05	287.46	-477.54	blk. lt.2
	1.5	9.08	1.41	181.91	-182.31	13.15	171.88	-155.91	201.42	-181.00	
	3	45.64	9.70	0.04	0.19	70.30	41.12	41.25	54.08	54.24	
74	0	45.64	9.70	0.04	0.19	70.30	41.12	41.25	54.08	54.24	blk. lt.2
	1.5	8.72	1.41	-181.82	182.69	12.72	-155.80	172.26	-180.87	201.86	
	3	-81.53	-15.31	-363.69	365.18	-122.33	-400.69	255.29	-477.12	288.19	
75	0	-80.53	-14.99	360.74	-363.08	-120.61	252.19	-399.24	284.78	-475.22	blk. lt.2
	1.5	10.32	1.82	182.87	-183.95	15.30	173.87	-156.26	204.00	-181.16	
	3	47.86	10.18	5.01	-4.82	73.73	47.58	38.74	61.93	51.61	
76	0	47.86	10.18	5.01	-4.82	73.73	47.58	38.74	61.93	51.61	blk. lt.2
	1.5	11.90	1.97	-172.86	174.31	17.43	-144.86	167.58	-167.77	196.76	
	3	-77.38	-14.68	-350.72	353.43	-116.34	-385.29	248.45	-458.75	280.61	
77	0	-25.74	-3.26	483.79	-488.74	-36.11	412.24	-463.03	478.90	-542.26	blk. lt.2
	1.75	9.25	0.85	-5.06	5.33	12.46	3.77	13.13	4.94	15.85	
	3.5	-20.17	-3.08	-493.91	499.41	-29.12	-462.67	431.32	-541.72	501.26	
78	0	-48.63	-14.24	355.43	-350.81	-81.14	276.12	-359.50	313.16	-428.38	blk. lt.3
	1.5	8.70	2.46	187.12	-184.53	14.37	176.23	-158.25	207.16	-183.08	
	3	34.36	10.73	16.82	-16.26	58.40	47.86	14.50	62.60	23.67	
79	0	34.36	10.73	16.82	-16.26	58.40	47.86	14.50	62.60	23.67	blk. lt.3
	1.5	8.19	2.41	-149.49	148.02	13.69	-127.17	140.59	-146.84	165.54	
	3	-49.64	-14.34	-317.79	314.29	-82.51	-330.69	238.19	-394.84	268.85	
80	0	-29.64	-6.26	425.62	-422.05	-45.57	356.39	-406.52	411.84	-478.22	blk. lt.3
	1.5	1.93	-0.36	-1.10	1.25	1.73	0.75	2.86	0.64	3.11	
	3	-19.82	-2.91	-427.81	424.56	-28.44	-402.87	364.26	-471.85	423.14	
81	0	-75.73	-14.23	302.63	-301.02	-113.64	204.21	-339.08	229.28	-404.55	blk. lt.3
	1.5	12.90	2.21	148.86	-147.96	19.02	145.58	-121.55	171.23	-140.42	
	3	48.21	10.21	-4.92	5.11	74.20	38.97	47.99	51.90	62.43	
82	0	48.21	10.21	-4.92	5.11	74.20	38.97	47.99	51.90	62.43	blk. lt.3
	1.5	10.03	1.64	-158.68	158.18	14.66	-133.79	151.39	-155.05	177.65	
	3	-81.46	-15.38	-312.45	311.25	-122.36	-354.53	206.81	-423.30	231.59	
83	0	-79.99	-15.03	308.67	-308.38	-120.03	205.82	-349.53	230.65	-417.25	blk. lt.3
	1.5	9.47	1.55	154.34	-154.08	13.84	147.43	-130.15	172.98	-150.86	
	3	45.62	9.69	0.01	0.22	70.24	41.06	41.26	54.01	54.23	
84	0	45.62	9.69	0.01	0.22	70.24	41.06	41.26	54.01	54.23	blk. lt.3
	1.5	8.27	1.25	-154.32	154.52	11.91	-131.45	146.51	-152.58	171.71	
	3	-82.40	-15.63	-308.66	308.83	-123.89	-351.95	203.78	-420.46	227.90	
85	0	-80.88	-15.39	308.34	-309.44	-121.68	204.71	-351.29	229.14	-419.53	blk. lt.3
	1.5	9.04	1.38	154.23	-154.66	13.06	146.94	-131.06	172.30	-152.03	
	3	45.65	9.71	0.12	0.12	70.32	41.19	41.19	54.17	54.18	

Lanjutan Tabel 4.15.a Momen Rencana Balok Portal As A-D (K=2)

ELM	Jarak (m)	MD (KNm)	ML (KNm)	M.GEMPA (KNm)		1.2MD + 1.6ML (KNm)	0.9(MD ± ME) (KNm)		1.05(MD+0.6ML ± ME) (KNm)		KET
				KIRI	KANAN		KIRI	KANAN	KIRI	KANAN	
86	0	45.65	9.71	0.12	0.12	70.32	41.19	41.19	54.17	54.18	blk. lt.3
	1.5	8.76	1.46	-154.00	154.90	12.86	-130.71	147.30	-151.57	172.77	
	3	-81.44	-15.22	-308.11	309.68	-122.08	-350.59	205.42	-418.61	230.06	
87	0	-79.12	-14.62	309.26	-311.67	-118.34	207.12	-351.72	232.43	-419.55	blk. lt.3
	1.5	11.11	2.02	156.38	-157.49	16.55	150.73	-131.75	177.13	-152.44	
	3	48.02	10.22	3.50	-3.31	73.97	46.37	40.24	60.53	53.38	
88	0	48.02	10.22	3.50	-3.31	73.97	46.37	40.24	60.53	53.38	blk. lt.3
	1.5	11.44	1.84	-149.39	150.87	16.67	-124.15	146.08	-143.69	171.58	
	3	-78.45	-14.98	-302.27	305.05	-118.11	-342.65	203.94	-409.19	228.49	
89	0	-22.68	-2.55	386.94	-392.03	-31.30	327.63	-373.24	380.66	-437.05	blk. lt.3
	1.75	9.27	0.86	-5.63	5.93	12.50	3.28	13.68	4.37	16.51	
	3.5	-23.19	-3.77	-398.20	403.89	-33.85	-379.25	342.63	-444.83	397.37	
90	0	-50.01	-14.77	227.78	-227.73	-83.65	159.99	-249.96	177.35	-300.93	blk. lt.4
	1.5	7.71	2.10	118.11	-118.08	12.61	113.23	-99.34	133.43	-114.57	
	3	33.77	10.54	8.44	-8.44	57.39	37.98	22.80	50.96	33.24	
91	0	33.77	10.54	8.44	-8.44	57.39	37.98	22.80	50.96	33.24	blk. lt.4
	1.5	7.99	2.40	-101.23	101.21	13.43	-83.92	98.28	-96.39	116.17	
	3	-49.45	-14.17	-210.90	210.85	-82.02	-234.32	145.26	-282.30	160.54	
92	0	-31.07	-6.72	248.26	-248.96	-48.03	195.48	-252.02	223.82	-298.26	blk. lt.4
	1.5	2.51	-0.27	-0.05	0.02	2.58	2.21	2.27	2.41	2.48	
	3	-17.23	-2.26	-248.35	248.99	-24.29	-239.03	208.58	-280.29	241.92	
93	0	-76.76	-14.38	207.34	-207.22	-115.12	117.53	-255.58	128.06	-307.24	blk. lt.4
	1.5	12.39	2.16	102.81	-102.74	18.32	103.68	-81.31	122.32	-93.51	
	3	48.23	10.25	-1.72	1.74	74.28	41.86	44.97	55.29	58.93	
94	0	48.23	10.25	-1.72	1.74	74.28	41.86	44.97	55.29	58.93	blk. lt.4
	1.5	10.56	1.78	-106.25	106.22	15.51	-86.12	105.11	-99.35	123.74	
	3	-80.42	-15.14	-210.78	210.70	-120.73	-262.06	117.26	-315.30	127.26	
95	0	-79.87	-15.06	200.79	-200.82	-119.95	108.83	-252.63	117.48	-304.22	blk. lt.4
	1.5	9.52	1.52	100.19	-100.20	13.86	98.74	-81.61	116.15	-94.26	
	3	45.61	9.67	-0.42	0.42	70.20	40.67	41.42	53.54	54.42	
96	0	45.61	9.67	-0.42	0.42	70.20	40.67	41.42	53.54	54.42	blk. lt.4
	1.5	8.19	1.24	-101.02	101.04	11.82	-83.55	98.31	-96.69	115.47	
	3	-82.54	-15.63	-201.63	201.66	-124.05	-255.75	107.21	-308.22	115.23	
97	0	-81.04	-15.43	201.81	-201.83	-121.93	108.70	-254.58	117.10	-306.73	blk. lt.4
	1.5	8.97	1.35	101.04	-101.06	12.92	99.01	-82.88	116.36	-95.84	
	3	45.66	9.69	0.27	-0.28	70.28	41.34	40.84	54.33	53.75	
98	0	45.66	9.69	0.27	-0.28	70.28	41.34	40.84	54.33	53.75	blk. lt.4
	1.5	8.85	1.44	-100.50	100.50	12.93	-82.49	98.41	-95.32	115.72	
	3	-81.27	-15.24	-201.27	201.28	-121.91	-254.29	108.00	-306.27	116.41	
99	0	-78.00	-14.24	207.75	-207.73	-116.38	116.78	-257.16	127.27	-308.99	blk. lt.4
	1.5	11.71	2.24	104.24	-104.24	17.64	104.36	-83.27	123.16	-95.74	
	3	48.11	10.29	0.73	-0.74	74.19	43.95	42.63	57.76	56.22	
100	0	46.11	10.29	0.73	-0.74	74.19	43.95	42.63	57.76	56.22	blk. lt.4
	1.5	11.00	1.75	-102.78	102.76	16.01	-82.60	102.38	-95.26	120.55	
	3	-79.41	-15.22	-206.29	206.25	-119.64	-257.13	114.16	-309.57	123.60	
101	0	-19.76	-1.85	224.58	-224.09	-26.67	184.34	-219.46	213.90	-257.21	blk. lt.4
	1.75	8.96	0.69	-4.29	4.38	11.85	4.20	12.01	5.34	14.44	
	3.5	-26.74	-4.81	-233.16	232.85	-39.78	-233.91	185.50	-275.92	213.39	

Lanjutan Tabel 4.15.a Momen Rencana Balok Portal As A-D (K=2)

ELM	Jarak (m)	MD (KNm)	ML (KNm)	M.GEMPA (KNm)		1.2MD + 1.6ML (KNm)	0.9(MD ± ME) (KNm)		1.05(MD+0.6ML ± ME) (KNm)		KET
				KIRI	KANAN		KIRI	KANAN	KIRI	KANAN	
102	0	-28.52	-8.75	119.44	-122.01	-48.22	81.83	-135.47	89.96	-163.56	blk. nok
	3	18.76	5.79	1.18	-1.90	31.77	17.94	15.18	24.58	21.35	
	6	-32.25	-10.06	-117.09	118.22	-54.78	-134.40	77.37	-163.14	83.94	
103	0	-25.69	-7.79	95.63	-96.11	-43.30	62.95	-109.62	68.53	-132.80	blk. nok
	1.5	1.96	1.34	-1.15	1.21	4.51	0.73	2.85	1.70	4.17	
	3	2.61	0.36	-97.94	98.52	3.71	-85.79	91.02	-99.87	**106.41**	
104	0	-49.92	-10.69	126.51	-126.40	-77.00	68.94	-158.68	73.69	**-191.86**	blk. nok
	3	25.33	5.06	0.59	-0.58	38.49	23.33	22.28	30.41	29.18	
	6	-47.20	-9.57	-125.33	125.25	-71.95	-155.28	70.24	-187.19	75.92	
105	0	-46.18	-9.40	110.46	-110.46	-70.45	57.85	-140.98	61.57	-170.39	blk. nok
	3	25.19	5.22	-0.24	0.23	38.58	22.46	22.87	29.49	29.98	
	6	-51.22	-10.53	-110.93	110.92	-78.32	-145.94	53.72	-176.89	56.04	
106	0	-50.78	-11.01	111.11	-111.08	-78.56	54.30	-145.67	56.41	-176.89	blk. nok
	3	25.12	5.28	0.09	-0.09	38.58	22.68	22.52	29.79	29.60	
	6	-46.77	-8.81	-110.94	110.90	-70.22	-141.93	57.72	-171.14	61.79	
107	0	-45.04	-9.01	120.12	-120.11	-68.46	67.58	-148.63	73.16	-179.09	blk. nok
	3	25.16	4.92	-0.56	0.58	38.06	22.14	23.17	28.93	30.13	
	6	-52.43	-11.53	-121.24	121.28	-81.36	-156.30	61.97	-189.61	65.03	
108	0	-0.32	0.50	84.17	-82.42	0.42	75.46	-74.47	88.36	-86.56	blk. nok
	1.75	6.84	2.11	-3.36	2.61	11.58	3.13	8.50	4.99	11.25	
	3.5	-17.23	-4.32	-90.89	87.63	-27.60	-97.31	63.36	-116.25	71.19	
109	0	-9.56	-2.58	48.34	-46.08	-15.60	34.90	-50.08	39.09	-60.05	blk. atap
	1.5	0.03	0.19	10.46	-10.13	0.34	9.44	-9.09	11.13	-10.49	
	3	-19.00	-8.85	-27.42	25.81	-36.96	-41.78	6.13	-54.32	1.58	
110	0	-64.85	-23.37	75.48	-74.63	-115.20	9.57	-125.53	-3.56	**-161.17**	blk. atap
	1.5	9.52	3.94	38.91	-38.43	17.74	43.59	-26.02	53.34	-27.87	
	3	55.27	19.44	2.34	-2.24	97.43	51.65	47.73	72.74	67.94	
111	0	55.27	19.44	2.34	-2.24	97.43	51.85	47.73	72.74	67.94	blk. atap
	1.5	10.59	3.58	-34.23	33.96	18.44	-21.28	40.09	-22.57	49.03	
	3	-62.72	-24.09	-70.80	70.16	-113.81	-120.16	6.70	-155.37	-7.36	
112	0	-43.75	-17.96	53.54	-53.39	-81.23	8.81	-87.43	-1.04	-113.31	blk. atap
	3	17.42	7.33	-0.74	0.85	32.63	15.02	16.44	22.13	23.80	
	6	-35.89	-14.64	-55.01	55.09	-66.49	-81.81	17.27	-104.67	10.93	
113	0	-36.74	-15.26	54.78	-55.29	-68.50	16.24	-82.83	9.33	-106.25	blk. atap
	3	18.02	7.28	0.80	-0.69	33.26	16.93	15.60	24.34	22.78	
	6	-41.70	-17.44	-53.19	53.92	-77.95	-85.40	10.99	-110.62	1.84	
114	0	-55.55	-25.29	67.38	-68.90	-107.14	10.65	-112.01	-3.52	-146.61	blk. atap
	1.5	9.54	3.54	31.74	-32.34	17.11	37.15	-20.52	45.57	-21.71	
	3	46.02	20.55	-3.91	4.22	88.11	37.90	45.21	57.16	65.70	
115	0	46.02	20.55	-3.91	4.22	88.11	37.90	45.21	57.16	65.70	blk. atap
	1.5	10.96	5.57	-39.56	40.77	22.08	-25.72	46.57	-26.50	57.64	
	3	-52.69	-21.23	-75.20	77.33	-97.20	-115.10	**22.18**	-147.66	12.50	

Tabel 4.15.b Gaya Geser Rencana Balok Portal As.A-D (K=2)

Elm	Jarak (m)	VD,B (KN)	VL,B (KN)	VE,B (KN)	VG,B (KN)	VUB=1,05(VD,B + VL,B ± 4/2. VE,B) (KN)	KETERANGAN
54	0	48.17	13.78	127.37	61.96	332.54	blk. lt.1
	1.5	27.07	8.16	127.37	35.23	304.47	
	3	5.96	2.53	127.37	8.50	276.40	
55	0	7.49	2.89	127.37	10.39	278.39	blk. lt.1
	1.5	28.60	8.52	127.37	37.12	306.46	
	3	49.70	14.14	127.37	63.85	334.52	
56	0	34.69	5.97	354.76	40.67	787.69	blk. lt.1
	1.5	0.85	0.35	354.76	1.20	746.24	
	3	36.39	5.28	354.76	41.67	**788.74**	
57	0	75.97	13.58	112.99	89.55	331.31	blk. lt.1
	1.5	40.43	7.95	112.99	48.38	288.09	
	3	4.88	2.33	112.99	7.21	244.86	
58	0	8.57	3.10	112.99	11.67	249.54	blk. lt.1
	1.5	44.12	8.73	112.99	52.84	292.77	
	3	79.66	14.35	112.99	94.01	335.99	
59	0	77.69	13.92	118.74	91.61	345.55	blk. lt.1
	1.5	42.14	8.30	116.74	50.44	302.32	
	3	6.60	2.67	118.74	9.28	259.09	
60	0	6.86	2.75	118.74	9.61	259.45	blk. lt.1
	1.5	42.40	8.38	118.74	50.78	302.67	
	3	77.94	14.00	118.74	91.94	345.90	
61	0	77.57	13.92	118.74	91.48	345.41	blk. lt.1
	1.5	42.02	8.29	118.74	50.32	302.19	
	3	6.46	2.67	118.74	9.15	258.96	
62	0	6.97	2.76	118.74	9.73	259.58	blk. lt.1
	1.5	42.52	8.39	118.74	50.90	302.80	
	3	78.06	14.01	118.74	92.07	346.03	
63	0	78.97	14.18	113.51	93.15	336.18	blk. lt.1
	1.5	43.43	8.56	113.51	51.99	292.96	
	3	7.89	2.93	113.51	10.82	249.73	
64	0	5.57	2.50	113.51	8.06	246.84	blk. lt.1
	1.5	41.11	8.12	113.51	49.23	290.07	
	3	76.65	13.75	113.51	90.40	333.29	
65	0	41.48	5.29	280.94	46.77	639.07	blk. lt.1
	1.5	4.67	0.69	280.94	5.37	595.60	
	3	32.13	3.90	280.94	36.03	627.80	
66	0	48.53	13.89	130.25	62.42	339.08	blk. lt.2
	1.5	27.43	8.27	130.25	35.69	311.01	
	3	6.32	2.64	130.25	8.96	282.94	
67	0	7.13	2.79	130.25	9.92	283.95	blk. lt.2
	1.5	28.24	8.41	130.25	36.65	312.01	
	3	49.34	14.04	130.25	63.38	340.08	
68	0	36.71	6.23	356.03	42.94	**792.74**	blk. lt.2
	1.5	1.17	0.60	356.03	1.77	749.51	
	3	34.36	5.02	356.03	39.40	789.02	
69	0	76.59	13.72	118.63	90.30	343.94	blk. lt.2
	1.5	41.04	8.09	118.63	49.13	300.72	
	3	5.50	2.47	118.63	7.97	257.49	
70	0	7.96	2.96	118.63	10.92	260.59	blk. lt.2
	1.5	43.50	8.59	118.63	52.09	303.82	
	3	79.04	14.21	118.63	93.25	347.04	
71	0	77.48	13.88	121.48	91.36	351.02	blk. lt.2
	1.5	41.94	8.26	121.48	50.19	307.80	
	3	6.39	2.63	121.48	9.02	264.57	

Lanjutan Tabel 4.15.b Gaya Geser Rencana Balok Portal As.A-D (K=2)

Elm	Jarak (m)	VD,B (KN)	VL,B (KN)	VE,B (KN)	VG,B (KN)	VUB=1,05(VD,B + VL,B ± 4/2. VE,B) (KN)	KETERANGAN
72	0	7.06	2.80	121.48	9.86	265.45	blk. lt.2
	1.5	42.60	8.42	121.48	51.03	308.68	
	3	78.15	14.05	121.48	92.20	351.90	
73	0	77.69	13.96	121.24	91.66	350.85	blk. lt.2
	1.5	42.15	8.34	121.24	50.49	307.62	
	3	6.61	2.71	121.24	9.32	264.40	
74	0	6.85	2.71	121.24	9.56	264.65	blk. lt.2
	1.5	42.39	8.34	121.24	50.73	307.88	
	3	77.93	13.96	121.24	91.90	351.10	
75	0	78.34	14.02	118.58	92.35	345.96	blk. lt.2
	1.5	42.80	8.39	118.58	51.19	302.75	
	3	7.25	2.77	118.58	10.02	259.53	
76	0	6.20	2.66	118.58	8.87	258.32	blk. lt.2
	1.5	41.75	8.29	118.58	50.03	301.54	
	3	77.29	13.91	118.58	91.20	344.77	
77	0	38.40	4.65	279.34	43.05	631.82	blk. lt.2
	1.75	1.59	0.05	279.34	1.65	588.35	
	3.5	35.22	4.54	279.34	39.76	628.36	
78	0	48.77	13.95	112.20	62.72	301.48	blk. lt.3
	1.5	27.67	8.32	112.20	35.99	273.41	
	3	6.56	2.70	112.20	9.26	245.35	
79	0	6.90	2.73	112.20	9.63	245.73	blk. lt.3
	1.5	28.00	8.36	112.20	36.36	273.80	
	3	49.11	13.98	112.20	63.09	301.87	
80	0	38.81	6.74	284.48	45.56	645.24	blk. lt.3
	1.5	3.27	1.12	284.48	4.39	602.01	
	3	32.27	4.51	284.48	36.78	636.02	
81	0	76.86	13.77	102.51	90.63	310.44	blk. lt.3
	1.5	41.32	8.15	102.51	49.46	267.21	
	3	5.77	2.52	102.51	8.29	223.99	
82	0	7.68	2.91	102.51	10.59	226.40	blk. lt.3
	1.5	43.23	8.53	102.51	51.76	269.62	
	3	78.77	14.16	102.51	92.92	312.85	
83	0	77.41	13.86	102.89	91.27	311.90	blk. lt.3
	1.5	41.87	8.24	102.89	50.11	268.68	
	3	6.33	2.61	102.89	8.94	225.45	
84	0	7.13	2.82	102.89	9.95	226.51	blk. lt.3
	1.5	42.67	8.44	102.89	51.11	269.73	
	3	78.22	14.07	102.89	92.28	312.96	
85	0	77.72	13.99	102.74	91.71	312.06	blk. lt.3
	1.5	42.18	8.37	102.74	50.55	268.83	
	3	6.64	2.74	102.74	9.38	225.60	
86	0	6.82	2.69	102.74	9.51	225.74	blk. lt.3
	1.5	42.36	8.31	102.74	50.67	268.96	
	3	77.91	13.94	102.74	91.84	312.19	
87	0	77.93	13.90	101.92	91.83	310.45	blk. lt.3
	1.5	42.38	8.28	101.92	50.66	267.23	
	3	6.84	2.65	101.92	9.49	224.00	
88	0	6.62	2.77	101.92	9.39	223.89	blk. lt.3
	1.5	42.16	8.40	101.92	50.56	267.12	
	3	77.70	14.02	101.92	91.73	310.35	
89	0	36.66	4.25	224.32	40.91	514.03	blk. lt.3
	1.75	0.15	0.35	224.32	0.49	471.60	
	3.5	36.95	4.94	224.32	41.89	515.07	

Lanjutan Tabel 4.15.b Gaya Geser Rencana Balok Portal As.A-D (K=2)

Elm	Jarak (m)	VD,B (KN)	VL,B (KN)	VE,B (KN)	VG,B (KN)	VUB=1,05(VD,B + VL,B ± 4/2. VE,B) (KN)	KETERANGAN
90	0	49.03	14.06	73.11	63.10	219.79	blk. lt.4
	1.5	27.93	8.44	73.11	36.37	191.72	
	3	6.62	2.61	73.11	9.64	163.65	
91	0	6.63	2.61	73.11	9.25	163.25	blk. lt.4
	1.5	27.74	8.24	73.11	35.98	191.31	
	3	48.84	13.86	73.11	62.71	219.38	
92	0	40.15	7.11	165.54	47.27	397.26	blk. lt.4
	1.5	4.61	1.49	165.54	6.10	354.03	
	3	30.93	4.14	165.54	35.07	384.45	
93	0	77.20	13.64	69.69	91.04	241.93	blk. lt.4
	1.5	41.66	8.21	69.69	49.87	198.71	
	3	6.12	2.59	69.69	8.71	155.48	
94	0	7.34	2.84	69.69	10.18	157.03	blk. lt.4
	1.5	42.88	8.47	69.69	51.35	200.26	
	3	78.42	14.09	69.69	92.51	243.48	
95	0	77.37	13.87	67.07	91.24	236.65	blk. lt.4
	1.5	41.83	8.25	67.07	50.07	193.42	
	3	6.28	2.62	67.07	8.90	150.20	
96	0	7.17	2.81	67.07	9.98	151.33	blk. lt.4
	1.5	42.71	8.43	67.07	51.15	194.55	
	3	78.26	14.06	67.07	92.32	237.78	
97	0	77.77	14.00	67.18	91.77	237.44	blk. lt.4
	1.5	42.23	8.37	67.18	50.60	194.21	
	3	6.69	2.75	67.18	9.43	150.98	
98	0	6.77	2.68	67.18	9.45	151.00	blk. lt.4
	1.5	42.31	8.31	67.18	50.62	194.23	
	3	77.85	13.93	67.18	91.79	237.45	
99	0	77.58	13.80	69.01	91.38	240.86	blk. lt.4
	1.5	42.04	8.18	69.01	50.21	197.64	
	3	6.49	2.55	69.01	9.04	154.41	
100	0	6.96	2.88	69.01	9.84	155.25	blk. lt.4
	1.5	42.51	8.50	69.01	51.01	198.47	
	3	78.05	14.13	69.01	92.18	241.70	
101	0	34.81	3.75	130.78	38.56	315.13	blk. lt.4
	1.75	1.99	0.85	130.78	2.84	277.62	
	3.5	38.80	5.44	130.78	44.24	321.10	
102	0	32.14	9.91	39.42	42.05	126.93	blk. nok
	3	0.62	0.22	39.42	0.84	63.67	
	6	33.38	10.34	39.42	43.73	128.70	
103	0	27.43	9.47	64.53	36.90	174.25	blk. nok
	1.5	9.43	2.72	64.53	12.15	148.26	
	3	8.57	4.03	64.53	12.60	148.73	
104	0	49.71	10.31	41.97	60.02	151.17	blk. Nok
	3	0.45	0.19	41.97	0.64	88.81	
	6	48.81	9.94	41.97	58.75	149.83	
105	0	48.42	9.94	36.90	58.36	138.76	blk. Nok
	3	0.84	0.19	36.90	1.03	78.57	
	6	50.10	10.32	36.90	60.42	140.92	
106	0	49.93	10.49	37.01	60.42	141.16.	blk. Nok
	3	0.67	0.37	37.01	1.04	78.80	
	6	48.59	9.76	37.01	58.35	138.98	
107	0	48.03	9.71	40.23	57.73	145.10	blk. Nok
	3	1.23	0.42	40.23	1.65	86.21	
	6	50.49	10.54	40.23	61.04	148.56	

Lanjutan Tabel 4.15.b Gaya Geser Rencana Balok Portal As.A-D (K=2)

Elm	Jarak (m)	VD,B (KN)	VL,B (KN)	VE,B (KN)	VG,B (KN)	VUB=1,05(VD,B + VL,B ± 4/2. VE,B) (KN)	KETERANGAN
108	0	13.02	3.22	50.02	16.23	122.08	blk. Nok
	1.75	4.83	1.38	50.02	6.21	111.55	
	3.5	22.68	5.97	50.02	28.66	135.12	
109	0	15.94	5.78	25.26	21.72	75.84	blk. atap
	1.5	3.15	2.09	25.26	5.24	58.53	
	3	22.23	9.97	25.26	32.19	86.84	
110	0	59.12	22.15	24.38	81.26	136.52	blk. Atap
	1.5	40.04	14.27	24.38	54.31	108.22	
	3	20.96	6.40	24.38	27.35	79.92	
111	0	20.25	6.64	24.38	26.89	79.43	blk. Atap
	1.5	39.33	14.51	24.38	53.84	107.73	
	3	58.41	22.39	24.38	80.80	136.03	
112	0	39.47	16.30	18.09	55.77	96.55	blk. Atap
	3	1.31	0.55	18.09	1.86	39.95	
	6	36.85	15.20	18.09	52.05	92.64	
113	0	37.33	15.39	17.99	52.72	93.14	blk. atap
	3	0.83	0.36	17.99	1.19	39.04	
	6	38.99	16.11	17.99	55.10	95.64	
114	0	52.94	23.16	23.76	76.10	129.80	blk. Atap
	1.5	33.86	15.28	23.76	49.14	101.50	
	3	14.78	7.41	23.76	22.19	73.20	
115	0	13.82	6.05	23.76	19.88	70.77	blk. atap
	1.5	32.90	13.93	23.76	46.83	99.08	
	3	51.98	21.80	23.76	73.79	127.38	

Tabel 4.15.c Momen Rencana Kolom Portal As.A-D (K=2)

Elm	Jarak (m)	MD,k (KNm)	ML,k (KNm)	ME,k (KNm)	MU,k = 1.05(MD,k +ML,k ±ωd.ME,k) (KNm)	KET
1	0	9.54	2.77	-484.68	664.35	Kol.Basmen
	1.925	-5.23	-1.53	-150.57	195.70	
	3.85	-20.01	-5.83	183.55	-272.95	
2	0	-5.40	-1.92	-580.64	776.83	Kol.Basmen
	1.925	2.62	0.94	-98.56	137.14	
	3.85	10.63	3.79	383.52	-502.55	
3	0	9.09	1.81	-575.82	791.53	Kol.Basmen
	1.925	-5.13	-1.05	-100.61	129.93	
	3.85	-19.35	-3.91	374.60	-531.66	
4	0	-0.99	-0.25	-542.08	736.75	Kol.Basmen
	1.925	0.07	0.01	-117.46	160.04	
	3.85	1.13	0.27	307.16	-416.68	
5	0	-0.81	-0.20	-542.80	741.72	Kol.Basmen
	1.925	-0.19	-0.05	-116.26	159.76	
	3.85	0.43	0.11	310.28	-424.20	
6	0	-0.75	-0.20	-540.67	742.64	Kol.Basmen
	1.925	-0.39	-0.08	-116.90	160.07	
	3.85	-0.03	0.03	306.88	-422.50	
7	0	-9.73	-2.16	-565.00	768.55	Kol.Basmen
	1.925	4.24	0.93	-103.76	148.54	
	3.85	18.20	4.01	357.48	-471.48	
8	0	-3.66	-0.55	-357.16	490.76	Kol.Basmen
	1.925	1.32	0.15	-69.88	98.19	
	3.85	6.29	0.85	217.41	-294.39	
9	0	25.95	7.68	-225.36	340.96	KOL LT.1
	1.925	0.84	0.27	2.28	-1.51	
	3.85	-24.27	-7.14	229.92	-343.97	
10	0	-15.45	-5.42	-501.84	658.14	KOL LT.1
	1.925	-1.04	-0.27	-6.91	8.07	
	3.85	13.38	4.89	488.03	-642.01	
11	0	26.59	5.37	-489.95	698.87	KOL LT.1
	1.925	0.31	0.09	-5.89	8.49	
	3.85	-25.96	-5.19	478.17	-661.69	
12	0	-1.98	-0.44	-397.34	538.78	KOL LT.1
	1.925	-0.26	-0.05	-2.24	2.75	
	3.85	1.46	0.34	392.86	-533.29	
13	0	-0.72	-0.16	-400.36	546.24	KOL LT.1
	1.925	-0.02	0.00	-3.08	4.13	
	3.85	0.67	0.16	394.19	-537.97	
14	0	0.24	0.00	-396.10	543.26	KOL LT.1
	1.925	0.19	0.05	-2.37	3.36	
	3.85	0.15	0.10	391.37	-536.54	
15	0	-25.53	-5.64	-463.57	-659.58	KOL LT.1
	1.925	-0.10	-0.01	-5.78	-5.98	
	3.85	25.32	5.62	452.01	647.62	
16	0	-8.93	-1.23	-278.58	-389.64	KOL LT.1
	1.925	0.26	0.09	-4.23	-3.48	
	3.85	9.44	1.39	270.12	382.67	
17	0	23.75	6.97	-182.89	-224.71	KOL LT.2
	1.925	-0.21	-0.06	21.16	30.69	
	3.85	-24.16	-7.10	225.22	286.10	
18	0	-10.96	-4.26	-413.65	-576.14	KOL LT.2
	1.925	-0.02	0.01	14.88	22.31	
	3.85	10.91	4.28	443.40	620.74	
19	0	26.53	5.31	-406.03	-526.38	KOL LT.2
	1.925	-0.38	-0.07	14.85	21.89	
	3.85	-27.29	-5.46	435.73	570.16	

Lanjutan Tabel 4.15.c Momen Rencana Kolom Portal As.A-D (K=2)

Elm	Jarak (m)	MD,k (KNm)	ML,k (KNm)	ME,k (KNm)	MU,k= 1.05(MD,k +ML,k ± ωd.ME,k) (KNm)	KET
20	0	-0.84	-0.17	-334.44	-457.39	KOL LT.2
	1.925	0.00	0.01	18.50	27.27	
	3.85	0.84	0.19	371.44	511.94	
21	0	-0.71	-0.11	-333.82	-456.41	KOL LT.2
	1.925	-0.02	0.00	18.17	26.81	
	3.85	0.68	0.11	370.15	510.01	
22	0	-0.85	-0.23	-333.06	-455.52	KOL LT.2
	1.925	-0.01	0.02	18.31	27.01	
	3.85	0.84	0.26	369.68	509.53	
23	0	-26.32	-5.80	-382.50	-549.74	KOL LT.2
	1.925	0.31	0.08	15.38	23.34	
	3.85	26.93	5.95	413.26	596.42	
24	0	-10.73	-1.69	-223.79	-316.73	KOL LT.2
	1.925	0.21	0.06	9.47	15.17	
	3.85	11.14	1.81	242.73	347.07	
25	0	24.47	7.14	-130.21	-152.04	KOL LT.3
	1.925	0.60	0.23	48.64	69.04	
	3.85	-23.27	-6.69	227.48	290.12	
26	0	-9.09	-3.81	-300.02	-419.07	KOL LT.3
	1.925	-0.56	-0.13	28.48	40.31	
	3.85	7.97	3.56	356.99	499.70	
27	0	28.62	5.86	-294.71	-372.23	KOL LT.3
	1.925	0.00	-0.04	29.50	42.29	
	3.85	-28.62	-5.94	353.72	456.82	
28	0	-0.64	-0.17	-124.84	339.06	KOL LT.3
	1.925	0.03	0.04	17.85	-48.32	
	3.85	0.69	0.25	160.55	-435.69	
29	0	-0.84	-0.14	-123.42	336.69	KOL LT.3
	1.925	0.01	0.01	17.44	-47.86	
	3.85	0.86	0.16	158.30	-432.61	
30	0	-1.48	-0.34	-123.85	339.07	KOL LT.3
	1.925	0.02	-0.04	17.59	-48.96	
	3.85	1.51	0.25	159.03	-436.99	
31	0	-12.05	-1.96	-77.73	201.64	KOL LT.3
	1.925	-0.11	-0.06	10.07	-28.80	
	3.85	11.83	1.83	97.87	-259.24	
32	0	-12.05	-1.96	-77.73	201.64	KOL LT.3
	1.925	-0.11	-0.06	10.07	-28.80	
	3.85	11.83	1.83	97.87	-259.24	
33	0	26.74	8.09	-0.15	45.84	KOL LT.4
	1.34	-0.89	-0.33	29.79	-79.92	
	2.68	-28.52	-8.75	59.72	-205.67	
34	0	-10.42	-3.90	-51.09	132.11	KOL LT.4
	1.34	-1.45	-0.69	19.35	-55.20	
	2.68	7.53	2.53	89.78	-242.52	
35	0	30.91	6.19	-50.99	183.59	KOL LT.4
	1.34	4.08	1.23	18.55	-45.06	
	2.68	-22.76	-3.73	88.10	-273.71	
36	0	0.15	0.17	-45.24	125.39	KOL LT.4
	1.34	-1.36	-0.39	21.87	-61.56	
	2.68	-2.87	-0.94	88.98	-248.51	
37	0	-0.65	-0.04	-43.42	116.37	KOL LT.4
	1.34	0.32	0.15	22.13	-59.97	
	2.68	1.29	0.34	87.69	-236.31	
38	0	-1.76	-0.74	-45.48	116.82	KOL LT.4
	1.34	1.66	0.79	21.87	-57.15	
	2.68	5.08	2.32	89.22	-231.12	

Lanjutan Tabel 4.15.c Momen Rencana Kolom Portal As.A-D (K=2)

Elm	Jarak (m)	MD,k (KNm)	ML,k (KNm)	MEki (KNm)	MU,k= 1.05(MD,k +ML,k ± ωd.ME,k) (KNm)	KET
39	0	-30.46	-6.69	-47.65	81.92	KOL LT.4
	1.34	-3.92	-1.33	20.02	-60.05	
	2.68	22.61	4.02	87.68	-202.03	
40	0	-14.91	-2.98	-18.71	25.48	KOL LT.4
	1.34	1.16	0.67	13.37	-35.75	
	2.68	17.23	4.32	45.44	-96.98	
41	0	0.97	0.26	-16.58	40.78	KOL LT.4
	1.1	-4.30	-1.16	3.80	-17.43	
	2.2	-9.56	-2.58	24.17	-75.65	
42	0	29.77	7.32	-24.13	100.05	KOL LT.4
	1.1	-8.04	-3.60	13.66	-50.22	
	2.2	-45.85	-14.52	51.45	-200.49	
43	0	-3.89	-1.12	-28.91	71.98	KOL LT.4
	1.1	7.54	2.51	16.63	-35.15	
	2.2	18.97	6.13	62.17	-142.29	
44	0	0.85	0.82	-23.33	66.76	KOL LT.4
	1.1	0.00	0.10	15.78	-42.72	
	2.2	-0.85	-0.62	54.89	-152.21	
45	0	3.35	2.53	-26.32	82.61	KOL LT.4
	1.1	-5.25	-2.66	16.99	-53.91	
	2.2	-13.85	-7.85	60.29	-190.44	
46	0	-29.49	-8.01	-15.02	-51.47	KOL LT.4
	1.1	11.60	6.61	11.29	28.74	
	2.2	52.69	21.23	37.60	108.96	

Tabel 4.15.d Gaya Geser Kolom Portal As.A-D (K=2)

Elm	Jarak (m)	VD,k (KNm)	VL,k (KNm)	VE,k (KNm)	VU,k= 1.05.(VD,k +VL,k ± ωd.VE,k) (KNm)	KET
1	0	7.68	2.24	173.56	247.32	Kol.Basmen
	1.925	7.68	2.24	173.56	247.32	
	3.85	7.68	2.24	173.56	247.32	
2	0	4.17	1.48	250.43	347.76	Kol.Basmen
	1.925	4.17	1.48	250.43	347.76	
	3.85	4.17	1.48	250.43	347.76	
3	0	7.39	1.49	246.86	346.28	Kol.Basmen
	1.925	7.39	1.49	246.86	346.28	
	3.85	7.39	1.49	246.86	346.28	
4	0	0.55	0.13	220.58	301.81	Kol.Basmen
	1.925	0.55	0.13	220.58	301.81	
	3.85	0.55	0.13	220.58	301.81	
5	0	0.32	0.08	221.58	302.88	Kol.Basmen
	1.925	0.32	0.08	221.58	302.88	
	3.85	0.32	0.08	221.58	302.88	
6	0	0.19	0.06	220.14	300.75	Kol.Basmen
	1.925	0.19	0.06	220.14	300.75	
	3.85	0.19	0.06	220.14	300.75	
7	0	7.26	1.60	239.60	336.36	Kol.Basmen
	1.925	7.26	1.60	239.60	336.36	
	3.85	7.26	1.60	239.60	336.36	
8	0	2.58	0.37	149.24	206.81	Kol.Basmen
	1.925	2.58	0.37	149.24	206.81	
	3.85	2.58	0.37	149.24	206.81	
9	0	13.04	3.85	118.25	179.15	KOL LT.1
	1.925	13.04	3.85	118.25	179.15	
	3.85	13.04	3.85	118.25	179.15	
10	0	7.49	2.68	257.11	361.63	KOL LT.1
	1.925	7.49	2.68	257.11	361.63	
	3.85	7.49	2.68	257.11	361.63	
11	0	13.66	2.74	251.46	360.46	KOL LT.1
	1.925	13.66	2.74	251.46	360.46	
	3.85	13.66	2.74	251.46	360.46	
12	0	0.89	0.20	205.24	281.31	KOL LT.1
	1.925	0.89	0.20	205.24	281.31	
	3.85	0.89	0.20	205.24	281.31	
13	0	0.36	0.08	206.38	282.17	KOL LT.1
	1.925	0.36	0.08	206.38	282.17	
	3.85	0.36	0.08	206.38	282.17	
14	0	0.02	0.03	204.54	279.24	KOL LT.1
	1.925	0.02	0.03	204.54	279.24	
	3.85	0.02	0.03	204.54	279.24	
15	0	13.21	2.93	237.81	341.56	KOL LT.1
	1.925	13.21	2.93	237.81	341.56	
	3.85	13.21	2.93	237.81	341.56	
16	0	4.77	0.68	142.52	200.26	KOL LT.1
	1.925	4.77	0.68	142.52	200.26	
	3.85	4.77	0.68	142.52	200.26	
17	0	12.44	3.66	106.00	161.60	KOL LT.2
	1.925	12.44	3.66	106.00	161.60	
	3.85	12.44	3.66	106.00	161.60	
18	0	5.68	2.22	222.61	312.15	KOL LT.2
	1.925	5.68	2.22	222.61	312.15	
	3.85	5.68	2.22	222.61	312.15	
19	0	13.98	2.80	218.64	316.06	KOL LT.2
	1.925	13.98	2.80	218.64	316.06	
	3.85	13.98	2.80	218.64	316.06	

Lanjutan Tabel 4.15.d Gaya Geser Rencana Kolom Portal As.A-D (K=2)

Elm	Jarak (m)	VD,k (KNm)	VL,k (KNm)	VE,k (KNm)	VU,k= 1.05.(VD,k +VL,k ± ωd.VE,k) (KNm)	KET
20	0	0.44	0.09	183.35	250.82	KOL LT.2
	1.925	0.44	0.09	183.35	250.82	
	3.85	0.44	0.09	183.35	250.82	
21	0	0.36	0.06	182.85	250.03	KOL LT.2
	1.925	0.36	0.06	182.85	250.03	
	3.85	0.36	0.06	182.85	250.03	
22	0	0.44	0.13	182.53	249.74	KOL LT.2
	1.925	0.44	0.13	182.53	249.74	
	3.85	0.44	0.13	182.53	249.74	
23	0	13.83	3.05	206.69	299.86	KOL LT.2
	1.925	13.83	3.05	206.69	299.86	
	3.85	13.83	3.05	206.69	299.86	
24	0	5.68	0.91	121.17	172.32	KOL LT.2
	1.925	5.68	0.91	121.17	172.32	
	3.85	5.68	0.91	121.17	172.32	
25	0	12.40	3.59	92.91	143.61	KOL LT.3
	1.925	12.40	3.59	92.91	143.61	
	3.85	12.40	3.59	92.91	143.61	
26	0	4.43	1.91	170.65	239.60	KOL LT.3
	1.925	4.43	1.91	170.65	239.60	
	3.85	4.43	1.91	170.65	239.60	
27	0	14.87	3.07	168.42	248.72	KOL LT.3
	1.925	14.87	3.07	168.42	248.72	
	3.85	14.87	3.07	168.42	248.72	
28	0	-0.64	-0.17	-124.84	202.85	KOL LT.3
	1.925	0.03	0.04	17.85	202.85	
	3.85	0.69	0.25	160.55	202.85	
29	0	-0.84	-0.14	-123.42	200.31	KOL LT.3
	1.925	0.01	0.01	17.44	200.31	
	3.85	0.86	0.16	158.30	200.31	
30	0	-1.48	-0.34	-123.85	201.56	KOL LT.3
	1.925	0.02	-0.04	17.59	201.56	
	3.85	1.51	0.25	159.03	201.56	
31	0	-28.84	-6.48	-137.97	236.23	KOL LT.3
	1.925	0.18	0.10	14.91	236.23	
	3.85	29.20	6.68	167.79	236.23	
32	0	-12.05	-1.96	-77.73	132.06	KOL LT.3
	1.925	-0.11	-0.06	10.07	132.06	
	3.85	11.83	1.83	97.87	132.06	
33	0	26.74	8.09	-0.15	91.98	KOL LT.4
	1.34	-0.89	-0.33	29.79	91.98	
	2.68	-28.52	-8.75	59.72	91.98	
34	0	-10.42	-3.90	-51.09	157.75	KOL LT.4
	1.34	-1.45	-0.69	19.35	157.75	
	2.68	7.53	2.53	89.78	157.75	
35	0	30.91	6.19	-50.99	171.72	KOL LT.4
	1.34	4.08	1.23	16.55	171.72	
	2.68	-22.76	-3.73	88.10	171.72	
36	0	0.15	0.17	-45.24	142.60	KOL LT.4
	1.34	-1.36	-0.39	21.87	142.60	
	2.68	-2.87	-0.94	88.98	142.60	
37	0	-0.65	-0.04	-43.42	138.59	KOL LT.4
	1.34	0.32	0.15	22.13	138.59	
	2.68	1.29	0.34	87.69	138.59	
38	0	-1.76	-0.74	-45.48	145.43	KOL LT.4
	1.34	1.66	0.79	21.87	145.43	
	2.68	5.08	2.32	89.22	145.43	

Lanjutan Tabel 4.15.d Gaya Geser Rencana Kolom Portal As.A-D (K=2)

Elm	Jarak (m)	VD,k (KNm)	VL,k (KNm)	VE,k (KNm)	VU,k=1.05.(VD,k +VL,k ± ωd.VE,k) (KNm)	KET
39	0	-30.46	-6.69	-47.65	167.85	KOL LT.4
	1.34	-3.92	-1.33	20.02	167.85	
	2.68	22.61	4.02	87.68	167.85	
40	0	-14.91	-2.98	-18.71	83.29	KOL LT.4
	1.34	1.16	0.67	13.37	83.29	
	2.68	17.23	4.32	45.44	83.29	
41	0	0.97	0.26	-16.58	56.95	KOL LT.4
	1.1	-4.30	-1.16	3.80	56.95	
	2.2	-9.56	-2.58	24.17	56.95	
42	0	34.37	9.92	68.71	140.30	KOL LT.4
	1.1	34.37	9.92	68.71	140.30	
	2.2	34.37	9.92	68.71	140.30	
43	0	10.39	3.30	82.80	127.39	KOL LT.4
	1.1	10.39	3.30	82.80	127.39	
	2.2	10.39	3.30	82.80	127.39	
44	0	0.77	0.65	71.12	98.56	KOL LT.4
	1.1	0.77	0.65	71.12	98.56	
	2.2	0.77	0.65	71.12	98.56	
45	0	7.82	4.72	78.73	120.63	KOL LT.4
	1.1	7.82	4.72	78.73	120.63	
	2.2	7.82	4.72	78.73	120.63	
46	0	37.35	13.29	47.84	118.48	KOL LT.4
	1.1	37.35	13.29	47.84	118.48	
	2.2	37.35	13.29	47.84	118.48	

Tabel 4.16.a Tulangan Lentur dan Geser Terpasang Balok 400/800 Portal As. 9-10 (K=1)

Lantai	Tulangan Tumpuan (mm^2)				Tulangan Lapangan (mm^2)				Jarak tulangan geser Av 3ϕ10 = 235,5 (mm^2)	
	Luas tulangan atas		Luas tulangan bawah		Luas tulangan atas		Luas tulangan bawah		Sendi plastis	Luar sendi plastis
	Perlu	Terpasang	Perlu	Terpasang	Perlu	Terpasang	Perlu	Terpasang		
1	5318.74	10D25 = 4909	2659.37	5D25 = 2454.8	1193.37	3D25 = 1472.7	1799.79	6D25 = 2945.2	ϕ10-90	ϕ10-150
2	5368.41	10D25 = 4909	2734.45	5D25 = 2454.8	1428.84	3D25 = 1472.7	2057.28	6D25 = 2945.2	ϕ10-90	ϕ10-150
3	5160.23	10D25 = 4909	2580.11	5D25 = 2454.8	1456.21	3D25 = 1472.7	1910.23	6D25 = 2945.2	ϕ10-90	ϕ10-150
4	5291.42	10D25 = 4909	2645.71	5D25 = 2454.8	1453.40	3D25 = 1472.7	1859.26	6D25 = 2945.2	ϕ10-90	ϕ10-150
Atap	2404.89	5D25 = 2454.8	-	2D25 = 981.80	-	-	-	-	ϕ10-200	ϕ10-300

Tabel 4.16.b Tulangan Lentur dan Geser Terpasang Balok 400/800 Portal As. 9-10 (K=2)

Lantai	Tulangan Tumpuan (mm^2)				Tulangan Lapangan (mm^2)				Jarak tulangan geser Av 3ϕ10 = 235,5 (mm^2)	
	Luas tulangan atas		Luas tulangan bawah		Luas tulangan atas		Luas tulangan bawah		Di dalam Darah d	Di luar Darah d
	Perlu	Terpasang	Perlu	Terpasang	Perlu	Terpasang	Perlu	Terpasang		
1	6660.00	13D25 = 6381,7	3454.34	11D25 = 5399,9	2224.75	5D25 = 2454.8	3414.87	10D25 = 4909	ϕ10-110	ϕ10-140
2	6660.00	13D25 = 6381,7	3605.73	11D25 = 5399,9	2749.28	5D25 = 2454.8	4262.96	10D25 = 4909	ϕ10-110	ϕ10-140
3	6660.00	13D25 = 6381,7	3857.46	11D25 = 5399,9	2508.04	5D25 = 2454.8	3696.58	10D25 = 4909	ϕ10-110	ϕ10-140
4	6660.00	13D25 = 6381,7	3579.47	11D25 = 5399,9	1962.97	5D25 = 2454.8	3567.29	10D25 = 4909	ϕ10-110	ϕ10-140
Atap	2404.89	5D25 = 2454.8	-	2D25 = 981.80	-	-	-	-	ϕ10-200	ϕ10-300

Tabel 4.17.a Tulangan Lentur dan Geser Terpasang Kolom 450/700 Portal As. 9-10 (K=1)

lt	kolom eksterior kiri								kolom eksterior kanan							
	Lentur						Geser 4P10		lentur						Geser 4P10	
	Mu,k (KNm)	Nu,k (KN)	e (mm)	As perlu (mm^2)	As pasang (mm^2)	ϕPn (KN)	Dalam d=450 mm	Tengah Bentang	Mu,k (KNm)	Nu,k (KN)	e (mm)	As perlu (mm^2)	As pasang (mm^2)	ϕPn (KN)	Dalam d=450 mm	Tengah Bentang
Bm	910.59	1081.76	841.77	9836	22D25=10799,8	1875.79	P10-70	P10-90	910.59	1081.76	841.77	9836	22D25=10799,8	1875.79	P10-70	P10-90
1	910.59	1081.76	841.77	9836	22D25=10799,8	1875.79	P10-70	P10-90	910.59	1081.76	841.77	9836	22D25=10799,8	1875.79	P10-70	P10-90
2	910.59	1081.76	841.77	9836	22D25=10799,8	1875.79	P10-70	P10-90	910.59	1081.76	841.77	9836	22D25=10799,8	1875.79	P10-70	P10-90
3	910.59	1081.76	841.77	9836	22D25=10799,8	1875.79	P10-70	P10-90	910.59	1081.76	841.77	9836	22D25=10799,8	1875.79	P10-70	P10-90
4	910.59	1081.76	841.77	9836	22D25=10799,8	1875.79	P10-70	P10-90	910.59	1081.76	841.77	9836	22D25=10799,8	1875.79	P10-70	P10-90

Tabel 4.17.b Tulangan Lentur dan Geser Terpasang Kolom 450/700 Portal As. 9-10 (K=2)

lt	kolom eksterior kiri								kolom eksterior kanan							
	Lentur						Geser 4P10		lentur						Geser 4P10	
	Mu,k (KNm)	Nu,k (KN)	e (mm)	As perlu (mm^2)	As pasang (mm^2)	ϕPn (KN)	Dalam d=450 mm	Tengah Bentang	Mu,k (KNm)	Nu,k (KN)	e (mm)	As perlu (mm^2)	As pasang (mm^2)	ϕPn (KN)	Dalam d=450 mm	Tengah Bentang
Bm	1291,32	2592,6	841.77	12600	26D25=12763,4	3481,2	P10-60	P10-100	1291,32	2592,6	841.77	12600	26D25=12763,4	3481,2	P10-100	P10-200
1	1291,32	2592,6	841.77	12600	26D25=12763,4	3481,2	P10-60	P10-100	1291,32	2592,6	841.77	12600	26D25=12763,4	3481,2	P10-100	P10-200
2	1291,32	2592,6	841.77	12600	26D25=12763,4	3481,2	P10-60	P10-100	1291,32	2592,6	841.77	12600	26D25=12763,4	3481,2	P10-100	P10-200
3	1291,32	2592,6	841.77	12600	26D25=12763,4	3481,2	P10-60	P10-100	1291,32	2592,6	841.77	12600	26D25=12763,4	3481,2	P10-100	P10-200
4	1291,32	2592,6	841.77	12600	26D25=12763,4	3481,2	P10-60	P10-100	1291,32	2592,6	841.77	12600	26D25=12763,4	3481,2	P10-100	P10-200

Tabel 4.18.a Tulangan Lentur dan Geser Terpasang Balok 400/800 Portal As. 6,7-8 (K=1)

Lantai	Tulangan Tumpuan (mm^2)				Tulangan Lapangan (mm^2)				Jarak tulangan geser Av 3ϕ10 = 235.5 (mm^2)	
	Luas tulangan atas		Luas tulangan bawah		Luas tulangan atas		Luas tulangan bawah		Sendi plastis	Luar sendi plastis
	Perlu	Terpasang	Perlu	Terpasang	Perlu	Terpasang	Perlu	Terpasang		
1	3012.63	8D25 = 3927.0	737.18	4D25 ≈ 1963.6	1193.37	3D25 ≈ 1472.7	1536.12	4D25 = 1963.6	ϕ10-100	ϕ10-200
2	3428.48	8D25 = 3927.0	1221.67	4D25 ≈ 1963.6	1428.84	3D25 ≈ 1472.7	1121.77	4D25 = 1963.6	ϕ10-100	ϕ10-200
3	3478.48	8D25 = 3927.0	1196.83	4D25 ≈ 1963.6	1456.21	3D25 ≈ 1472.7	981.86	4D25 = 1963.6	ϕ10-100	ϕ10-200
4	3478.18	8D25 = 3927.0	955.22	4D25 ≈ 1963.6	1453.40	3D25 ≈ 1472.7	1094.14	4D25 = 1963.6	ϕ10-100	ϕ10-200
Atap	2303.36	5D25 = 2454.8	-	2D25 ≈ 819.8	-	-	-	-	ϕ10-250	ϕ10-300

Tabel 4.18.b Tulangan Lentur dan Geser Terpasang Balok 400/800 Portal As. 6,7-8 (K=2)

Lantai	Tulangan Tumpuan (mm^2)				Tulangan Lapangan (mm^2)				Jarak tulangan geser Av 3ϕ10 = 235.5 (mm^2)	
	Luas tulangan atas		Luas tulangan bawah		Luas tulangan atas		Luas tulangan bawah		Di dalam Darah d	Di luar Darah d
	Perlu	Terpasang	Perlu	Terpasang	Perlu	Terpasang	Perlu	Terpasang		
1	3573.72	10D25 = 4909.0	1916.48	6D25 ≈ 2945.2	1873.19	4D25 ≈ 1963.6	2121.57	6D25 = 2945.2	ϕ10-110	ϕ10-150
2	4335.97	10D25 = 4909.0	2900.29	6D25 ≈ 2945.2	877.46	4D25 ≈ 1963.6	2379.70	6D25 = 2945.2	ϕ10-110	ϕ10-150
3	4431.92	10D25 = 4909.0	2933.70	6D25 ≈ 2945.2	922.57	4D25 ≈ 1963.6	2446.23	6D25 = 2945.2	ϕ10-110	ϕ10-150
4	4393.81	10D25 = 4909.0	2225.10	6D25 ≈ 2945.2	859.40	4D25 ≈ 1963.6	2566.75	6D25 = 2945.2	ϕ10-110	ϕ10-150
Atap	1985.80	5D25 = 2454.8	-	2D25 ≈ 819.8	-	-	-	-	ϕ10-250	ϕ10-300

Tabel 4.19.a Tulangan Lentur dan Geser Terpasang Kolom 450/700 Portal As. 6,7-8 (K=1)

lt	kolom eksterior kiri dan kanan								kolom interior							
	Lentur						Geser 4P10		lentur						Geser 4P10	
	Mu,k (KNm)	Nu,k (KN)	e (mm)	As perlu (mm^2)	As pasang (mm^2)	ϕPn (KN)	Dalam d=450 mm	Tengah Bentang	Mu,k (KNm)	Nu,k (KN)	e (mm)	As perlu (mm^2)	As pasang (mm^2)	ϕPn (KN)	Dalam d=450 mm	Tengah Bentang
Bm	819.06	1127.20	575	6300	14D25=6872.6	1984.91	P10-70	P10-90	1295.42	2957.36	440	10080	22D25=10799,8	3308.78	P10-70	P10-90
1	819.06	1127.20	575	6300	14D25=6872.6	1984.91	P10-70	P10-90	1295.42	2957.36	440	10080	22D25=10799,8	3308.78	P10-70	P10-90
2	819.06	1127.20	575	6300	14D25=6872.6	1984.91	P10-70	P10-90	1295.42	2957.36	440	10080	22D25=10799,8	3308.78	P10-70	P10-90
3	819.06	1127.20	575	6300	14D25=6872.6	1984.91	P10-70	P10-90	1295.42	2957.36	440	10080	22D25=10799,8	3308.78	P10-70	P10-90
4	819.06	1127.20	575	6300	14D25=6872.6	1984.91	P10-70	P10-90	1295.42	2957.36	440	10080	22D25=10799,8	3308.78	P10-70	P10-90

Tabel 4.19.b Tulangan Lentur dan Geser Terpasang Kolom 450/700 Portal As. 6,7-8 (K=2)

lt	kolom eksterior kiri dan kanan								kolom interior							
	Lentur						Geser 4P10		lentur						Geser 4P10	
	Mu,k (KNm)	Nu,k (KN)	e (mm)	As perlu (mm^2)	As pasang (mm^2)	ϕPn (KN)	Dalam d=450 mm	Tengah Bentang	Mu,k (KNm)	Nu,k (KN)	e (mm)	As perlu (mm^2)	As pasang (mm^2)	ϕPn (KN)	Dalam d=450 mm	Tengah Bentang
Bm	1390.81	1683.93	841.77	12600	26D25=12763,4	3481,2	P10-60	P10-100	1429.69	3213.25	841.77	12600	26D25=12763,4	3481,2	P10-100	P10-200
1	1390.81	1683.93	841.77	12600	26D25=12763,4	3481,2	P10-60	P10-100	1429.69	3213.25	841.77	12600	26D25=12763,4	3481,2	P10-100	P10-200
2	1390.81	1683.93	841.77	12600	26D25=12763,4	3481,2	P10-60	P10-100	1429.69	3213.25	841.77	12600	26D25=12763,4	3481,2	P10-100	P10-200
3	1390.81	1683.93	841.77	12600	26D25=12763,4	3481,2	P10-60	P10-100	1429.69	3213.25	841.77	12600	26D25=12763,4	3481,2	P10-100	P10-200
4	1390.81	1683.93	841.77	12600	26D25=12763,4	3481,2	P10-60	P10-100	1429.69	3213.25	841.77	12600	26D25=12763,4	3481,2	P10-100	P10-200

Tabel 4.20.a Tulangan Lentur dan Geser Terpasang Balok 400/800 Portal As. A-D (K=1)

Lantai	Tulangan Tumpuan (mm^2)				Tulangan Lapangan (mm^2)				Jarak tulangan geser Av 3ϕ10 = 235.5 (mm^2)	
	Luas tulangan atas		Luas tulangan bawah		Luas tulangan atas		Luas tulangan bawah		Sendi plastis	Luar sendi plastis
	Perlu	Terpasang	Perlu	Terpasang	Perlu	Terpasang	Perlu	Terpasang		
1	1200.00	4D22 = 1520.4	1233.37	4D22 = 1520.4	225.05	2D22 = 760.2	491.99	2D22 = 760.2	ϕ10-100	ϕ10-250
2	1200.00	4D22 = 1520.4	1221.10	4D22 = 1520.4	229.28	2D22 = 760.2	483.86	2D22 = 760.2	ϕ10-100	ϕ10-250
3	1200.00	4D22 = 1520.4	1200.00	4D22 = 1520.4	193.51	2D22 = 760.2	420.32	2D22 = 760.2	ϕ10-100	ϕ10-250
4	1200.00	4D22 = 1520.4	1200.00	4D22 = 1520.4	117.54	2D22 = 760.2	274.37	2D22 = 760.2	ϕ10-100	ϕ10-250
Nok	1200.00	4D22 = 1520.4	1200.00	4D22 = 1520.4	-	2D22 = 760.2	147.64	2D22 = 760.2	ϕ10-200	ϕ10-300
Atap	1200.00	4D22 = 1520.4	1200.00	4D22 = 1520.4	62.14	2D22 = 760.2	375.46	2D22 = 760.2	ϕ10-200	ϕ10-300

Tabel 4.20.b Tulangan Lentur dan Geser Terpasang Balok 400/800 Portal As. A-D (K=2)

Lantai	Tulangan Tumpuan (mm^2)				Tulangan Lapangan (mm^2)				Jarak tulangan geser Av 3ϕ10 = 235.5(mm^2)	
	Luas tulangan atas		Luas tulangan bawah		Luas tulangan atas		Luas tulangan bawah		Di dalam Darah d	Di luar Darah d
	Perlu	Terpasang	Perlu	Terpasang	Perlu	Terpasang	Perlu	Terpasang		
1	2436.54	7D22 = 2660.7	2150.28	6D22 = 2280.6	485.67	2D22 = 760.2	947.70	4D22 = 1520.4	ϕ10-110	ϕ10-180
2	2417.76	7D22 = 2660.7	2156.29	6D22 = 2280.6	490.02	2D22 = 760.2	938.44	4D22 = 1520.4	ϕ10-110	ϕ10-180
3	1936.12	7D22 = 2660.7	1652.17	6D22 = 2280.6	415.89	2D22 = 760.2	809.15	4D22 = 1520.4	ϕ10-110	ϕ10-180
4	1248.70	7D22 = 2660.7	949.07	6D22 = 2280.6	258.08	2D22 = 760.2	516.44	4D22 = 1520.4	ϕ10-110	ϕ10-180
Nok	747.96	4D22 = 1520.4	410.51	4D22 = 1520.4	-	2D22 = 760.2	147.64	4D22 = 1520.4	ϕ10-200	ϕ10-300
Atap	625.93	4D22 = 1520.4	149.60	4D22 = 1520.4	62.14	2D22 = 760.2	375.46	4D22 = 1520.4	ϕ10-200	ϕ10-300

Tabel 4.21.a Tulangan Lentur dan Geser Terpasang Kolom 450/700 Portal As. A-D (K=1)

lt	kolom eksterior kiri dan kanan								kolom interior							
	Lentur						geser		lentur						geser	
	Mu,k (KNm)	Nu,k (KN)	e (mm)	As perlu (mm^2)	As pasang (mm^2)	ϕPn (KN)	Dalam d=450 mm	Tengah Bentang	Mu,k (KNm)	Nu,k (KN)	e (mm)	As perlu (mm^2)	As pasang (mm^2)	ϕPn (KN)	Dalam d=450 mm	Tengah Bentang
Bm	372.41	370.23	1005	3150	8D25=3927.2	568.39	P10-70	P10-90	744.61	1931.84	385	6300	14D25=6872.6	2289.56	P10-70	P10-90
1	372.41	370.23	1005	3150	8D25=3927.2	568.39	P10-70	P10-90	744.61	1931.84	385	6300	14D25=6872.6	2289.56	P10-70	P10-90
2	372.41	370.23	1005	3150	8D25=3927.2	568.39	P10-70	P10-90	744.61	1931.84	385	6300	14D25=6872.6	2289.56	P10-70	P10-90
3	372.41	370.23	1005	3150	8D25=3927.2	568.39	P10-70	P10-90	744.61	1931.84	385	6300	14D25=6872.6	2289.56	P10-70	P10-90
4	372.41	370.23	1005	3150	8D25=3927.2	568.39	P10-70	P10-90	744.61	1931.84	385	6300	14D25=6872.6	2289.56	P10-70	P10-90

Tabel 4.21.b Tulangan Lentur dan Geser Terpasang Kolom 450/700 Portal As. A-D (K=2)

lt	kolom eksterior kiri dan kanan								kolom interior							
	Lentur						Geser 4P10		lentur						Geser 4P10	
	Mu,k (KNm)	Nu,k (KN)	e (mm)	As perlu (mm^2)	As pasang (mm^2)	ϕPn (KN)	Dalam d=450 mm	Tengah Bentang	Mu,k (KNm)	Nu,k (KN)	e (mm)	As perlu (mm^2)	As pasang (mm^2)	ϕPn (KN)	Dalam d=450 mm	Tengah Bentang
Bm	863.62	1245.31	453	6750	14D25=6872.6	1547.6	P10-60	P10-100	891.76	2709.18	330	6750	14D25=6872.6	3081,2	P10-100	P10-200
1	863.62	1245.31	453	6750	14D25=6872.6	1547.6	P10-60	P10-100	891.76	2709.18	330	6750	14D25=6872.6	3081,2	P10-100	P10-200
2	863.62	1245.31	453	6750	14D25=6872.6	1547.6	P10-60	P10-100	891.76	2709.18	330	6750	14D25=6872.6	3081,2	P10-100	P10-200
3	863.62	1245.31	453	6750	14D25=6872.6	1547.6	P10-60	P10-100	891.76	2709.18	330	6750	14D25=6872.6	3081,2	P10-100	P10-200
4	863.62	1245.31	453	6750	14D25=6872.6	1547.6	P10-60	P10-100	891.76	2709.18	330	6750	14D25=6872.6	3081,2	P10-100	P10-200

Tabel 4.22.a Perbandingn Berat Tulangan Lentur Balok 400/800 Portal As.9-10

Lt	Tulangan Tumpauan										Tulangan Lapangan									
	Daktilitas Penuh (K=1)					Daktilitas Terbatas (K=2)					Daktilitas Penuh (K=1)					Daktilitas Terbatas (K=2)				
	Atas	Bawah	BS (kg/m)	L (m)	Berat (kg)	Atas	Bawah	BS (kg/m)	L (m)	Berat (kg)	Atas	Bawah	BS (kg/m)	L (m)	Berat (kg)	Atas	Bawah	BS (kg/m)	L (m)	Berat (kg)
1	10D25	5D25	3.85	4.88	281.53	13D25	11D25	3.85	4.88	450.45	3D25	6D25	3.85	8.75	303.19	5D25	10D25	3.85	8.75	505.31
2	10D25	5D25	3.85	4.88	281.53	13D25	11D25	3.85	4.88	450.45	3D25	6D25	3.85	8.75	303.19	5D25	10D25	3.85	8.75	505.31
3	10D25	5D25	3.85	4.88	281.53	13D25	11D25	3.85	4.88	450.45	3D25	6D25	3.85	8.75	303.19	5D25	10D25	3.85	8.75	505.31
4	10D25	5D25	3.85	4.88	281.53	13D25	11D25	3.85	4.88	450.45	3D25	6D25	3.85	8.75	303.19	5D25	10D25	3.85	8.75	505.31
Atap	5D25	2D25	3.85	3.25	87.59	5D25	2D25	3.85	3.25	87.59	-	-	3.85	-	-	-	-	3.85	-	-
Jumlah					1213.71	Jumlah				1889.39	Jumlah				1212.75	Jumlah				2021.25
Perbandingan					1.00	Perbandingan				1.56	Perbandingan				1.00	Perbandingan				1.67

Tabel 4.22.b Perbandingn Berat Tulangan Lentur Balok 400/800 Portal As.6,7,8

Lt	Tulangan Tumpauan										Tulangan Lapangan									
	Daktilitas Penuh (K=1)					Daktilitas Terbatas (K=2)					Daktilitas Penuh (K=1)					Daktilitas Terbatas (K=2)				
	Atas	Bawah	BS (kg/m)	L (m)	Berat (kg)	Atas	Bawah	BS (kg/m)	L (m)	Berat (kg)	Atas	Bawah	BS (kg/m)	L (m)	Berat (kg)	Atas	Bawah	BS (kg/m)	L (m)	Berat (kg)
1	8D25	4D25	3.85	6.5	300.3	10D25	6D25	3.85	6.5	400.4	3D25	4D25	3.85	11.5	309.93	4D25	6D25	3.85	11.5	442.75
2	8D25	4D25	3.85	6.5	300.3	10D26	6D26	3.85	6.5	400.4	3D25	4D25	3.85	11.5	309.93	4D25	6D25	3.85	11.5	442.75
3	8D25	4D25	3.85	6.5	300.3	10D27	6D27	3.85	6.5	400.4	3D25	4D25	3.85	11.5	309.93	4D25	6D25	3.85	11.5	442.75
4	8D25	4D25	3.85	6.5	300.3	10D28	6D28	3.85	6.5	400.4	3D25	4D25	3.85	11.5	309.93	4D25	6D25	3.85	11.5	442.75
Atap	5D25	2D25	3.85	3.25	87.58	5D25	2D25	3.85	3.25	87.59	-	-	3.85	-	-	-	-	3.85	-	-
Jumlah					1288.79	Jumlah				1689.19	Jumlah				1239.7	Jumlah				1771.0
Perbandingan					1	Perbandingan				1.31	Perbandingan				1	Perbandingan				1.43

Tabel 4.22.c Perbandingn Berat Tulangan Lentur Balok 250/400 Portal As.A-D

Lt	Tulangan Tumpauan										Tulangan Lapangan									
	Daktilitas Penuh (K=1)					Daktilitas Terbatas (K=2)					Daktilitas Penuh (K=1)					Daktilitas Terbatas (K=2)				
	Atas	Bawah	BS (kg/m)	L (m)	Berat (kg)	Atas	Bawah	BS (kg/m)	L (m)	Berat (kg)	Atas	Bawah	BS (kg/m)	L (m)	Berat (kg)	Atas	Bawah	BS (kg/m)	L (m)	Berat (kg)
1	4D22	4D22	2.98	11.2	267.01	7D22	6D22	2.98	11.2	433.89	2D22	2D22	2.98	25.3	301.58	2D22	4D22	2.98	25.3	452.36
2	4D22	4D22	2.98	11.2	267.01	7D22	6D22	2.98	11.2	433.89	2D22	2D22	2.98	25.3	301.58	2D22	4D22	2.98	25.3	452.36
3	4D22	4D22	2.98	11.2	267.01	7D22	6D22	2.98	11.2	433.89	2D22	2D22	2.98	25.3	301.58	2D22	4D22	2.98	25.3	452.36
4	4D22	4D22	2.98	11.2	267.01	7D22	6D22	2.98	11.2	433.89	2D22	2D22	2.98	25.3	301.58	2D22	4D22	2.98	25.3	452.36
Nok	4D22	4D22	2.98	11.2	267.01	4D22	4D22	2.98	11.2	267.01	2D22	2D22	2.98	25.3	301.58	2D22	4D22	2.98	25.3	452.36
Atap	4D22	4D22	2.98	8	190.72	4D22	4D22	2.98	8	190.72	2D22	2D22	2.98	19	226.48	2D22	4D22	2.98	19	339.72
Jumlah					1525.76	Jumlah				2193.28	Jumlah				2599.56	Jumlah				2601.54
Perbandingan					1	Perbandingan				1.438	Perbandingan				1	Perbandingan				1.5

Tabel 4.23.a Perbandingn Berat Tulangan Lentur Kolom 450/700 Portal As.9-10

Lt	Tinggi (m)	Daktilitas Penuh (K=1)				Daktilitas Terbatas (K=2)			
		Kol ekst kiri		Kol ekst kanan	Berat (kg)	Kol ekst kiri		Kol ekstr kanan	Berat (kg)
		tulangan	BS (kg/m)	tulangan		tulangan	BS (kg/m)	tulangan	
Bm	3.85	22D25	3.85	22D25	326.10	26D25	3.85	26D25	385.39
1	3.85	22D25	3.85	22D25	326.10	26D25	3.85	26D25	385.39
2	3.85	22D25	3.85	22D25	326.10	26D25	3.85	26D25	385.39
3	3.85	22D25	3.85	22D25	326.10	26D25	3.85	26D25	385.39
4	4.88	22D25	3.85	22D25	413.34	26D25	3.85	26D25	488.49
Jumlah					1717.72	Jumlah			2030.03
Perbandingan					1.00	Perbandingan			1.18

Tabel 4.23.b Perbandingn Berat Tulangan Lentur Kolom 450/700 Portal As.6,7,8

Lt	Tinggi (m)	Daktilitas Penuh (K=1)					Daktilitas Terbatas (K=2)				
		eksterior kiri		Eksterior kanan	interior	Berat (kg)	Eksterior kiri		Eksterior kanan	interior	Berat (kg)
		tulangan	BS (kg/m)	tulangan	tulangan		tulangan	BS (kg/m)	tulangan	tulangan	
Bm	3.85	14D25	3.85	14D25	22D25	741.13	26D25	3.85	26D25	26D25	1156.16
1	3.85	14D25	3.85	14D25	22D25	741.13	26D25	3.85	26D25	26D25	1156.16
2	3.85	14D25	3.85	14D25	22D25	741.13	26D25	3.85	26D25	26D25	1156.16
3	3.85	14D25	3.85	14D25	22D25	741.13	26D25	3.85	26D25	26D25	1156.16
4	4.88	14D25	3.85	14D25	22D25	939.40	26D25	3.85	26D25	26D25	1465.46
Jumlah						3903.9	Jumlah				6090.1
Perbandingan						1	Perbandingan				1.56

Tabel 4.23.c Perbandingn Berat Tulangan Lentur Kolom 450/700 Portal As.A-D

Lt	tinggi (m)	Daktilitas Penuh (K=1)					Daktilitas Terbatas (K=2)				
		eksterior kiri		Eksterior kanan	interior	Berat (kg)	eksterior kiri		Eksterior kanan	interior	Berat (kg)
		tulangan	BS (kg/m)	tulangan	tulangan		tulangan	BS (kg/m)	tulangan	tulangan	
Bmt	3.85	8D25	3.85	8D25	14D25	1482.25	14D25	3.85	14D25	14D25	1660.12
1	3.85	8D25	3.85	8D25	14D25	1482.25	14D25	3.85	14D25	14D25	1660.12
2	3.85	8D25	3.85	8D25	14D25	1482.25	14D25	3.85	14D25	14D25	1660.12
3	3.85	8D25	3.85	8D25	14D25	1482.25	14D25	3.85	14D25	14D25	1660.12
4	4.88	8D25	3.85	8D25	14D25	1878.80	14D25	3.85	14D25	14D25	2104.26
Jumlah						7807.8	Jumlah				8744.74
Perbandingan						1	Perbandingan				1.12

Tabel 4.24.a Perbandingn Berat Tulangan Geser Balok 400/800 Portal As.9-10

Lt	Daktilitas Penuh (K=1)				Daktilitas Terbatas (K=2)			
	Sendi plastis	diluar sendi plastis	BS (kg/m)	Berat (kg)	Sendi plastis	diluar sendi plastis	BS (kg/m)	Berat (kg)
1	3P10-90	3P10-150	0.617	184.76	3P10-110	3P10-140	0.617	174.95
2	3P10-90	3P10-150	0.617	184.76	3P10-110	3P10-140	0.617	174.95
3	3P10-90	3P10-150	0.617	184.76	3P10-110	3P10-140	0.617	174.95
4	3P10-90	3P10-150	0.617	184.76	3P10-110	3P10-140	0.617	174.95
Atap	3P10-200	3P10-300	0.617	47.42	3P10-200	3P10-300	0.617	47.42
Jumlah				**786.46**	*Jumlah*			**747.22**
Perbandingan				**1.0525**	*Perbandingan*			**1**

Tabel 4.24.b Perbandingn Berat Tulangan Geser Balok 400/800 Portal As.6,7,8

Lt	Daktilitas Penuh (K=1)				Daktilitas Terbatas (K=2)			
	Sendi Plastis	Diluar sendi plastis	BS (kg/m)	Berat (kg)	Sendi plastis	Diluar sendi plastis	BS (kg/m)	Berat (kg)
1	3P10-100	3P10-200	0.617	199.48	3P10-110	3P10-150	0.617	217.46
2	3P10-100	3P10-200	0.617	199.48	3P10-110	3P10-150	0.617	217.46
3	3P10-100	3P10-200	0.617	199.48	3P10-110	3P10-150	0.617	217.46
4	3P10-100	3P10-200	0.617	199.48	3P10-110	3P10-150	0.617	217.46
Atap	3P10-250	3P10-300	0.617	42.51	3P10-250	3P10-300	0.617	42.51
Jumlah				**840.42**	*Jumlah*			**912.35**
Perbandingan				**1**	*Perbandingan*			**1.086**

Tabel 4.24.c Perbandingn Berat Tulangan Geser Balok 250/400 Portal As.A-D

Lt	Daktilitas Penuh (K=1)				Daktilitas Terbatas (K=2)			
	Sendi Plastis	Diluar sendi plastis	BS (kg/m)	Berat (kg)	Sendi plastis	Diluar sendi plastis	BS (kg/m)	Berat (kg)
1	3P10-100	3P10-250	0.617	349.90	3P10-110	3P10-180	0.617	397.32
2	3P10-100	3P10-250	0.617	349.90	3P10-110	3P10-180	0.617	397.32
3	3P10-100	3P10-250	0.617	349.90	3P10-110	3P10-180	0.617	397.32
4	3P10-100	3P10-250	0.617	349.90	3P10-110	3P10-180	0.617	397.32
Nok	3P10-200	3P10-300	0.617	230.54	3P10-200	3P10-300	0.617	230.54
Atap	3P10-200	3P10-300	0.617	170.05	3P10-200	3P10-300	0.617	170.05
Jumlah				1800.19	Jumlah			1989.96
Perbandingan				1	Perbandingan			1.109

Tabel 4.25.a Perbandingn Berat Tulangan Geser Kolom 450/700 Portal As.9-10

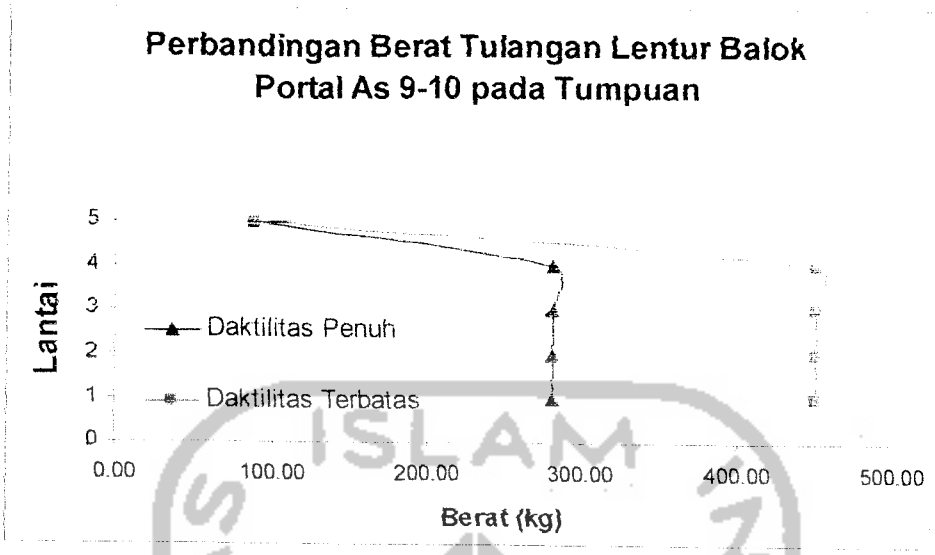
Lantai	Daktilitas Penuh (K=1)				Daktilitas Terbatas (K=2)			
	Ujung kolom	Tengah kolom	BS (kg/m)	Berat (kg)	Ujung kolom	Tengah kolom	BS (kg/m)	Berat Kg)
bm	4P10-70	4P10-90	0.617	214.85	4P10-100	4P10-200	0.617	112.10
1	4P10-70	4P10-90	0.617	214.85	4P10-100	4P10-200	0.617	112.10
2	4P10-70	4P10-90	0.617	214.85	4P10-100	4P10-200	0.617	112.10
3	4P10-70	4P10-90	0.617	214.85	4P10-100	4P10-200	0.617	112.10
4	4P10-70	4P10-90	0.617	270.90	4P10-100	4P10-200	0.617	135.45
Jumlah				1130.31	Jumlah			583.54
Perbandingan				1.936	Perbandingan			1

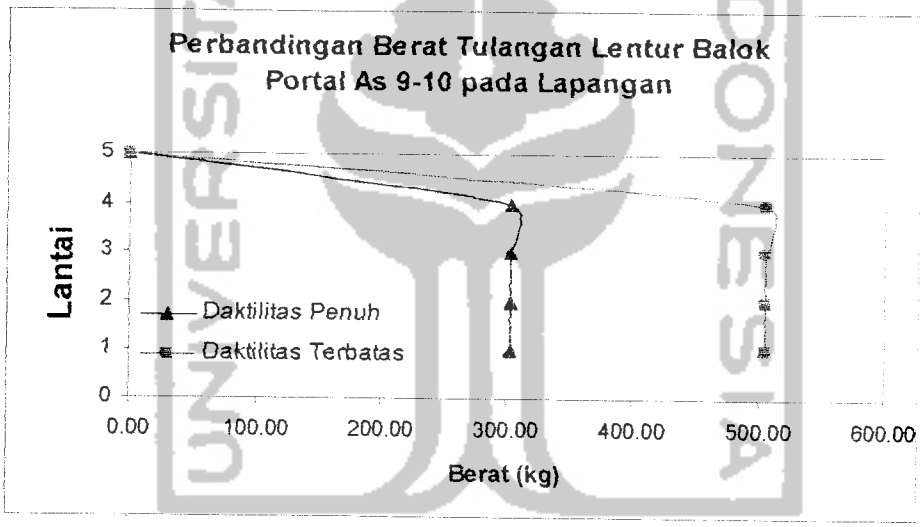
Tabel 4.25.b Perbandingn Berat Tulangan Geser Kolom 450/700 Portal As.6,7,8

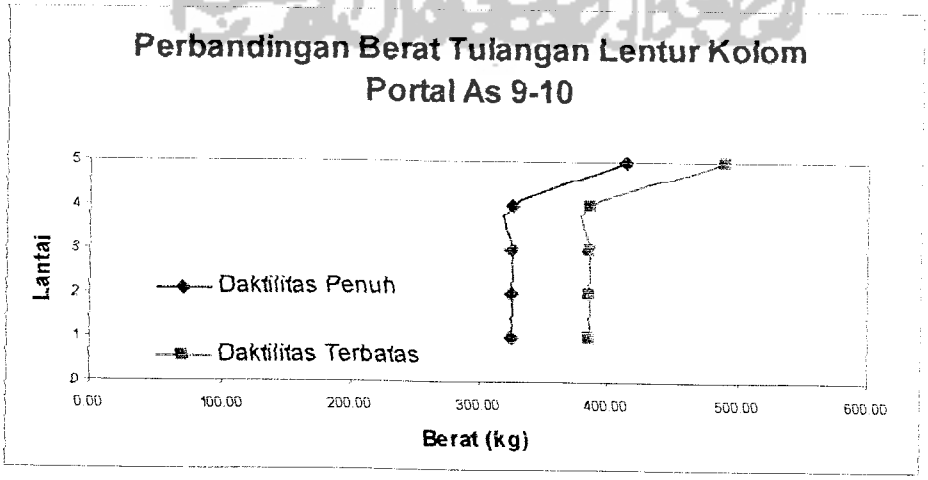
Lt	Daktilitas Penuh (K=1)								Daktilitas Terbatas (K=2)							
	eksterior kiri		eksterior kanan		interior		BS kg/m)	Berat (kg)	eksterior kiri		eksterior kanan		interior		BS (kg/m)	Berat (kg)
	Ujung kolom	Tengah kolom	ujung kolom	Tengah kolom	Ujung kolom	Tengah kolom			Ujung kolom	Tengah kolom	Ujung kolom	Tengah kolom	Ujung kolom	Tengah kolom		
Bm	4P10-70	4P10-90	4P10-70	4P10-90	4P10-70	4P10-90	0.617	322.28	4P10-60	4P10-100	4P10-60	4P10-100	4P10-100	4P10-200	0.617	266.23
1	4P10-70	4P10-90	4P10-70	4P10-90	4P10-70	4P10-90	0.617	322.28	4P10-60	4P10-100	4P10-60	4P10-100	4P10-100	4P10-200	0.617	266.23
2	4P10-70	4P10-90	4P10-70	4P10-90	4P10-70	4P10-90	0.617	322.28	4P10-60	4P10-100	4P10-60	4P10-100	4P10-100	4P10-200	0.617	266.23
3	4P10-70	4P10-90	4P10-70	4P10-90	4P10-70	4P10-90	0.617	322.28	4P10-60	4P10-100	4P10-60	4P10-100	4P10-100	4P10-200	0.617	266.23
4	4P10-70	4P10-90	4P10-70	4P10-90	4P10-70	4P10-90	0.617	406.35	4P10-60	4P10-100	4P10-60	4P10-100	4P10-100	4P10-200	0.617	324.61
Jumlah								1695.46	Jumlah							1389.53
Perbandingan								1.220	Perbandingan							1

Tabel 4.25.c Perbandingn Berat Tulangan Geser Kolom 450/700 Portal As.A-D

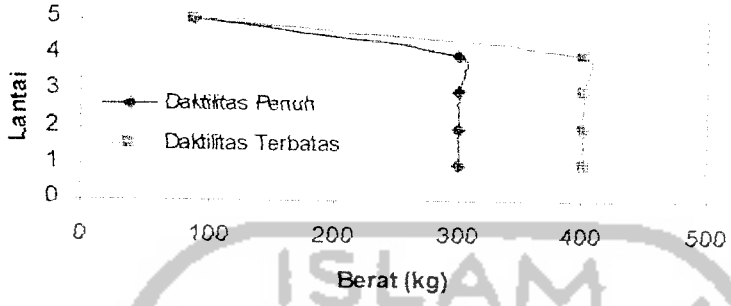
Lantai	Daktilitas Penuh (K=1)								Daktilitas Terbatas (K=2)							
	eksterior kiri		eksterior kanan		interior		BS (kg/m)	Berat (kg)	eksterior kiri		eksterior kanan		interior		BS (kg/m)	Berat (kg)
	Ujung kolom	Tengah kolom	Ujung kolom	Tengah kolom	Ujung kolom	Tengah kolom			Ujung kolom	Tengah kolom	Ujung kolom	Tengah kolom	Ujung kolom	Tengah kolom		
Bm	4P10-70	4P10-90	4P10-70	4P10-90	4P10-70	4P10-90	0.617	859.41	4P10-60	4P10-100	4P10-60	4P10-100	4P10-100	4P10-200	0.617	546.47
1	4P10-70	4P10-90	4P10-70	4P10-90	4P10-70	4P10-90	0.617	859.41	4P10-60	4P10-100	4P10-60	4P10-100	4P10-100	4P10-200	0.617	546.47
2	4P10-70	4P10-90	4P10-70	4P10-90	4P10-70	4P10-90	0.617	859.41	4P10-60	4P10-100	4P10-60	4P10-100	4P10-100	4P10-200	0.617	546.47
3	4P10-70	4P10-90	4P10-70	4P10-90	4P10-70	4P10-90	0.617	859.41	4P10-60	4P10-100	4P10-60	4P10-100	4P10-100	4P10-200	0.617	546.47
4	4P10-70	4P10-90	4P10-70	4P10-90	4P10-70	4P10-90	0.617	597.85	4P10-60	4P10-100	4P10-60	4P10-100	4P10-100	4P10-200	0.617	401.68
Atap	4P10-70	4P10-90	4P10-70	4P10-90	4P10-70	4P10-90	0.617	523.12	4P10-60	4P10-100	4P10-60	4P10-100	4P10-100	4P10-200	0.617	354.97
Jumlah								4035.48	Jumlah							2587.56
Perbandingan								1.560	Perbandingan							1


Perbandingan Berat Tulangan Lentur Balok
Portal As 9-10 pada Tumpuan
Lantai
5
4
3
2
1
0
Daktilitas Penuh
Daktilitas Terbatas
0.00
100.00
200.00
300.00
400.00
500.00
Berat (kg)

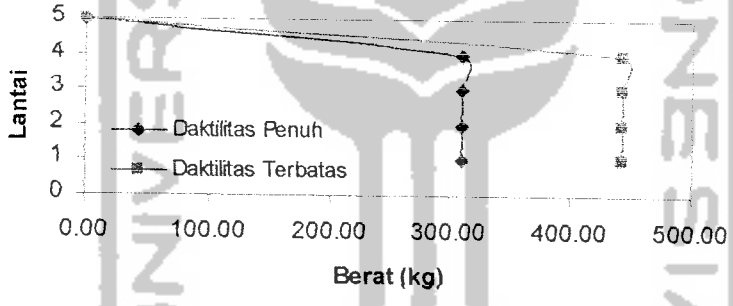

Perbandingan Berat Tulangan Lentur Balok
Portal As 9-10 pada Lapangan
Lantai
5
4
3
2
1
0
Daktilitas Penuh
Daktilitas Terbatas
0.00
100.00
200.00
300.00
400.00
500.00
600.00
Berat (kg)


Perbandingan Berat Tulangan Lentur Kolom
Portal As 9-10
Lantai
5
4
3
2
1
0
Daktilitas Penuh
Daktilitas Terbatas
0.00
100.00
200.00
300.00
400.00
500.00
600.00
Berat (kg)

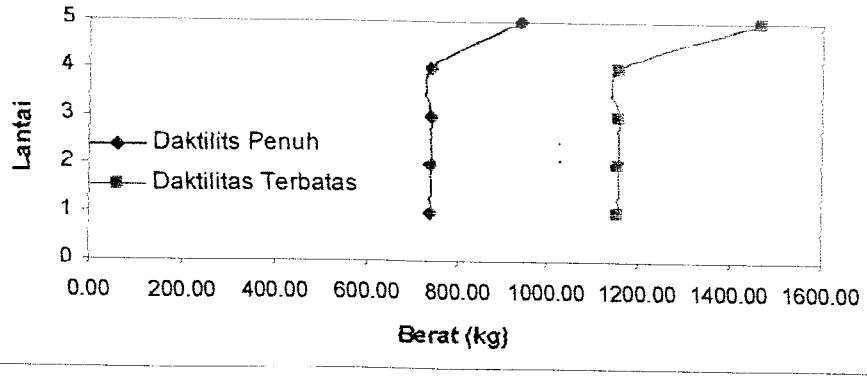
Perbandingan Berat Tulangan Lentur Balok Portal As 6,7,8 pada Tumpuan

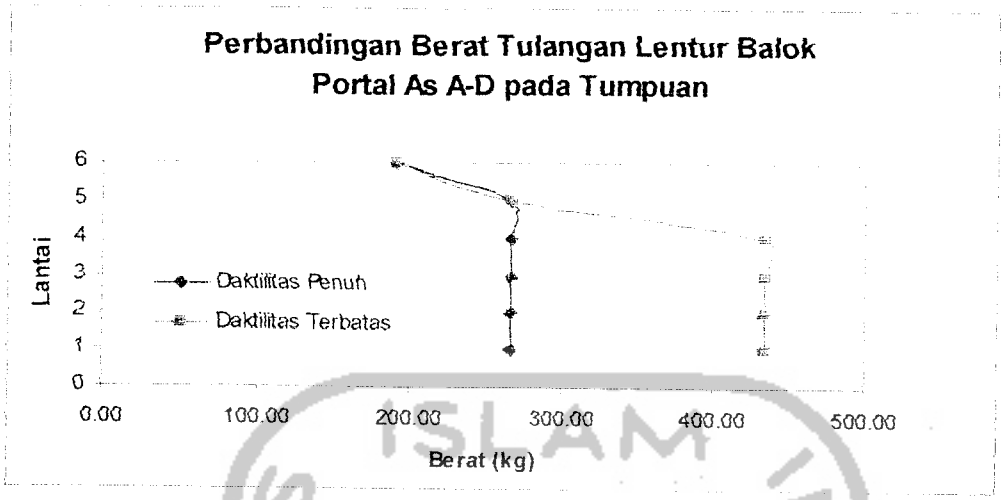


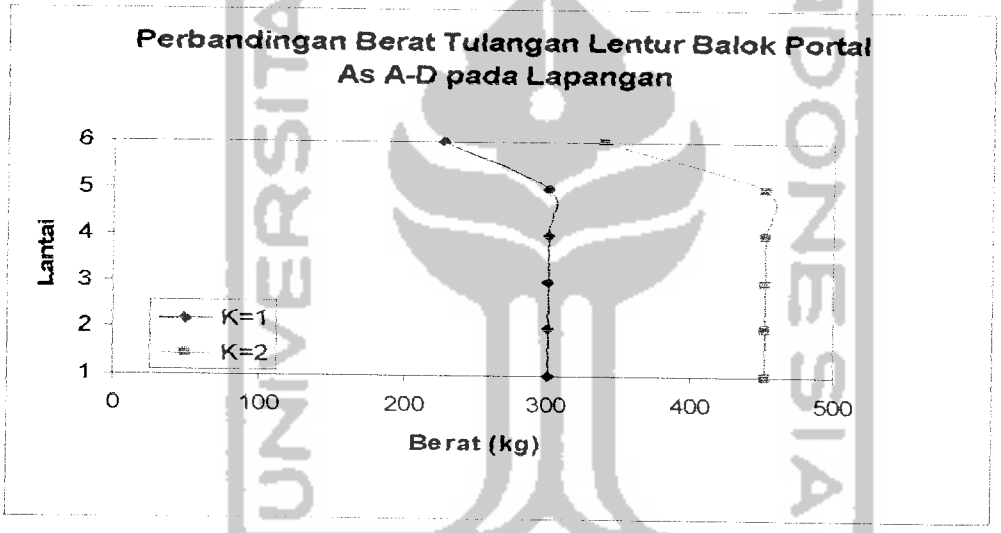
Perbandingan Volume Tulangan Lentur Balok Portal As 6,7,8 pada Lapangan

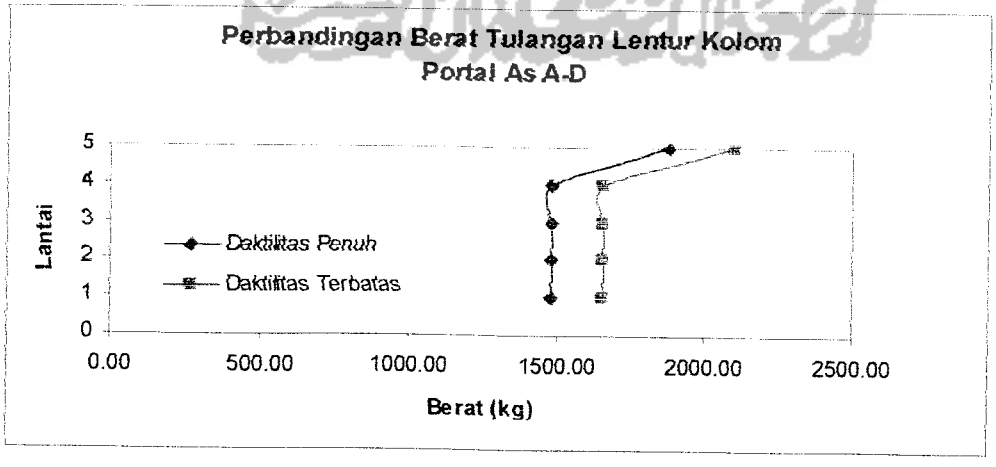


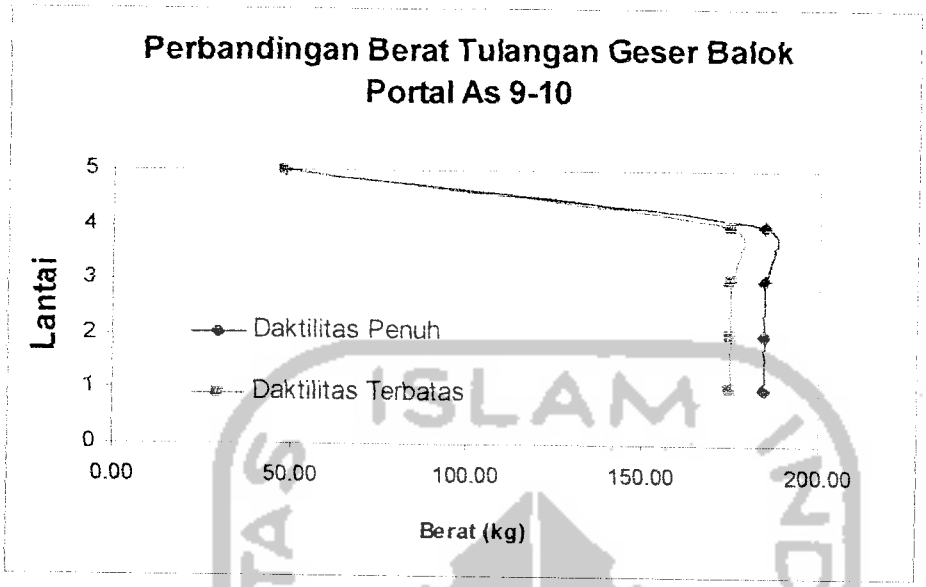
Perbandingan Berat Tulangan Lentur Kolom Portal As 6,7,8

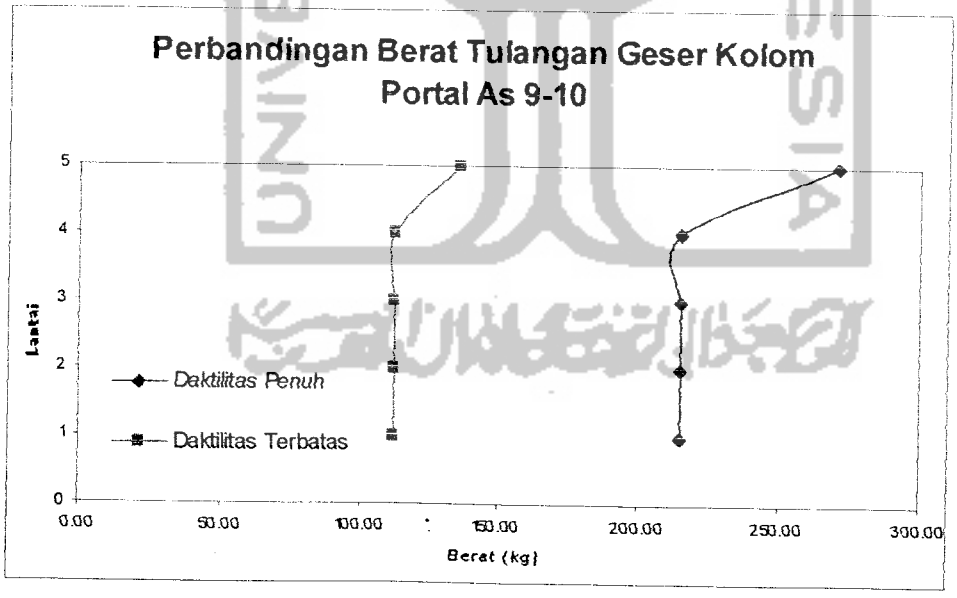


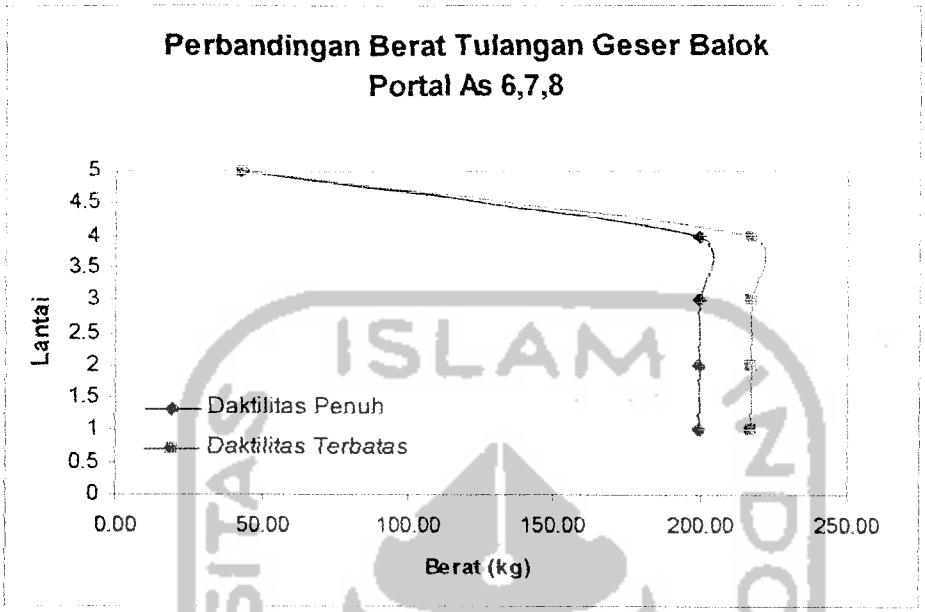

Perbandingan Berat Tulangan Lentur Balok
Portal As A-D pada Tumpuan
Lantai
Daktilitas Penuh
Daktilitas Terbatas
0.00
100.00
200.00
300.00
400.00
500.00
Berat (kg)

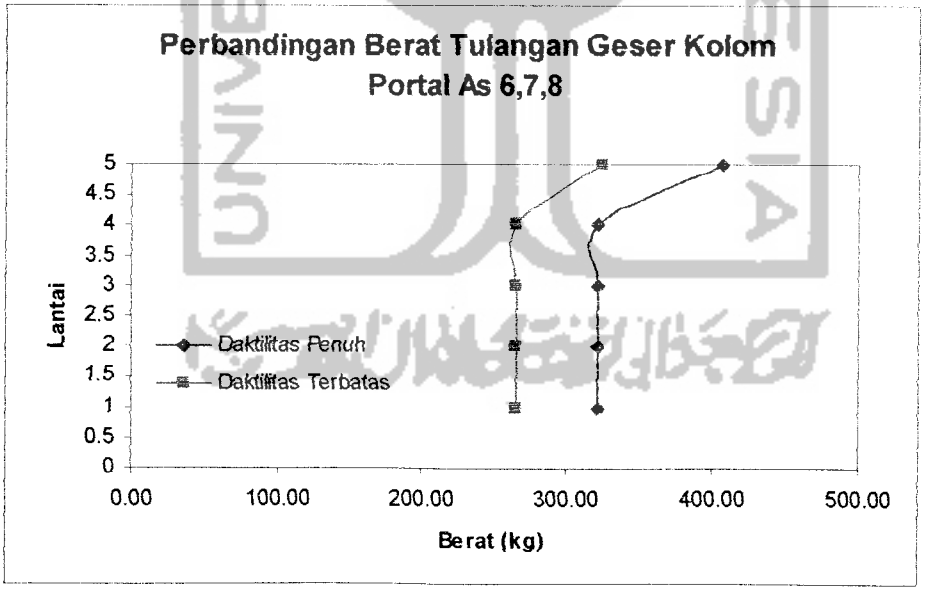

Perbandingan Berat Tulangan Lentur Balok Portal
As A-D pada Lapangan
Lantai
K=1
K=2
0
100
200
300
400
500
Berat (kg)

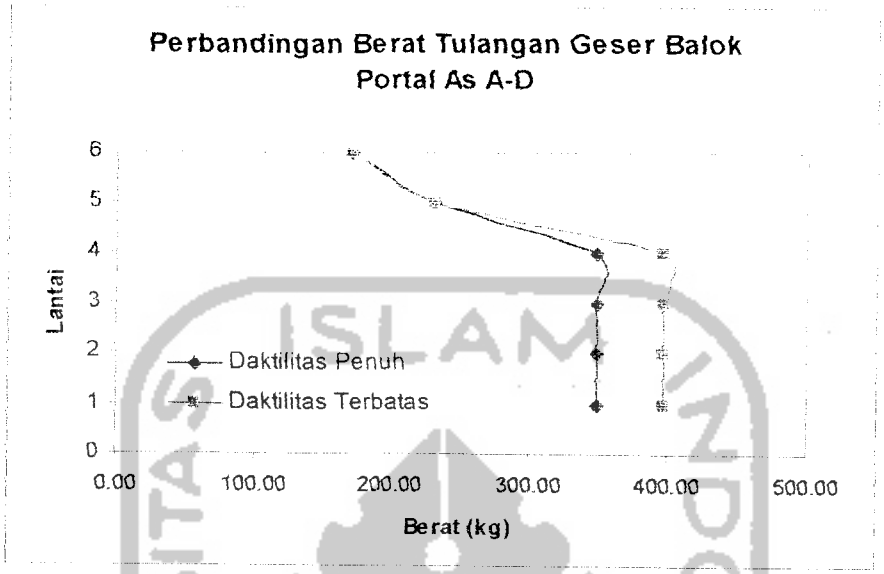

Perbandingan Berat Tulangan Lentur Kolom
Portal As A-D
Lantai
Daktilitas Penuh
Daktilitas Terbatas
0.00
500.00
1000.00
1500.00
2000.00
2500.00
Berat (kg)

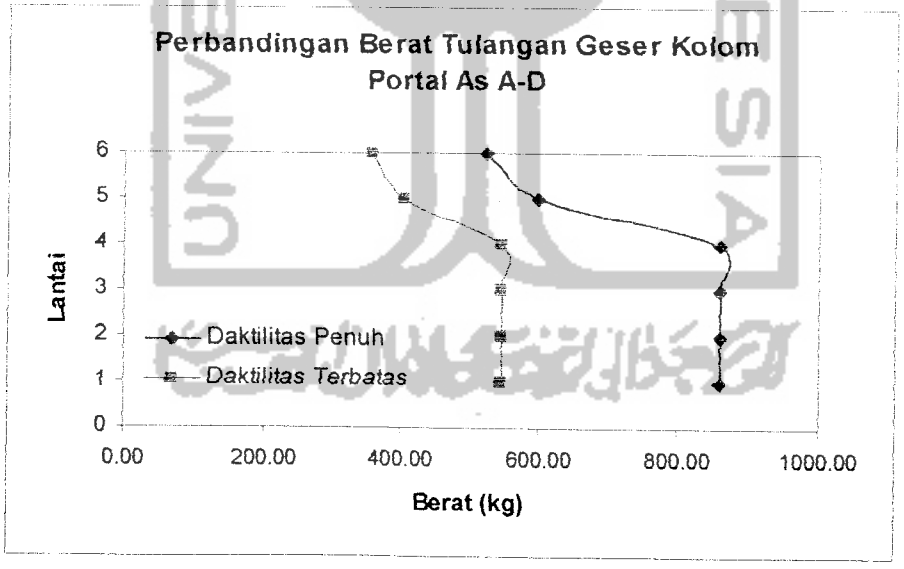

Perbandingan Berat Tulangan Geser Balok
Portal As 9-10
Lantai
5
4
3
2
1
0
Daktilitas Penuh
Daktilitas Terbatas
0.00
50.00
100.00
150.00
200.00
Berat (kg)


Perbandingan Berat Tulangan Geser Kolom
Portal As 9-10
Lantai
5
4
3
2
1
0
Daktilitas Penuh
Daktilitas Terbatas
0.00
50.00
100.00
150.00
200.00
250.00
300.00
Berat (kg)


Perbandingan Berat Tulangan Geser Balok
Portal As 6,7,8
Lantai
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Daktilitas Penuh
Daktilitas Terbatas
0.00
50.00
100.00
150.00
200.00
250.00
Berat (kg)


Perbandingan Berat Tulangan Geser Kolom
Portal As 6,7,8
Lantai
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Daktilitas Penuh
Daktilitas Terbatas
0.00
100.00
200.00
300.00
400.00
500.00
Berat (kg)


Perbandingan Berat Tulangan Geser Balok
Portal As A-D
Lantai
Berat (kg)
Daktilitas Penuh
Daktilitas Terbatas
0
1
2
3
4
5
6
0.00
100.00
200.00
300.00
400.00
500.00


Perbandingan Berat Tulangan Geser Kolom
Portal As A-D
Lantai
Berat (kg)
Daktilitas Penuh
Daktilitas Terbatas
0
1
2
3
4
5
6
0.00
200.00
400.00
600.00
800.00
1000.00