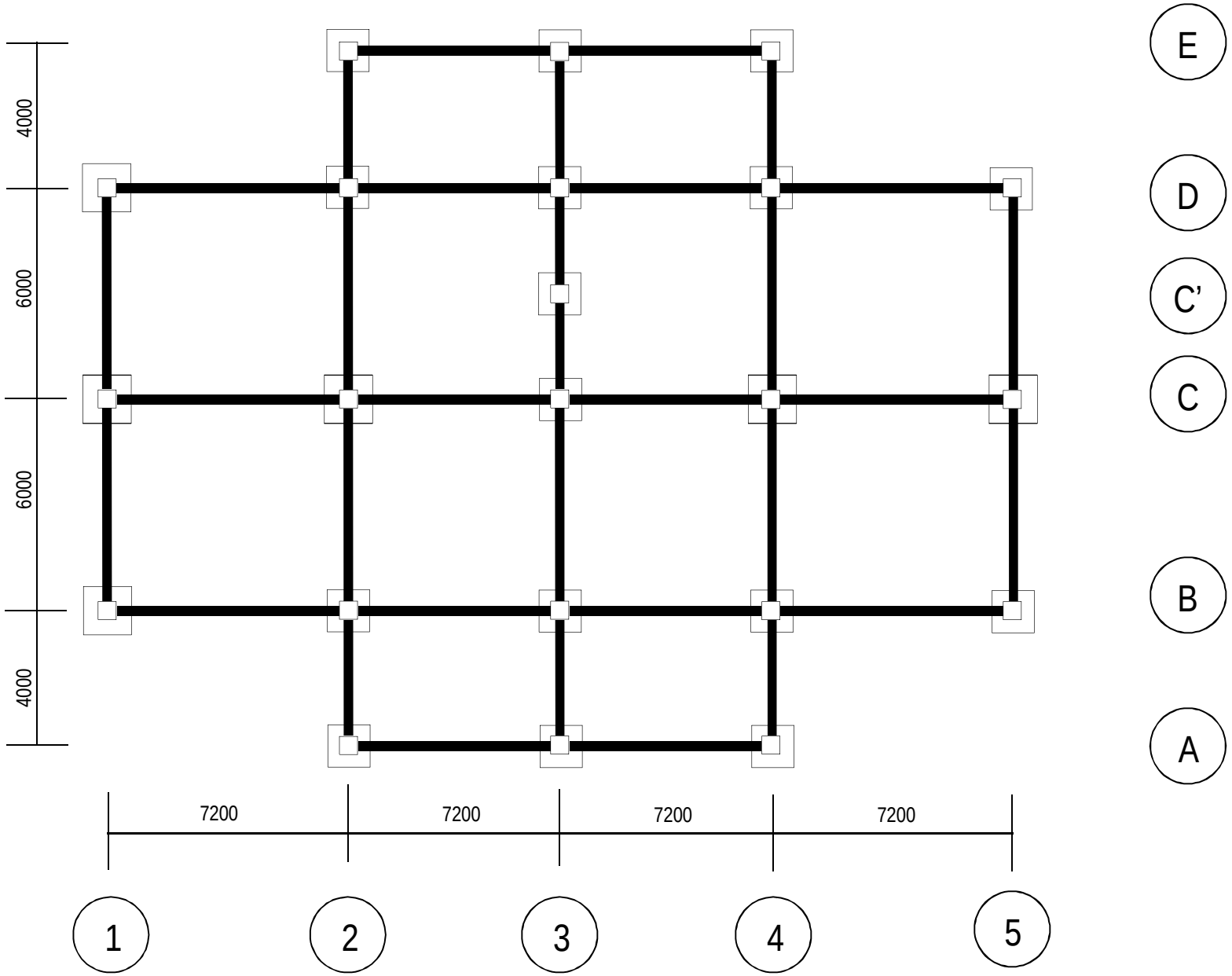
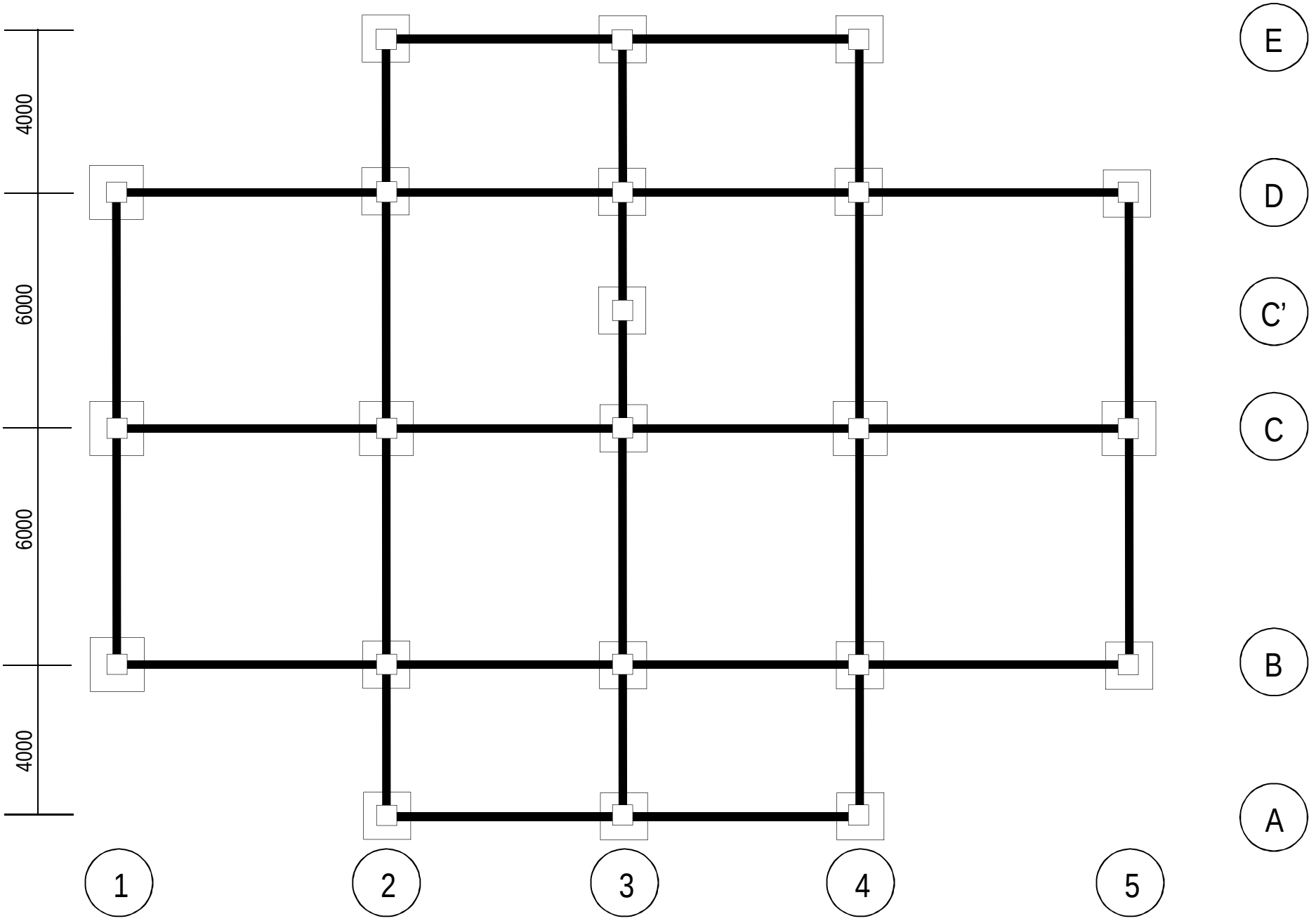
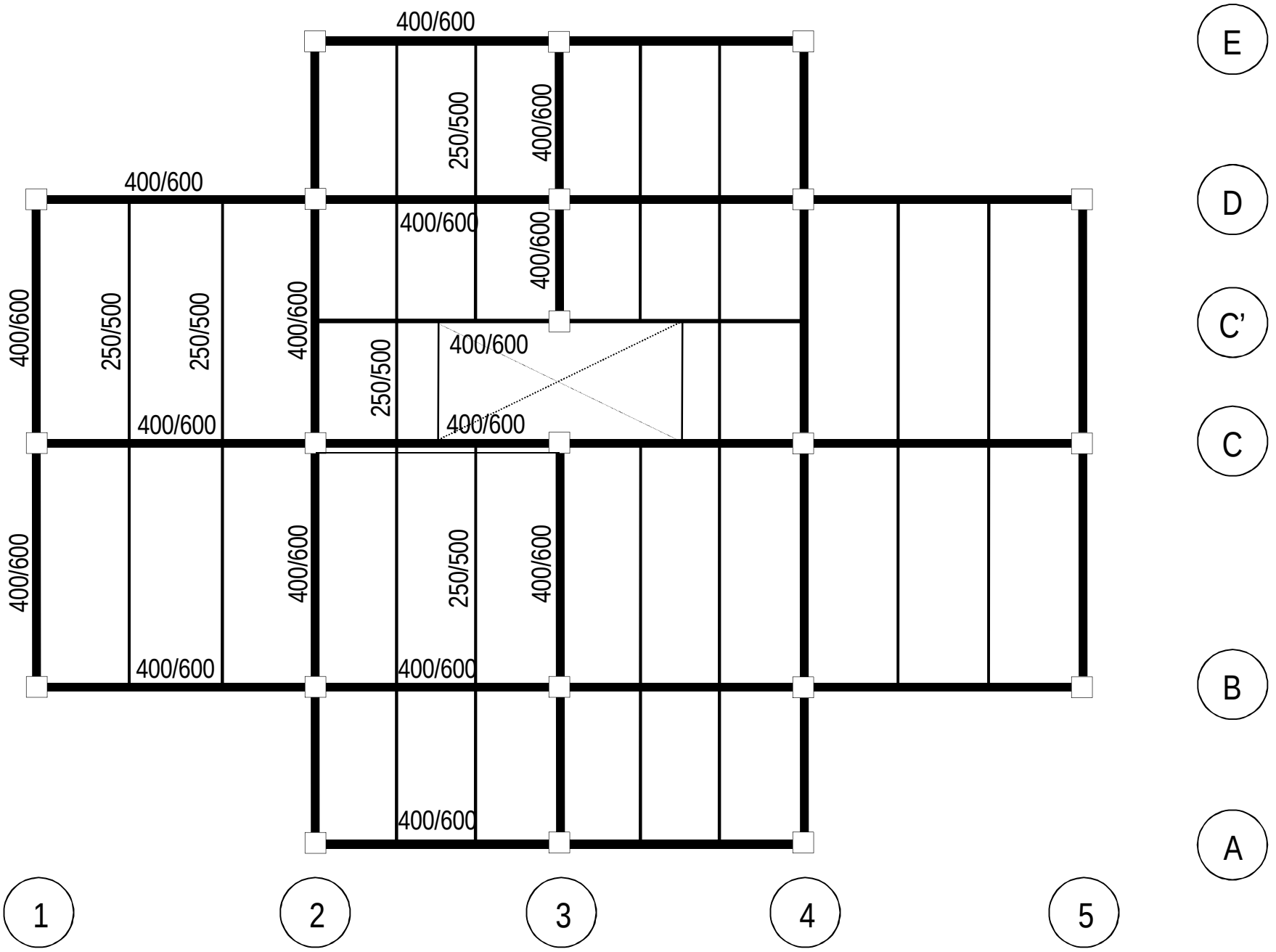
DOKUMEN GAMBAR UNTUK TUGAS PEMBESIAN - 2016


E
D
C'
C
B
A
4000
6000
6000
4000
7200
7200
7200
7200
1
2
3
4
5



DENAH TIE BEAM & POER



DENAH BALOK LANTAI 2 & 3

ANALISIS PENULANGAN PELAT

Project :
Location :

(1). Kuat-bahan

f'c = 20 MPa β = 0.85

fy = 235 MPa α_o = 0.4581

Rn_o = 6.0038 Mpa

(2). Analisis Penulangan Pelat

(a). Pelat Type 1 qD = 4.63 kN/m2

qL = 2.50 kN/m2 qu = 9.56 kN/m2

1 b = 1000 mm t = 120 mm As min = 300 mm2/m ly / lx = 2.5

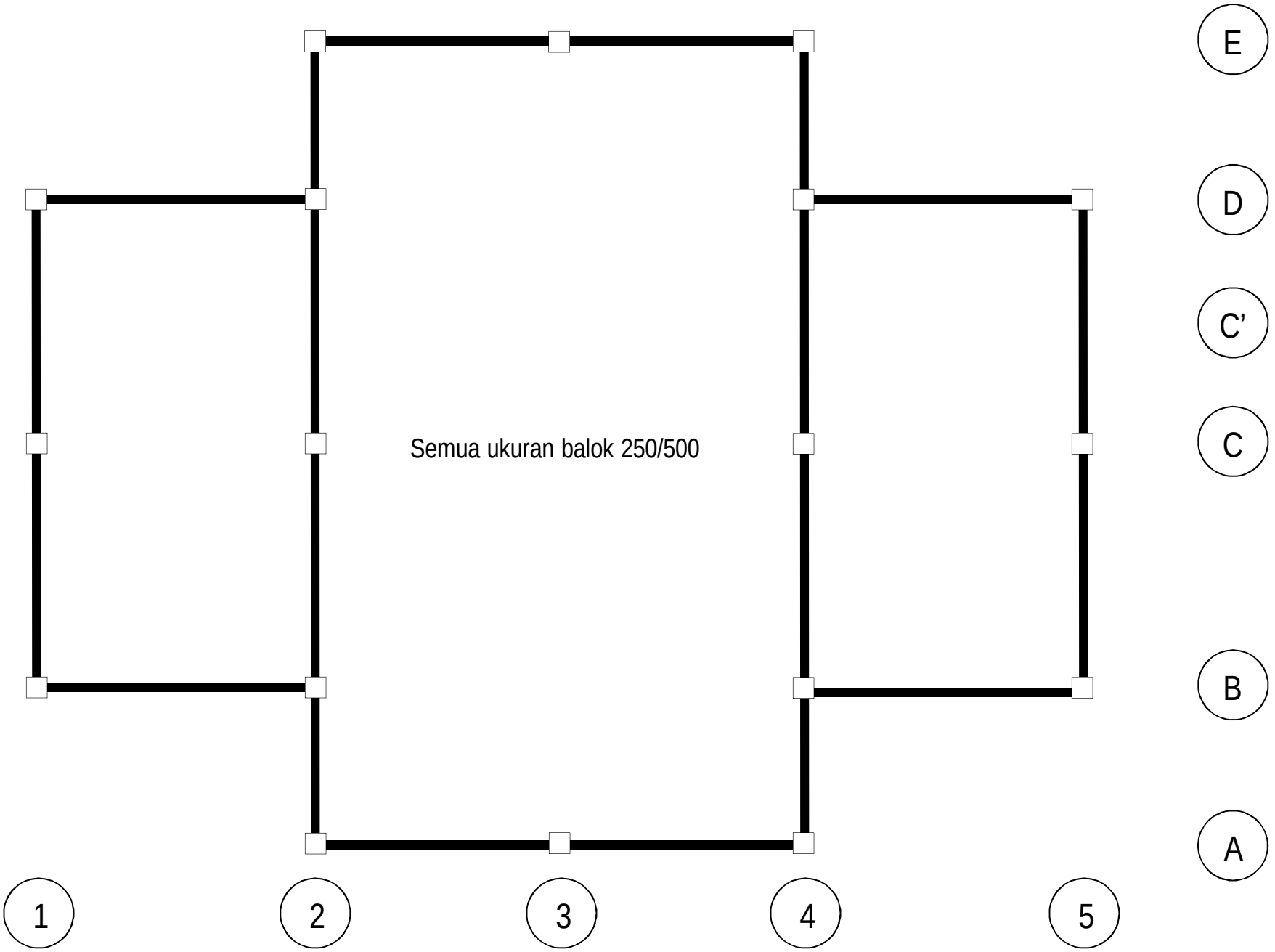
No	ly	lx	Momen / m lebar			d	Rn	α	As perlu (mm2/m)		Tulangan digunakan	
	(m)	(m)	Nama	Koef.	Mn (kNm)	(mm)	(Mpa)		pokok	pembagi	Pokok	Pembagi
	6.00	2.40	Mlx	61.6	4.237	96	0.4597	0.027420	300.000	60.000	D 8 - 167	D 8 - 200
			Mly	33.9	2.335	96	0.2534	0.015017	300.000	60.000	D 8 - 167	D 8 - 200
			Mtx	61.6	4.237	96	0.4597	0.027420	300.000	60.000	D 8 - 167	D 6 - 200
			Mty	33.9	2.335	96	0.2534	0.015017	300.000	60.000	D 8 - 167	D 6 - 200

(b). Pelat Type 2 qD = 4.63 kN/m2

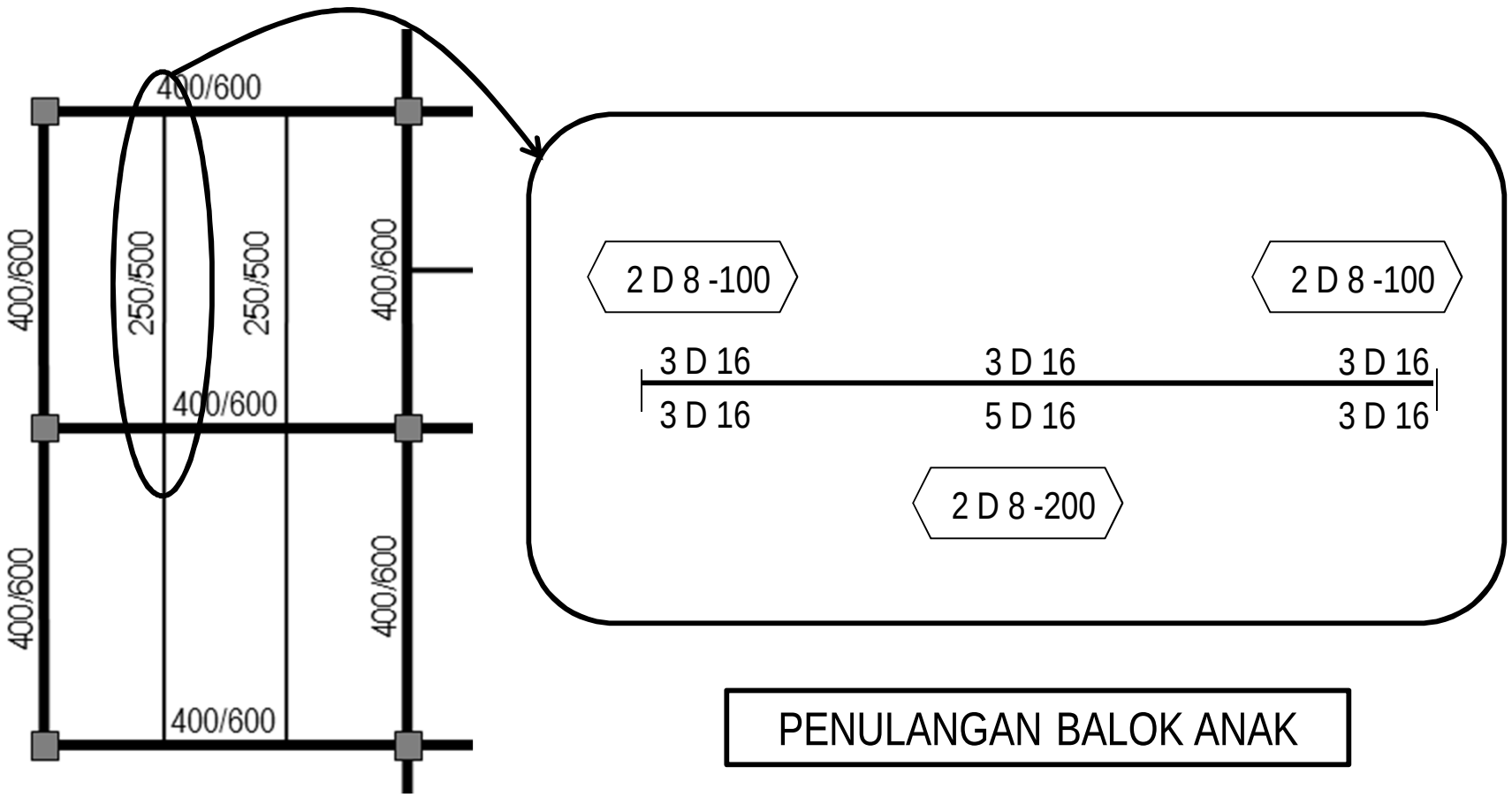
qL = 2.50 kN/m2 qu = 9.56 kN/m2

2 b = 1000 mm t = 120 mm As min = 300 mm2/m ly / lx = 1.7

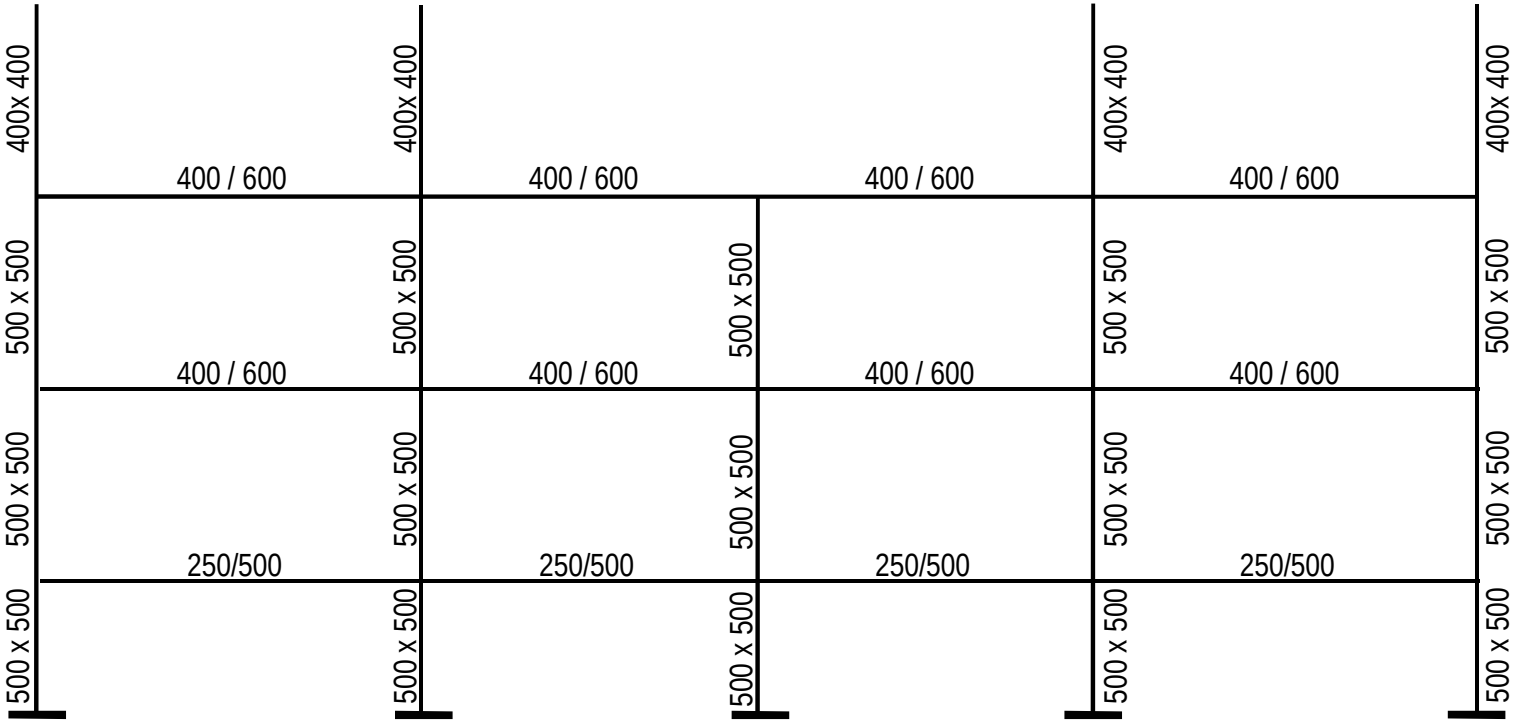
No	ly	lx	Momen / m lebar			d	Rn	α	As perlu (mm2/m)		Tulangan digunakan	
	(m)	(m)	Nama	Koef.	Mn (kNm)	(mm)	(Mpa)		pokok	pembagi	Pokok	Pembagi
	4.00	2.40	Mlx	58.4	4.016	96	0.4358	0.025973	300.000	60.000	D 8 - 167	D 8 - 200
			Mly	36.1	2.482	96	0.2693	0.015971	300.000	60.000	D 8 - 167	D 8 - 200
			Mtx	58.4	4.016	96	0.4358	0.025973	300.000	60.000	D 8 - 167	D 6 - 200
			Mty	36.1	2.482	96	0.2693	0.015971	300.000	60.000	D 8 - 167	D 6 - 200



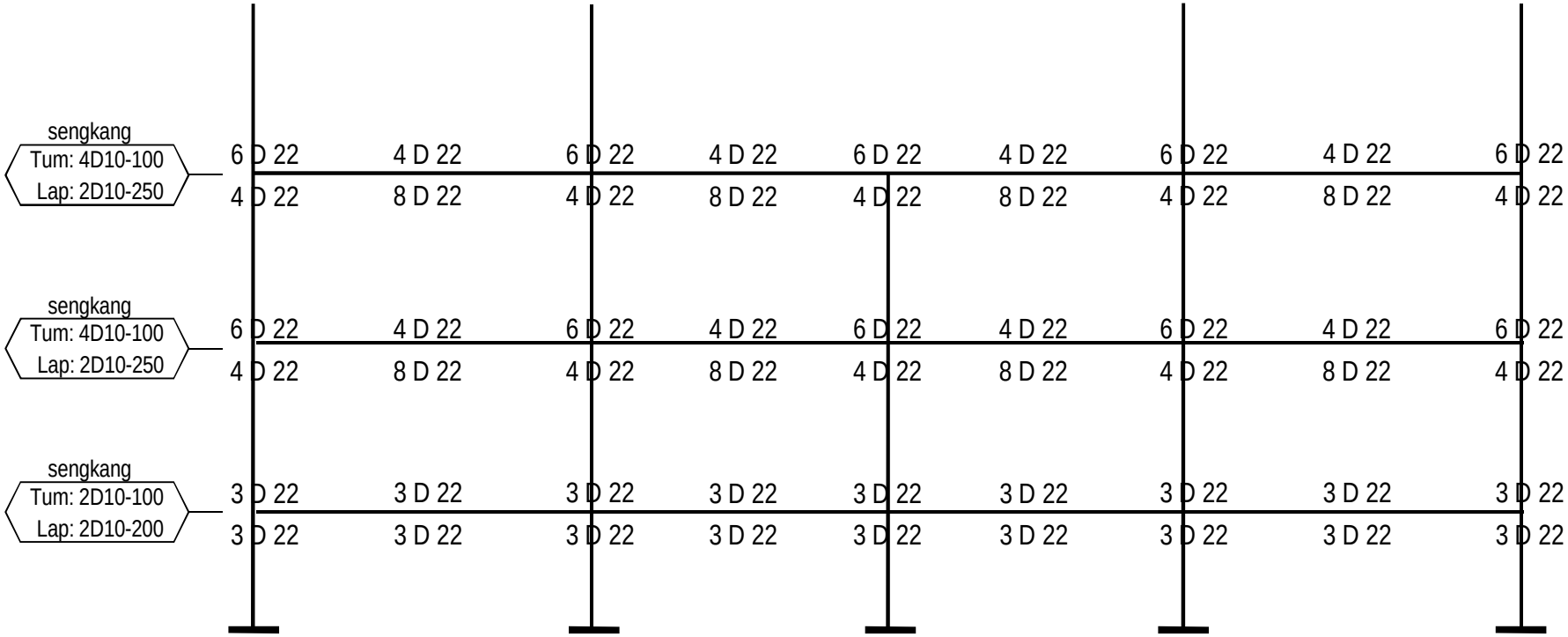
DENAH BALOK RING



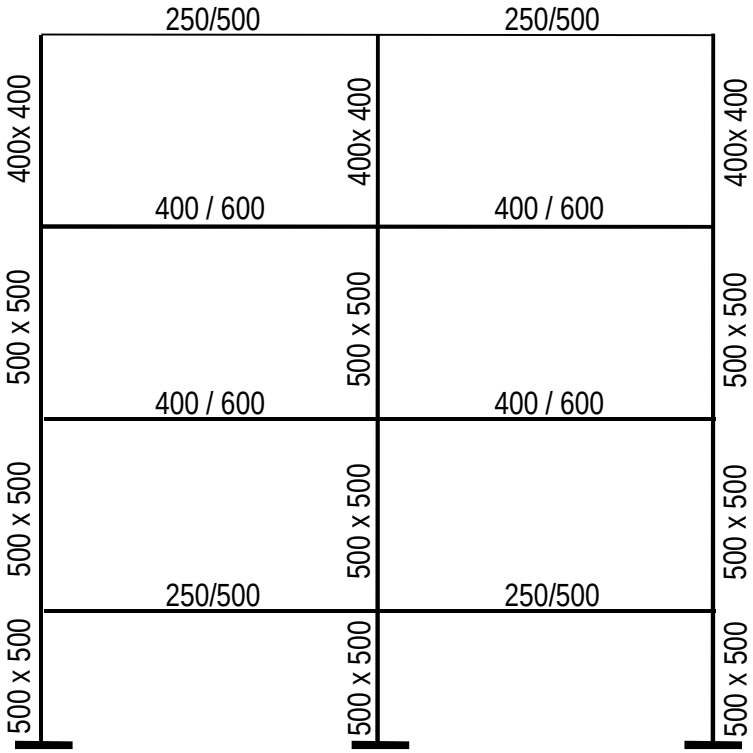
PENULANGAN BALOK ANAK



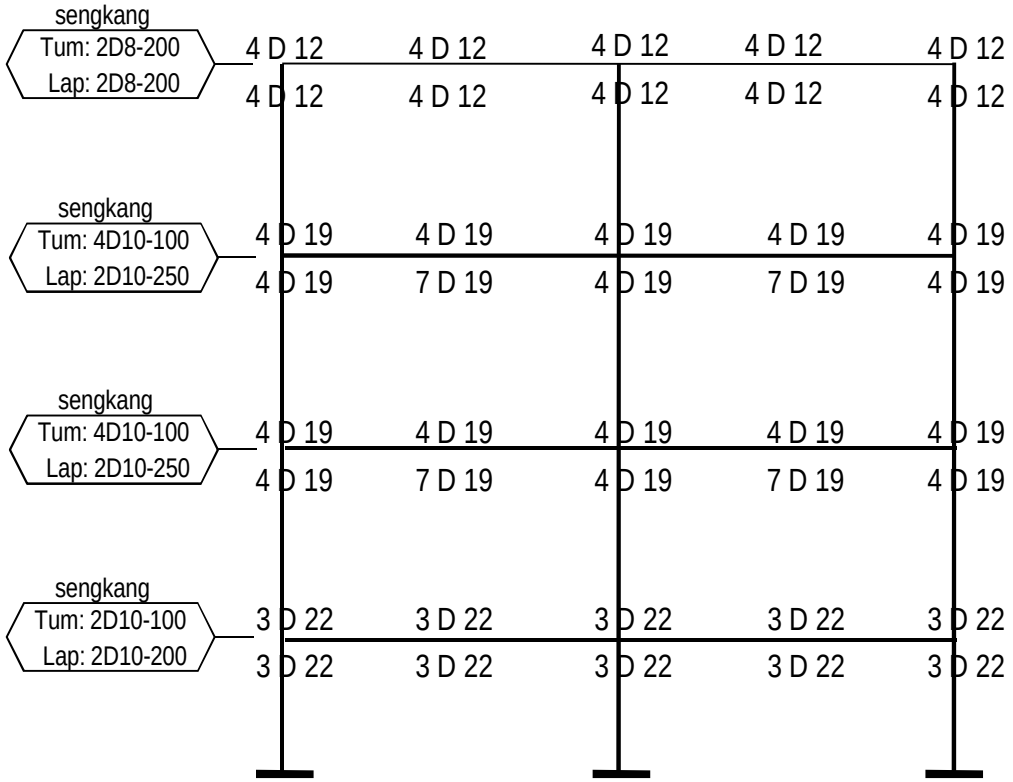
PORTAL AS B, C, D



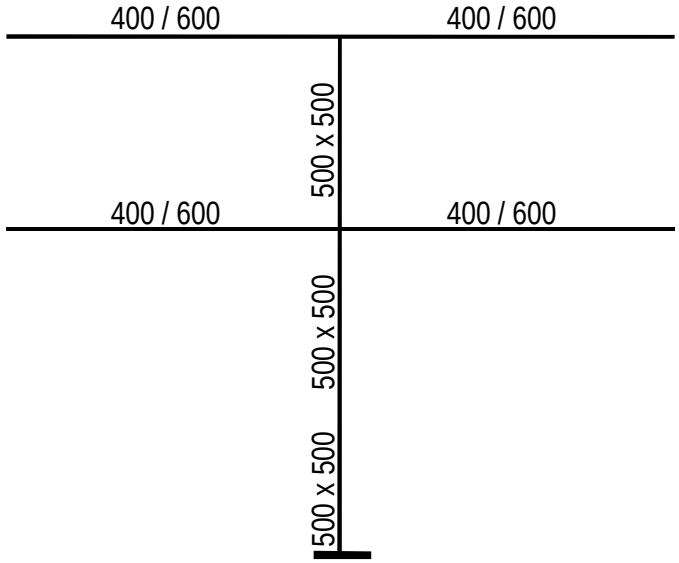
PORTAL AS B, C, D


250/500
250/500
400x 400
400x 400
400x 400
400 / 600
400 / 600
500 x 500
500 x 500
500 x 500
400 / 600
400 / 600
500 x 500
500 x 500
500 x 500
250/500
250/500
500 x 500
500 x 500
500 x 500

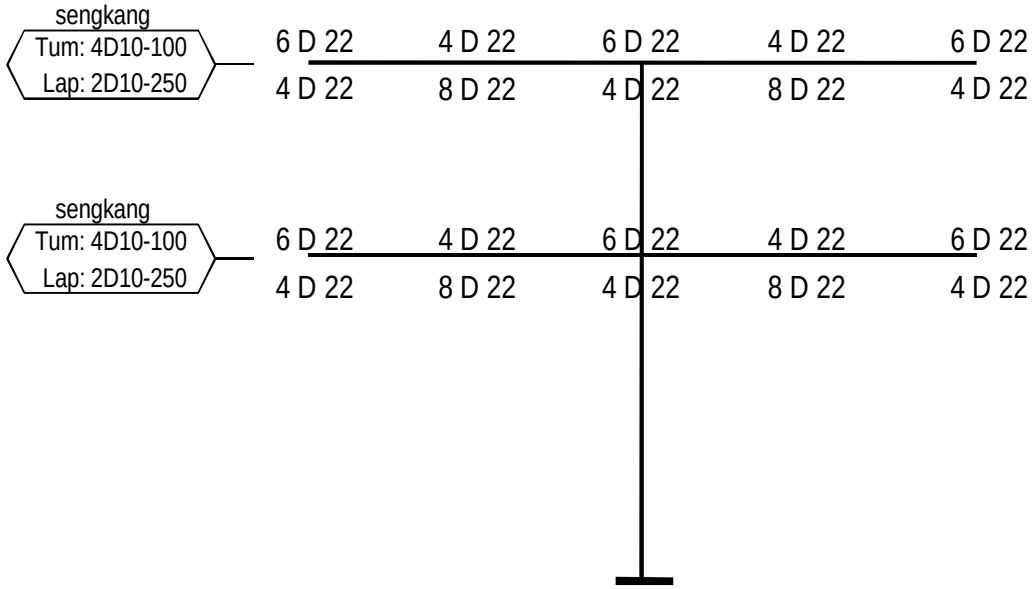
PORTAL AS A & E


sengkang
Tum: 2D8-200
Lap: 2D8-200
4 D 12
4 D 12
4 D 12
4 D 12
4 D 12
4 D 12
4 D 12
4 D 12
4 D 12
4 D 12
sengkang
Tum: 4D10-100
Lap: 2D10-250
4 D 19
4 D 19
4 D 19
4 D 19
4 D 19
4 D 19
7 D 19
4 D 19
7 D 19
4 D 19
sengkang
Tum: 4D10-100
Lap: 2D10-250
4 D 19
4 D 19
4 D 19
4 D 19
4 D 19
4 D 19
7 D 19
4 D 19
7 D 19
4 D 19
sengkang
Tum: 2D10-100
Lap: 2D10-200
3 D 22
3 D 22
3 D 22
3 D 22
3 D 22
3 D 22
3 D 22
3 D 22
3 D 22
3 D 22

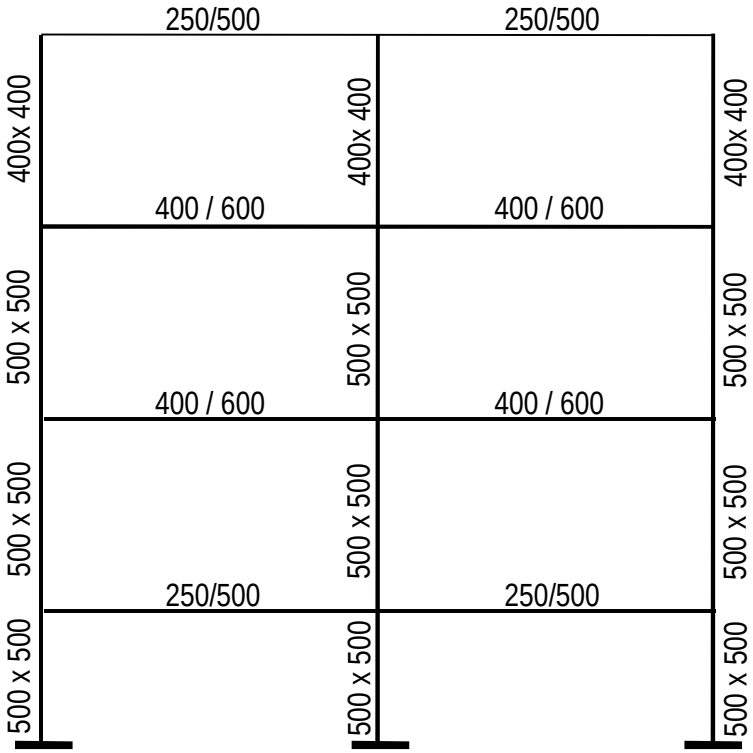
PORTAL AS A & E



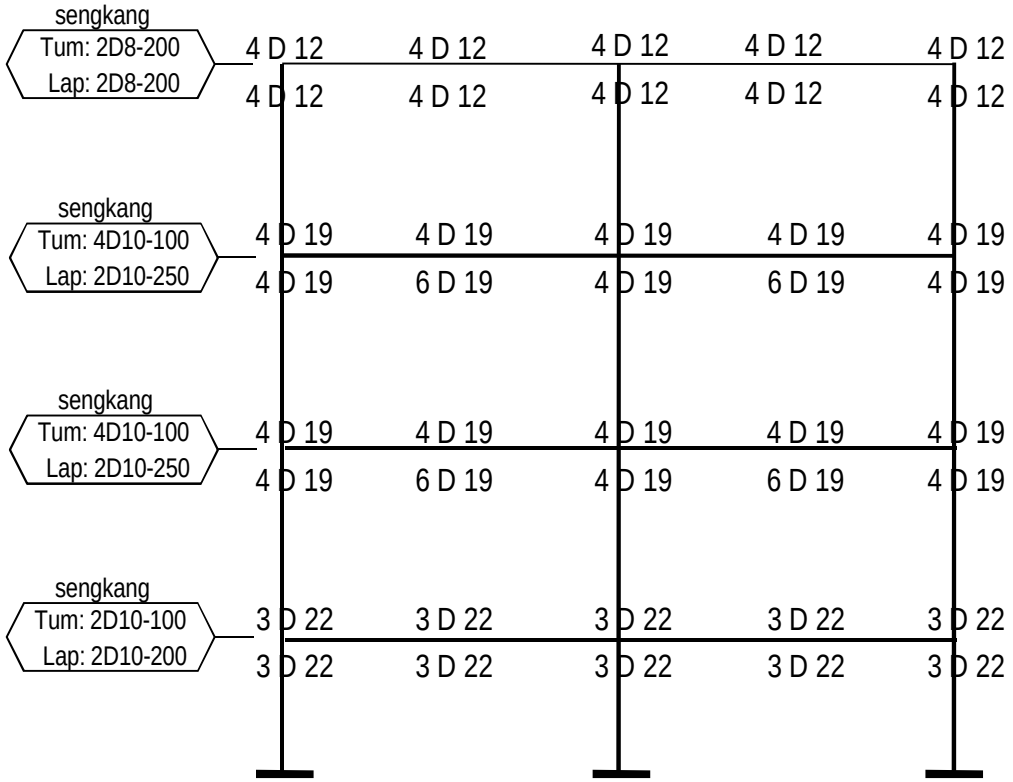
PORTAL AS C’


sengkang
Tum: 4D10-100
Lap: 2D10-250
6 D 22
4 D 22
6 D 22
4 D 22
6 D 22
4 D 22
8 D 22
4 D 22
8 D 22
4 D 22
sengkang
Tum: 4D10-100
Lap: 2D10-250
6 D 22
4 D 22
6 D 22
4 D 22
6 D 22
4 D 22
8 D 22
4 D 22
8 D 22
4 D 22

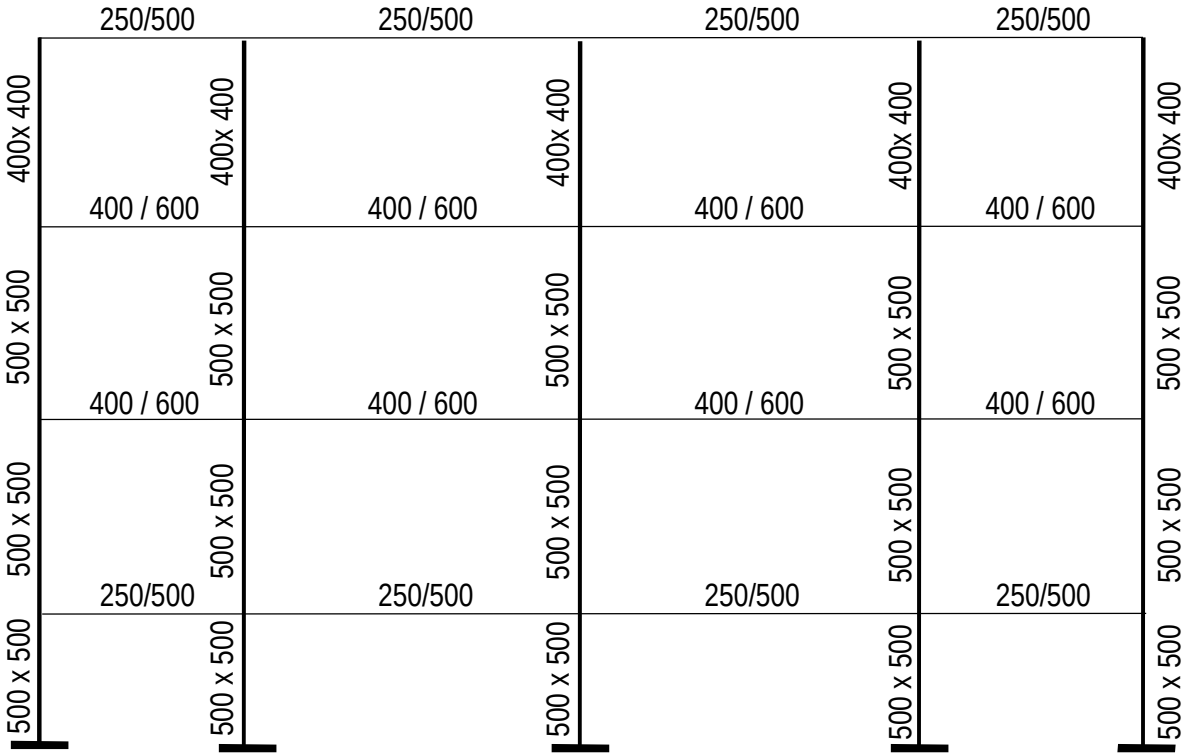
PORTAL AS C’


250/500
250/500
400x 400
400x 400
400x 400
400 / 600
400 / 600
500 x 500
500 x 500
500 x 500
400 / 600
400 / 600
500 x 500
500 x 500
500 x 500
250/500
250/500
500 x 500
500 x 500
500 x 500

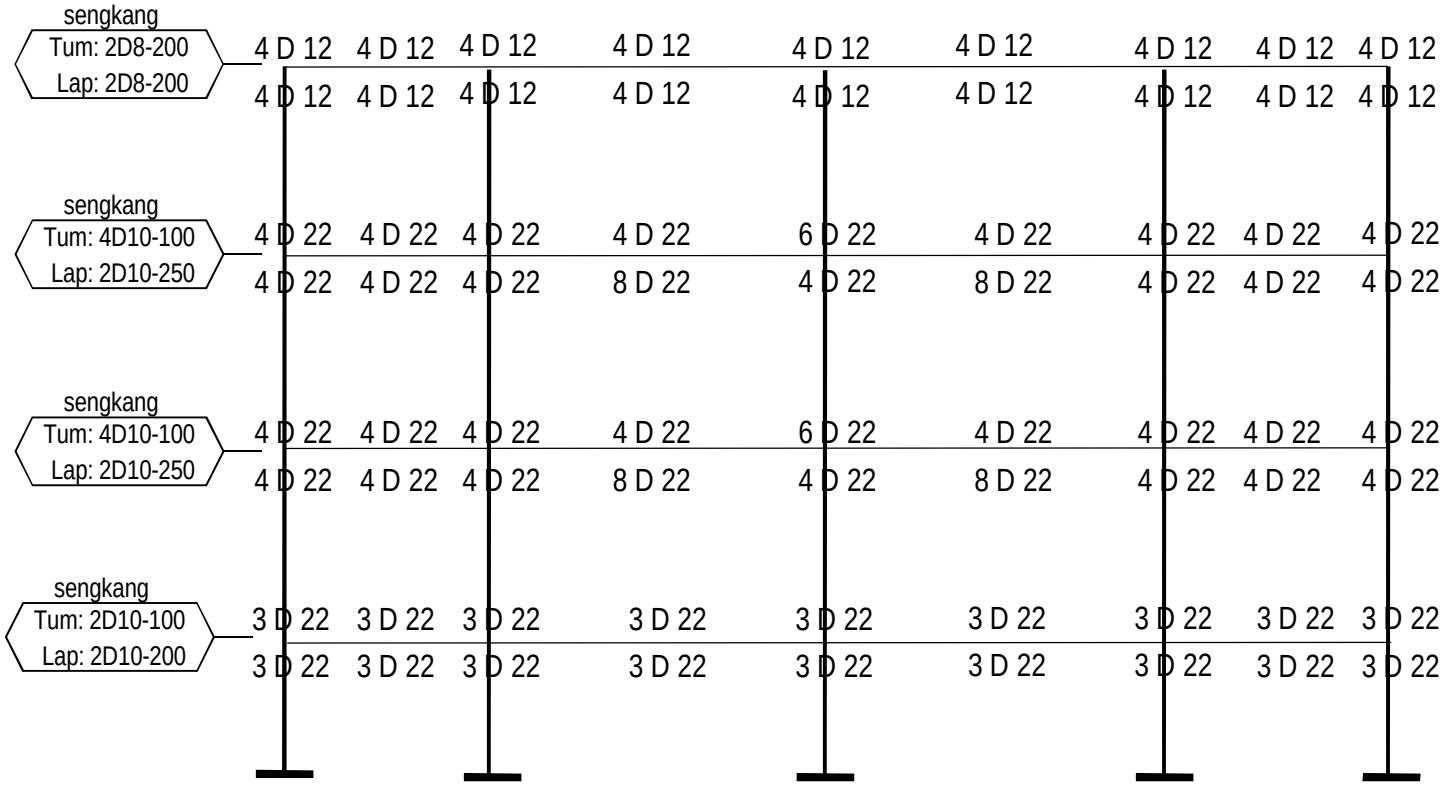
PORTAL AS 1 & 5


sengkang
Tum: 2D8-200
Lap: 2D8-200
4 D 12
4 D 12
4 D 12
4 D 12
4 D 12
4 D 12
4 D 12
4 D 12
4 D 12
4 D 12
sengkang
Tum: 4D10-100
Lap: 2D10-250
4 D 19
4 D 19
4 D 19
4 D 19
4 D 19
4 D 19
6 D 19
4 D 19
6 D 19
4 D 19
sengkang
Tum: 4D10-100
Lap: 2D10-250
4 D 19
4 D 19
4 D 19
4 D 19
4 D 19
4 D 19
6 D 19
4 D 19
6 D 19
4 D 19
sengkang
Tum: 2D10-100
Lap: 2D10-200
3 D 22
3 D 22
3 D 22
3 D 22
3 D 22
3 D 22
3 D 22
3 D 22
3 D 22
3 D 22

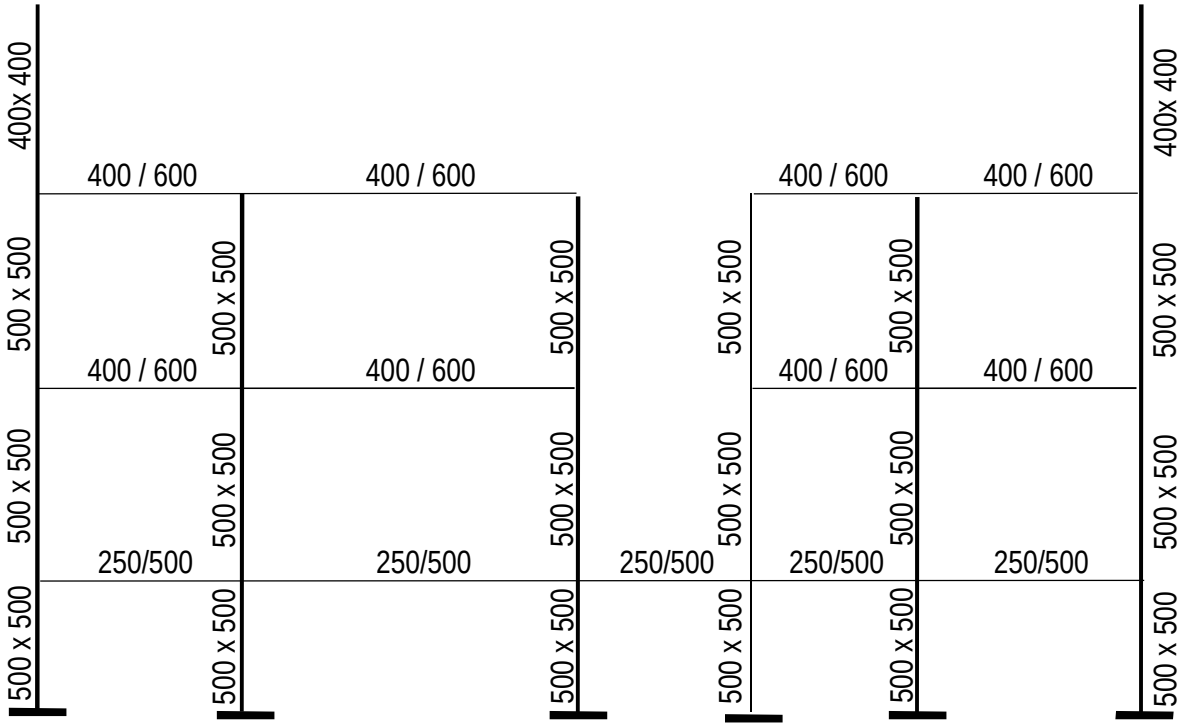
PORTAL AS 1 & 5


250/500
250/500
250/500
250/500
400x 400
400x 400
400x 400
400x 400
400x 400
400 / 600
400 / 600
400 / 600
400 / 600
500 x 500
500 x 500
500 x 500
500 x 500
500 x 500
400 / 600
400 / 600
400 / 600
400 / 600
500 x 500
500 x 500
500 x 500
500 x 500
500 x 500
250/500
250/500
250/500
250/500
500 x 500
500 x 500
500 x 500
500 x 500
500 x 500

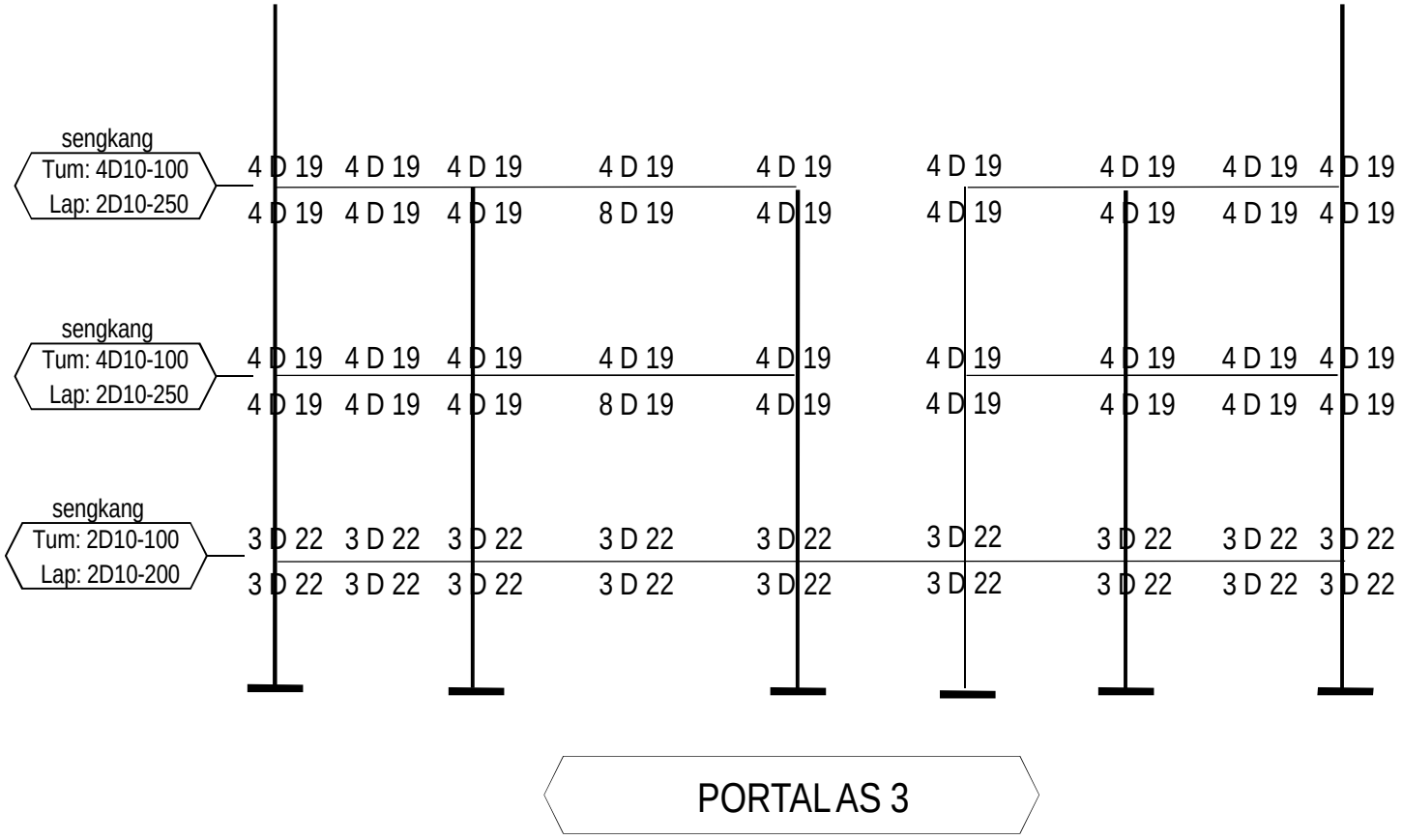
PORTAL AS 2 & 4


sengkang
Tum: 2D8-200
Lap: 2D8-200
4 D 12 4 D 12 4 D 12 4 D 12 4 D 12 4 D 12 4 D 12 4 D 12 4 D 12
4 D 12 4 D 12 4 D 12 4 D 12 4 D 12 4 D 12 4 D 12 4 D 12 4 D 12
sengkang
Tum: 4D10-100
Lap: 2D10-250
4 D 22 4 D 22 4 D 22 4 D 22 6 D 22 4 D 22 4 D 22 4 D 22 4 D 22
4 D 22 4 D 22 4 D 22 8 D 22 4 D 22 8 D 22 4 D 22 4 D 22 4 D 22
sengkang
Tum: 4D10-100
Lap: 2D10-250
4 D 22 4 D 22 4 D 22 4 D 22 6 D 22 4 D 22 4 D 22 4 D 22 4 D 22
4 D 22 4 D 22 4 D 22 8 D 22 4 D 22 8 D 22 4 D 22 4 D 22 4 D 22
sengkang
Tum: 2D10-100
Lap: 2D10-200
3 D 22 3 D 22 3 D 22 3 D 22 3 D 22 3 D 22 3 D 22 3 D 22 3 D 22
3 D 22 3 D 22 3 D 22 3 D 22 3 D 22 3 D 22 3 D 22 3 D 22 3 D 22

PORTAL AS 2 & 4


400x 400
400 / 600
400 / 600
400 / 600
400 / 600
500 x 500
500 x 500
500 x 500
500 x 500
500 x 500
500 x 500
500 x 500
500 x 500
400 / 600
400 / 600
400 / 600
400 / 600
500 x 500
500 x 500
500 x 500
500 x 500
500 x 500
500 x 500
500 x 500
500 x 500
250/500
250/500
250/500
250/500
250/500
500 x 500
500 x 500
500 x 500
500 x 500
500 x 500
500 x 500
500 x 500
500 x 500
400x 400

PORTAL AS 3


sengkang
Tum: 4D10-100
Lap: 2D10-250
4 D 19 4 D 19 4 D 19 4 D 19 4 D 19 4 D 19 4 D 19 4 D 19 4 D 19
4 D 19 4 D 19 4 D 19 8 D 19 4 D 19 4 D 19 4 D 19 4 D 19 4 D 19
sengkang
Tum: 4D10-100
Lap: 2D10-250
4 D 19 4 D 19 4 D 19 4 D 19 4 D 19 4 D 19 4 D 19 4 D 19 4 D 19
4 D 19 4 D 19 4 D 19 8 D 19 4 D 19 4 D 19 4 D 19 4 D 19 4 D 19
sengkang
Tum: 2D10-100
Lap: 2D10-200
3 D 22 3 D 22 3 D 22 3 D 22 3 D 22 3 D 22 3 D 22 3 D 22 3 D 22
3 D 22 3 D 22 3 D 22 3 D 22 3 D 22 3 D 22 3 D 22 3 D 22 3 D 22

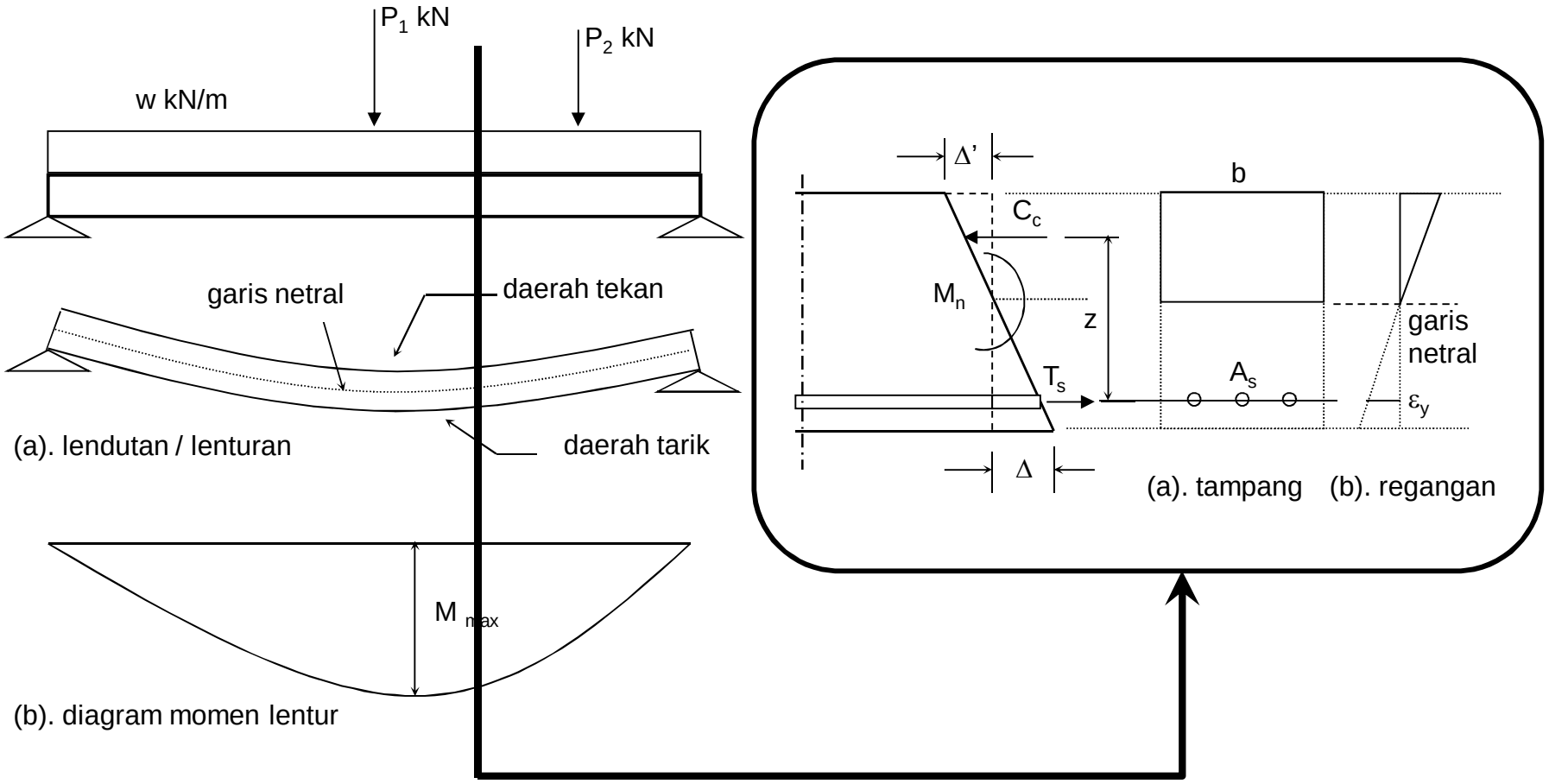
PORTAL AS 3

SUPLEMEN KHUSUS

PELAT BETON

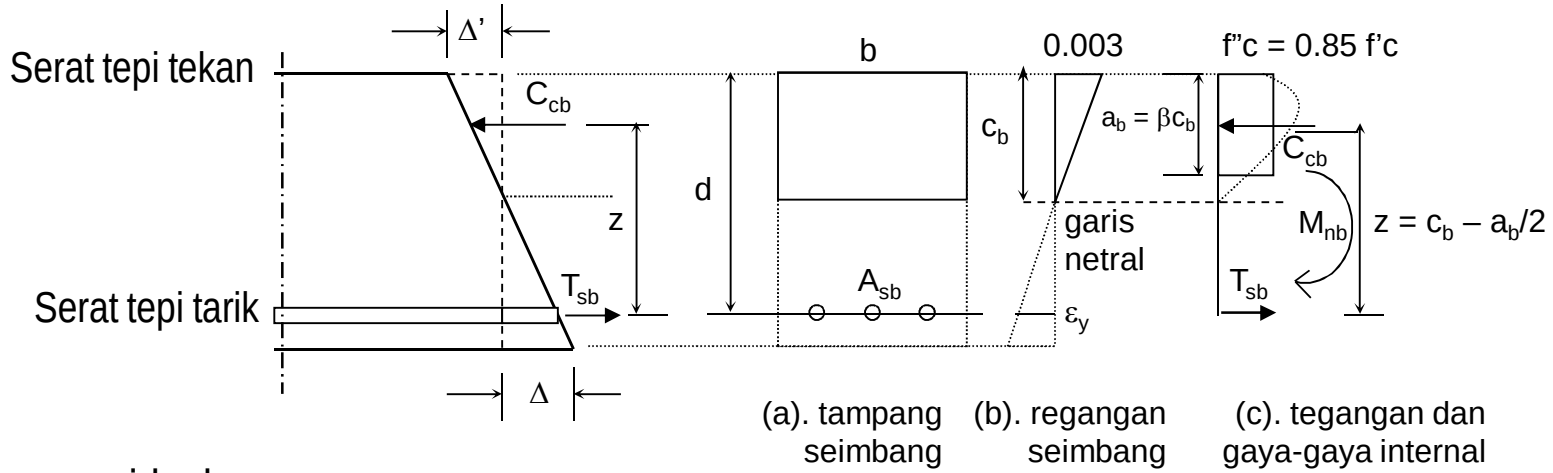
PELAT LANTAI / ATAP

ANALISIS PELENTURAN PADA PENAMPANG PERSEGI



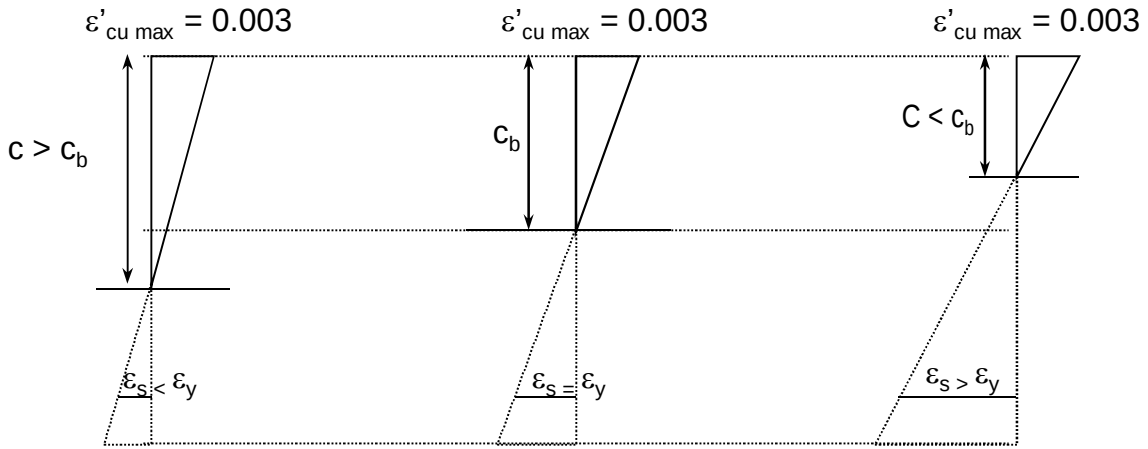
Tampang Seimbang & Pembatasan Tulangan

PELENTURAN PADA PENAMPANG PERSEGI



(a). tampang seimbang (b). regangan seimbang (c). tegangan dan gaya-gaya internal

penampang ideal

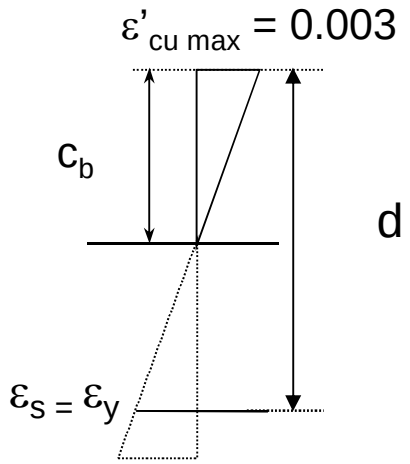


(a) regangan pada $A_s > A_{sb}$ (b) regangan berimbang ($A_s = A_{sb}$) (c) regangan pada $A_s < A_{sb}$

PELAT BETON

Tampang Seimbang Penampang Persegi

PELENTURAN PADA PENAMPANG PERSEGI

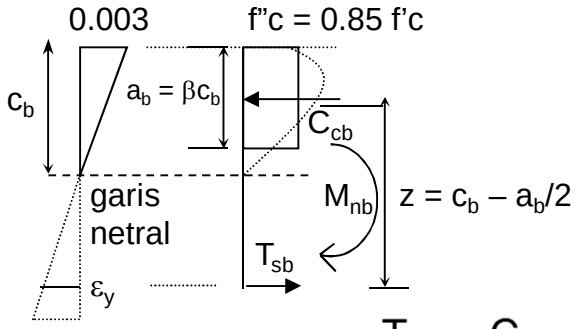


$$\frac{\varepsilon_y}{0.003} = \frac{d - c_b}{c_b} \quad \text{, sehingga:} \quad \frac{f_y / E_s}{0.003} = \frac{d - c_b}{c_b}$$

Dengan Es = 200,000 Mpa →

$$c_b = \left(\frac{600}{600 + f_y}\right) \cdot d$$

$$a_b = \alpha_b \cdot d = \beta \cdot \left(\frac{600}{600 + f_y}\right) \cdot d \quad \rightarrow \quad \alpha_b = \beta \cdot \left(\frac{600}{600 + f_y}\right)$$



$$M_{nb} = a_b \cdot b \cdot f''_c \cdot \left(d - \frac{a_b}{2}\right) = R_{nb} \cdot \left(bd^2\right), \text{ sehingga}$$

$$R_{nb} = \left[\alpha_b \cdot \left(1 - \frac{\alpha_b}{2}\right) \cdot f''_c\right]$$

$$A_{sb} = \frac{T_{sb}}{f_y} = \frac{C_{cb}}{f_y} = \frac{a_b \cdot b \cdot f''_c}{f_y} \rightarrow A_{sb} = \rho_b \cdot bd = \left(\alpha_b \frac{f''_c \cdot}{f_y}\right) \cdot bd \rightarrow \quad \rho_b = \left(\alpha_b \frac{f''_c \cdot}{f_y}\right)$$

PELENTURAN PADA PENAMPANG PERSEGI

Pembatasan Tulangan pada penampang persegi

$$A_s = A_{so} = 0.75 \cdot A_{sb} = 0.75 \cdot \rho_b \cdot bd = 0.75 \cdot \left(\alpha_b \frac{f''_c \cdot}{f_y} \right) \cdot bd$$

$$a_o = \beta \cdot \left(\frac{450}{600 + f_y} \right) \cdot d \rightarrow \quad \alpha_o = \beta \cdot \left(\frac{450}{600 + f_y} \right)$$

$$M_{no} = R_{no} \cdot bd^2 = \left[\alpha_o \cdot \left(1 - \frac{\alpha_o}{2} \right) \cdot f''_c \right] \cdot bd^2 \Rightarrow \quad R_{no} = \left[\alpha_o \cdot \left(1 - \frac{\alpha_o}{2} \right) \cdot f''_c \right]$$

$$A_{so} = \rho_o \cdot bd = \left(\alpha_o \frac{f''_c \cdot}{f_y} \right) \cdot bd \Rightarrow \quad \rho_o = \left(\alpha_o \frac{f''_c \cdot}{f_y} \right)$$

PELENTURAN PADA PENAMPANG PERSEGI

Pada perencanaan penampang akibat momen lentur berlaku ketentuan sebagai berikut:

1. Jika $R_n < R_{no}$, maka penampang dianalisis sebagai penampang dengan tulangan tunggal (hanya tulangan tarik saja). Tulangan tekan tetap diberikan dengan luasan tertentu dengan tujuan dapat difungsikan sebagai tulangan montasi
2. Jika $R_{no} < R_n \leq R_{n\text{-}max}$ (nilai $R_{nb} < R_{n\text{-}max} < 1.5\ R_{no}$) maka penampang harus direncanakan dengan tulangan rangkap
3. Jika $R_n > R_{n\text{-}max}$, maka ukuran penampang harus diperbesar

Pelat dengan tebal kurang dari 200 harus direncanakan sebagai penampang dengan tulangan tunggal, sehingga $R_n < R_{no}$

Pelat dengan tebal kurang dari 200 harus direncanakan mampu memikul gaya geser yang terjadi tanpa bantuan tulangan geser

Perencanaan Penampang Dengan Bajatulangan Tunggal

$$R_n = \frac{M_n}{bd^2} \le R_{no} = \frac{M_{no}}{bd^2} = \left[\alpha_o \cdot \left(1 - \frac{\alpha_o}{2}\right) \cdot f''_c\right]$$

$$R_n = \left[\alpha \cdot \left(1 - \frac{\alpha}{2}\right) \cdot f''_c\right]$$

$$\frac{R_n}{R_{no}} = \frac{\alpha \cdot \left(1 - \frac{\alpha}{2}\right) \cdot f''_c}{\alpha_o \cdot \left(1 - \frac{\alpha_o}{2}\right) \cdot f''_c}$$

$$\alpha^2 - 2\alpha + 2\frac{R_n}{R_{no}}\left[\alpha_o \cdot \left(1 - \frac{\alpha_o}{2}\right)\right] = 0 \Rightarrow \alpha^2 - 2\alpha + 2\frac{R_n}{R_{no}}\left[\frac{R_{no}}{f''_c}\right] = 0 \rightarrow$$

$$\alpha^2 - 2\alpha + 2\frac{R_n}{f''_c} = 0$$

Salah satu akar persamaan kuadrat tersebut adalah:

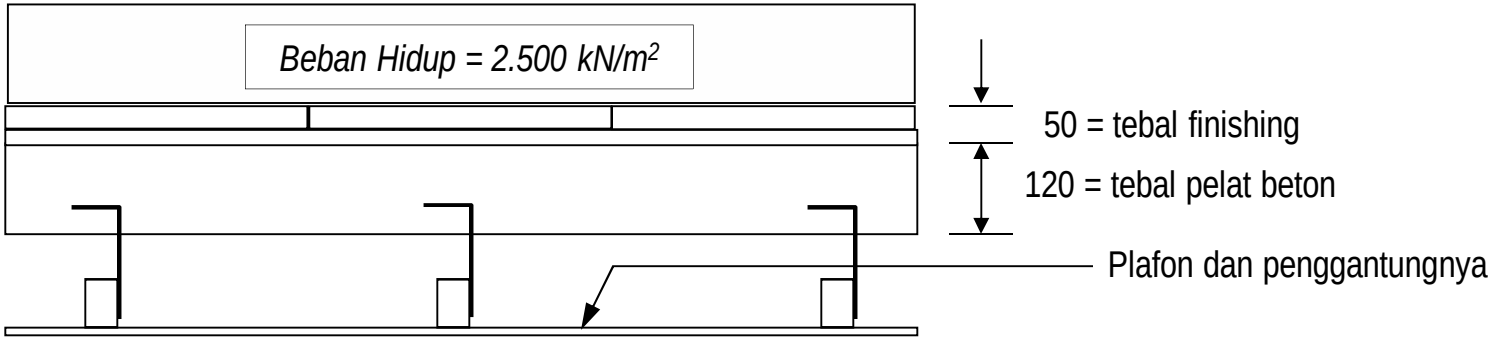
$$\alpha = 1 - \sqrt{1 - 2\frac{R_n}{f''c}}$$

Luas penampang bajatulangan yang diperlukan adalah:

$$A_s = \alpha \cdot \frac{f''_c}{f_y} \cdot bd$$

PELAT BETON

PELAT LANTAI / ATAP



Analisis Beban Pelat

1. Beban Mati (D)

Berat sendiri pelat = 0.120 x 24 = 2.880 kN/m^2

Beban finishing pelat = 0.050 x 21 = 1.050 kN/m^2

Berat plafon dan penggantungnya = 0.200 kN/m^2

w_D = 4.130 kN/m^2

2. Beban Hidup (w_D) = 2.500 kN/m^2

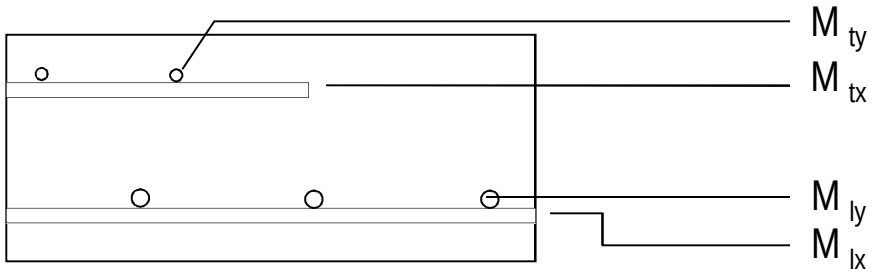
$w_{U1} = 1.4\ w_D = 5.782$ kN/m^2

$w_{U2} = 1.2\ w_D + 1.6\ w_L = 8.956$ kN/m^2

w_U = 8.956 kN/m^2 ~ ***9 kN/m^2***

PELAT BETON

PELAT LANTAI / ATAP



b = 1000 mm t = 120 mm As min = 300 mm2/m ly / lx = 1.2

No	ly	lx	Momen / m lebar			d	Rn	α	As perlu (mm2/m)		Tulangan digunakan	
	(m)	(m)	Nama	Koef.	Mn (kNm)	(mm)	(Mpa)		pokok	pembagi	Pokok	Pembagi
	3.50	3.00	Mlx	44.5	4.481	95	0.4965	0.029646	300	60	D 10 - 200	D 10 - 200
			Mly	37.7	3.802	85	0.5262	0.031447	300	60	D 10 - 200	D 10 - 200
			Mtx	44.5	4.481	87	0.5920	0.035454	300	60	D 10 - 200	D 8 - 200
			Mty	37.7	3.802	95	0.4212	0.025094	300	60	D 10 - 200	D 8 - 200