

BAB V

PERHITUNGAN STRUKTUR PLAT LANTAI

5.1 Plat Lantai

Pada sistem perencanaan plat direncanakan sama dari lantai 1-5 dengan tumpuan berupa jepit ataupun bebas. Sistem penulangan direncanakan sama pada tiap-tiap lantai.

5.2 Pedoman Perhitungan Plat

Dalam perencanaan plat lantai, pedoman yang dipakai adalah :

1. **Pedoman Perencanaan Pembebanan Untuk Rumah dan Gedung** (PPPURG 1987)
2. SNI 03-2847-2002. **Tata Cara Perhitungan Struktur Beton untuk Bangunan Gedung.**
3. Kusuma, Gideon. 1993. **Dasar-dasar Perencanaan Beton Bertulang.** Penerbit Erlangga : Jakarta.
4. Sunggono. 1984. **Teknik Sipil.** Penerbit Nova : Bandung.

5.3 Perhitungan Plat Lantai

5.3.1 Data Teknis Plat Lantai Rencana :

1. Material Beton

F_c	= 25	Mpa
Berat per unit volume	= 2400	Kg/m ³ (PPPURG 1987)
Modulus elastisitas	= 23500	Mpa

$$E_c = 4700\sqrt{f_c} \rightarrow 4700\sqrt{25} = 23500 \text{ Mpa}$$

(SNI -03 -2847 -2002, pasal 10.5(1), hal 54)

2. Material Tulangan

F_y	= 240 Mpa	(SNI-03-1729-2002, pasal 5.1.3, hal 9)
Berat per unit volume	= 7850 kg/m ³	(PPPURG 1987)
Modulus elastisitas	= 200000 Mpa	(SNI-03-1729-2002, pasal 5.1.3, hal 9)

5.3.2 Menentukan Syarat-Syarat Batas dan Bentang Plat Lantai

1. Penulangan plat model I – 5

- Plat 1 $L_x = 300 \text{ cm}$, $L_y = 400 \text{ cm}$ dengan kode A
- Plat 2 $L_x = 300 \text{ cm}$, $L_y = 350 \text{ cm}$ dengan kode B
- Plat 3 $L_x = 300 \text{ cm}$, $L_y = 300 \text{ cm}$ dengan kode C
- Plat 4 $L_x = 150 \text{ cm}$, $L_y = 300 \text{ cm}$ dengan kode D
- Plat 5 $L_x = 150 \text{ cm}$, $L_y = 150 \text{ cm}$ dengan kode E

2. Penulangan plat model I – 3

- Plat 6 $L_x = 300 \text{ cm}$, $L_y = 400 \text{ cm}$ dengan kode F

Keterangan: Sisi bentang pendek (L_x)

Sisi bentang panjang (L_y)

$$\beta = \frac{L_y}{L_x} = \frac{400}{300} = 1,33 < 2 \rightarrow \text{menggunakan plat lantai dua arah (two way slab)}$$

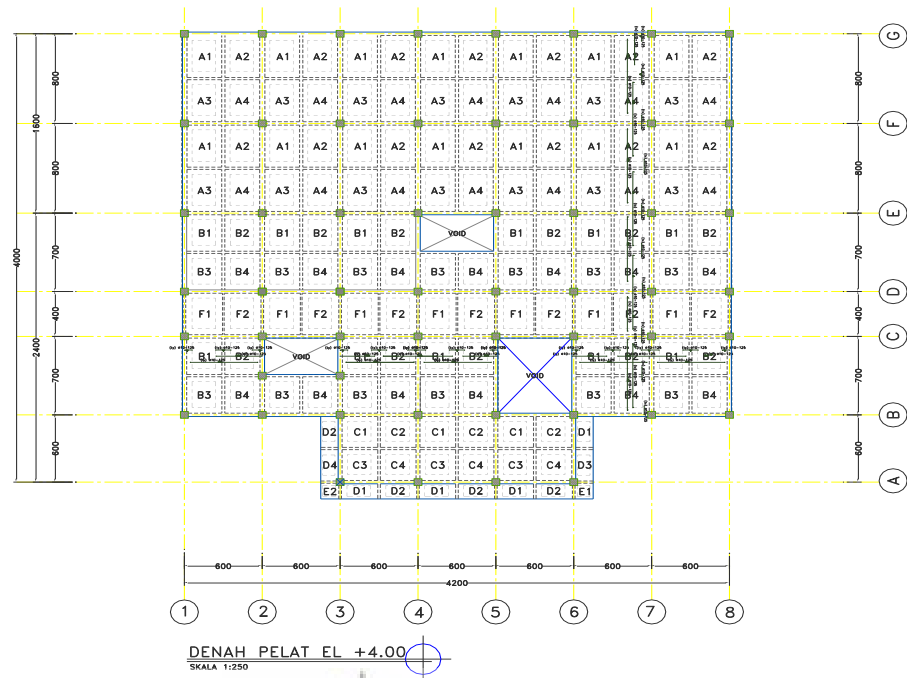
$$\beta = \frac{L_y}{L_x} = \frac{350}{300} = 1,17 < 2 \rightarrow \text{menggunakan plat lantai dua arah (two way slab)}$$

$$\beta = \frac{L_y}{L_x} = \frac{300}{300} = 1 < 2 \rightarrow \text{menggunakan plat lantai dua arah (two way slab)}$$

$$\beta = \frac{L_y}{L_x} = \frac{300}{150} = 2 \leq 2 \rightarrow \text{menggunakan plat lantai dua arah (two way slab)}$$

$$\beta = \frac{L_y}{L_x} = \frac{150}{150} = 1 < 2 \rightarrow \text{menggunakan plat lantai dua arah (two way slab)}$$

$$\beta = \frac{L_y}{L_x} = \frac{400}{300} = 1,5 < 2 \rightarrow \text{menggunakan plat lantai dua arah (two way slab)}$$



Gambar 5.1 Denah Plat Lantai

Sumber : dokumen pribadi (program CAD)

5.3.3 Menentukan Tebal Plat Lantai

Perencanaan plat dalam menentukan tebal diambil dari bentang plat yang 3 lebih pendek (l_x) dari luasan plat terbesar. Pada lantai dasar sampai 5 memiliki *type* plat dengan luasan yang berbeda. Dengan menggunakan asumsi plat 2 arah, dan menggunakan standar plat dengan ketebalan 12 cm. Asumsi menggunakan beton konvensional dengan perhitungan bahwa setiap plat dibatasi oleh balok.

$$h = \frac{\ln \left(0,8 + \frac{f_y}{1500} \right)}{36 + 9 \frac{l_x}{l_y}}$$

$$h = \frac{400 \left(0,8 + \frac{240}{1500} \right)}{36 + 9 \frac{300}{400}}$$

$$h = 8,982 \text{ cm}$$

(Maka tebal plat lantai yang digunakan yaitu **12 cm**)

(SNI -03 -2847 -2002, pasal 11.5(3(3)), hal 66)

5.3.4 Data Beban Yang Bekerja Pada Plat

5.3.4.1 Beban Mati

Berat jenis beton bertulang	= 2400	Kg/m ³
Berat jenis Baja	= 7850	Kg/m ³
Berat jenis lapisan lantai	= 1800	Kg/m ³
Penutup lantai ubin	= 24	Kg/m ²
Tebal lapisan lantai	= 3	cm
Dinding pasangan bata merah	= 1700	Kg/m ³ (tanpa lubang)
Berat plafond 11+7	= 18	Kg/cm

(PPPURG 1987, hal 5 dan 6)

5.3.4.2 Beban Hidup

Bangunan kantor	= 250	Kg/m ²
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(PPPURG 1987, hal 12)

5.3.5 Pembebanan Pada Plat

1. Beban Mati (W_D)

Berat plat lantai	= 2400 x 0,12	= 288	Kg/m ³
Berat spaci lantai	= 0,03 x 1800	= 54	Kg/m ³
Penutup lantai		= 24	Kg/m ²
Berat plafond		= 18	Kg/m ²
Total pembebanan (W_D)		= 384	Kg/m ²

2. Beban Hidup (W_L)

Beban hidup kantor	= 250	Kg/m ²
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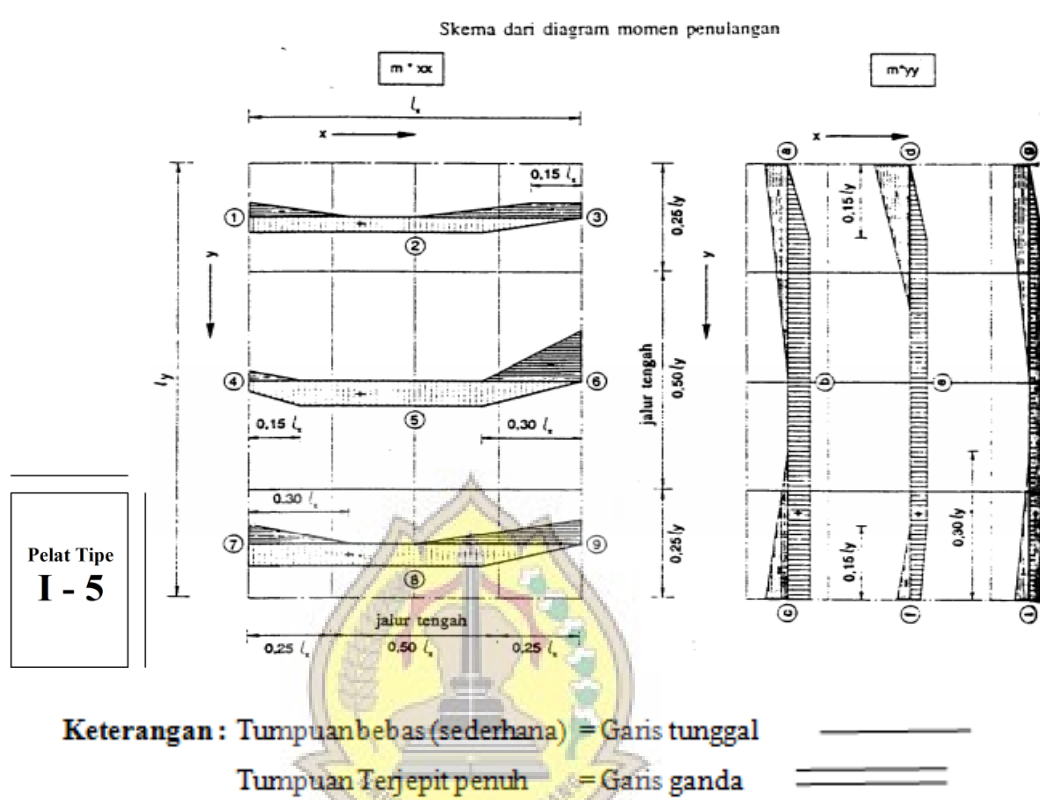
Kombinasi Pembebanan

Sebagai lantai utama kantor

$$\begin{aligned}W_U &= 1,2 W_D + 1,6 W_L \\ &= 1,2 (384) + 1,6 (250) \\ &= 860,8 \quad \text{Kg/m}^2 \quad \rightarrow 8,608 \quad \text{KN/m}^2\end{aligned}$$

5.3.6 Perhitungan Momen pada Tumpuan dan Lapangan

Penulangan plat model I – 5 dan model I – 3 dengan skema dari diagram momen penulangan. Momen penulangan persatuan panjang terhadap beban terbagi rata. Buku Gideon jilid 4, hal 32.



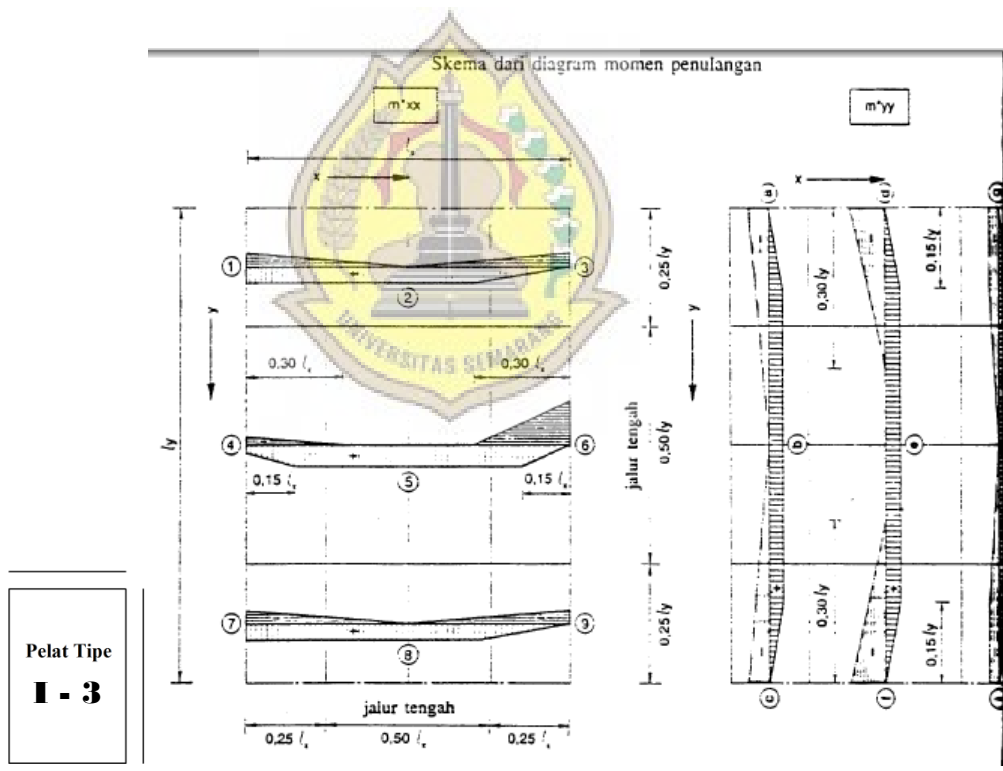
Gambar 5.2. Skema Penulangan Plat Model I – 5

Sumber : buku struktur beton bertulang (Gideon Kusuma)

Tabel 5.1. Skema Penulangan Plat Model I – 5

Koefisien untuk momen penulangan																		
l_y/l_x	$m_{xx} = 0,001 w l_x^2 x$									$m_{yy} = 0,001 w l_y^2 x$								
	1	2	3	4	5	6	7	8	9	a	b	c	d	e	f	g	h	i
1,0	±20	+20	-16	±12	+27	-60	±31	+31	-33	-33	+31	±31	-60	+27	±12	-16	+20	±20
1,2	±24	+24	-21	±13	+37	-76	±36	+36	-41	-36	+35	±35	-65	+27	±14	-17	+22	±22
1,4	±28	+28	-26	±13	+44	-88	±40	+40	-48	-38	+38	±38	-67	+28	±15	-18	+23	±23
1,6	±30	+30	-32	±12	+50	-98	±43	+43	-54	-38	+39	±39	-67	+27	±16	-18	+23	±23
1,8	±32	+32	-36	±11	+55	-104	±45	+45	-59	-38	+39	±39	-67	+28	±16	-18	+23	±23
2,0	±33	+33	-41	±10	+59	-110	±45	+45	-63	-38	+38	±38	-66	+28	±16	-17	+23	±23
2,5	±36	+36	-51	±6	+64	-117	±46	+46	-71	-38	+37	±37	-64	+28	±17	-17	+22	±22
3,0	±38	+38	-60	±4	+67	-121	±48	+48	-78	-38	+37	±37	-63	+28	+18	-17	+22	±22

Sumber : buku struktur beton bertulang (Gideon Kusuma) hal.32



Gambar 5.3. Skema Penulangan Plat Model I – 3

Sumber : buku struktur beton bertulang (Gideon Kusuma)

Tabel 5.2. Skema Penulangan Plat Model I – 3

Koefisien untuk momen penulangan																		
l_y/l_x	$m_{xx} = 0,001 w l_x^2 x$									$m_{yy} = 0,001 w l_y^2 x$								
	1	2	3	4	5	6	7	8	9	a	b	c	d	e	f	g	h	i
1,0	±17	+17	-15	±10	+21	-47	±17	+17	-15	-30	+20	-30	-53	+22	-53	-15	+12	-15
1,2	±22	+22	-20	±12	+30	-63	±22	+22	-20	-34	+24	-34	-61	+23	-61	-16	+14	-16
1,4	±26	+26	-26	±13	+38	-77	±26	+26	-26	-36	+26	-36	-65	+23	-65	-17	+15	-17
1,6	±29	+29	-31	±13	+45	-89	±29	+29	-31	-38	+27	-38	-66	+22	-66	-17	+16	-17
1,8	±31	+31	-36	±12	+51	-98	±31	+31	-36	-38	+29	-38	-66	+22	-66	-18	+17	-18
2,0	±33	+33	-41	±11	+56	-104	±33	+33	-41	-38	+30	-38	-66	+22	-66	-17	+17	-17
2,5	±36	+36	-51	±8	+63	-115	±36	+36	-51	-38	+29	-38	-64	+22	-64	-17	+16	-17
3,0	±38	+38	-60	±5	+66	-120	±38	+38	-60	-38	+29	-38	-64	+22	-64	-17	+18	-17

Sumber : buku struktur beton bertulang (Gideon Kusuma) hal.32

5.3.6.1 Momen Yang Dihasilkan

Perhitungan pada pelat **tipe A.1** dengan dimensi 300 x 400 cm, lantai utama.

1. Momen lapangan arah x (1)

$$\frac{L_y}{L_x} = \frac{4}{3} = 1,33$$

$$\frac{L_y}{L_x} = 1,33 \sim 1,4 \rightarrow x = -48$$

$$M_x = 0,001 \cdot W_u \cdot L_x^2 \cdot x$$

$$M_x = 0,001 \cdot 8,608 \cdot 3^2 \cdot -48$$

$$M_x = -3,719 \text{ KN.m}$$

2. Momen arah x (2)

$$\frac{L_y}{L_x} = \frac{4}{3} = 1,33$$

$$\frac{L_y}{L_x} = 1,33 \sim 1,4 \rightarrow x = 40$$

$$M_x = 0,001 \cdot W_u \cdot L_x^2 \cdot x$$

$$M_x = 0,001 \cdot 8,608 \cdot 3^2 \cdot 40$$

$$M_x = 3,099 \text{ KN.m}$$

3. Momen arah x (3)

$$\frac{L_y}{L_x} = \frac{4}{3} = 1,33$$

$$\frac{L_y}{L_x} = 1,33 \sim 1,4 \rightarrow x = -40$$

$$M_x = 0,001 \cdot W_u \cdot L_x^2 \cdot x$$



$$M_x = 0,001 \cdot 8,608 \cdot 3^2 \cdot -40$$

$$M_x = -3,099 \text{ KN.m}$$

4. Momen arah x (4)

$$\frac{Ly}{Lx} = \frac{4}{3} = 1,33$$

$$\frac{Ly}{Lx} = 1,33 \sim 1,4 \rightarrow x = -88$$

$$M_x = 0,001 \cdot Wu \cdot L_x^2 \cdot x$$

$$M_x = 0,001 \cdot 8,608 \cdot 3^2 \cdot -88$$

$$M_x = -6,818 \text{ KN.m}$$

5. Momen arah x (5)

$$\frac{Ly}{Lx} = \frac{4}{3} = 1,33$$

$$\frac{Ly}{Lx} = 1,33 \sim 1,4 \rightarrow x = 44$$

$$M_x = 0,001 \cdot Wu \cdot L_x^2 \cdot x$$

$$M_x = 0,001 \cdot 8,608 \cdot 3^2 \cdot 44$$

$$M_x = 3,409 \text{ KN.m}$$

6. Momen arah x (6)

$$\frac{Ly}{Lx} = \frac{4}{3} = 1,33$$

$$\frac{Ly}{Lx} = 1,33 \sim 1,4 \rightarrow x = -13$$

$$M_x = 0,001 \cdot Wu \cdot L_x^2 \cdot x$$

$$M_x = 0,001 \cdot 8,608 \cdot 3^2 \cdot -13$$

$$M_x = -1,007 \text{ KN.m}$$

7. Momen arah x (7)

$$\frac{Ly}{Lx} = \frac{4}{3} = 1,33$$

$$\frac{Ly}{Lx} = 1,33 \sim 1,4 \rightarrow x = -26$$

$$M_x = 0,001 \cdot Wu \cdot L_x^2 \cdot x$$

$$M_x = 0,001 \cdot 8,608 \cdot 3^2 \cdot -26$$

$$M_x = -2,014 \text{ KN.m}$$

8. Momen arah x (8)



$$\frac{Ly}{Lx} = \frac{4}{3} = 1,33$$

$$\frac{Ly}{Lx} = 1,33 \sim 1,4 \rightarrow x = 28$$

$$M_x = 0,001 \cdot Wu \cdot L_x^2 \cdot x$$

$$M_x = 0,001 \cdot 8,608 \cdot 3^2 \cdot 28$$

$$M_x = 2,169 \text{ KN.m}$$

9. Momen arah x (9)

$$\frac{Ly}{Lx} = \frac{4}{3} = 1,33$$

$$\frac{Ly}{Lx} = 1,33 \sim 1,4 \rightarrow x = -28$$

$$M_x = 0,001 \cdot Wu \cdot L_x^2 \cdot x$$

$$M_x = 0,001 \cdot 8,608 \cdot 3^2 \cdot -28$$

$$M_x = -2,169 \text{ KN.m}$$

10. Momen arah y (a)

$$\frac{Ly}{Lx} = \frac{4}{3} = 1,33$$

$$\frac{Ly}{Lx} = 1,33 \sim 1,4 \rightarrow x = -38$$

$$M_y = 0,001 \cdot Wu \cdot L_x^2 \cdot x$$

$$M_y = 0,001 \cdot 8,608 \cdot 3^2 \cdot -38$$

$$M_y = -2,944 \text{ KN.m}$$

11. Momen arah y (b)

$$\frac{Ly}{Lx} = \frac{4}{3} = 1,33$$

$$\frac{Ly}{Lx} = 1,33 \sim 1,4 \rightarrow x = 38$$

$$M_y = 0,001 \cdot Wu \cdot L_x^2 \cdot x$$

$$M_y = 0,001 \cdot 8,608 \cdot 3^2 \cdot 38$$

$$M_y = 2,944 \text{ KN.m}$$

12. Momen arah y (c)

$$\frac{Ly}{Lx} = \frac{4}{3} = 1,33$$



$$\frac{Ly}{Lx} = 1,33 \sim 1,4 \rightarrow x = -38$$

$$M_y = 0,001 \cdot Wu \cdot L_x^2 \cdot x$$

$$M_y = 0,001 \cdot 8,608 \cdot 3^2 \cdot -38$$

$$M_y = -2,944 \text{ KN.m}$$

13. Momen arah y (d)

$$\frac{Ly}{Lx} = \frac{4}{3} = 1,33$$

$$\frac{Ly}{Lx} = 1,33 \sim 1,4 \rightarrow x = -67$$

$$M_y = 0,001 \cdot Wu \cdot L_x^2 \cdot x$$

$$M_y = 0,001 \cdot 8,608 \cdot 3^2 \cdot -67$$

$$M_y = -5,191 \text{ KN.m}$$

14. Momen arah y (e)

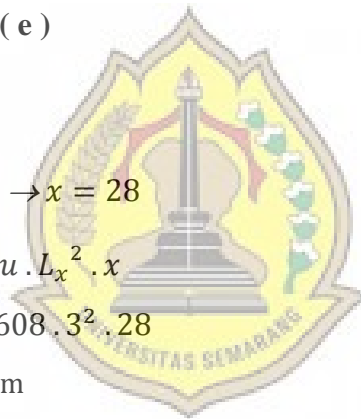
$$\frac{Ly}{Lx} = \frac{4}{3} = 1,33$$

$$\frac{Ly}{Lx} = 1,33 \sim 1,4 \rightarrow x = 28$$

$$M_y = 0,001 \cdot Wu \cdot L_x^2 \cdot x$$

$$M_y = 0,001 \cdot 8,608 \cdot 3^2 \cdot 28$$

$$M_y = 2,169 \text{ KN.m}$$



15. Momen arah y (f)

$$\frac{Ly}{Lx} = \frac{4}{3} = 1,33$$

$$\frac{Ly}{Lx} = 1,33 \sim 1,4 \rightarrow x = -15$$

$$M_y = 0,001 \cdot Wu \cdot L_x^2 \cdot x$$

$$M_y = 0,001 \cdot 8,608 \cdot 3^2 \cdot -15$$

$$M_y = -1,162 \text{ KN.m}$$

16. Momen arah y (g)

$$\frac{Ly}{Lx} = \frac{4}{3} = 1,33$$

$$\frac{Ly}{Lx} = 1,33 \sim 1,4 \rightarrow x = -18$$

$$M_y = 0,001 \cdot Wu \cdot L_x^2 \cdot x$$

$$M_y = 0,001 \cdot 8,608 \cdot 3^2 \cdot -18$$

$$M_y = -1,394 \text{ KN.m}$$

17. Momen arah y (h)

$$\frac{L_y}{L_x} = \frac{4}{3} = 1,33$$

$$\frac{L_y}{L_x} = 1,33 \sim 1,4 \rightarrow x = 23$$

$$M_y = 0,001 \cdot W_u \cdot L_x^2 \cdot x$$

$$M_y = 0,001 \cdot 8,608 \cdot 3^2 \cdot 23$$

$$M_y = 1,782 \text{ KN.m}$$

18. Momen arah y (i)

$$\frac{L_y}{L_x} = \frac{4}{3} = 1,33$$

$$\frac{L_y}{L_x} = 1,33 \sim 1,4 \rightarrow x = -23$$

$$M_y = 0,001 \cdot W_u \cdot L_x^2 \cdot x$$

$$M_y = 0,001 \cdot 8,608 \cdot 3^2 \cdot -23$$

$$M_y = -1,782 \text{ KN.m}$$

Perhitungan Momen Secara Manual Dengan Dibantu Program Excel.

Tabel 5.3. Momen Plat Yang Dihasilkan

No.	DIMENSI (cm)	FUNGSI	Wu (KN/m ²)	Ly / Lx	TIPE	Koefisien Momen penulangan Arah X									
						(x)									
1	300 x 400	Lantai Utama	8,608	1,333	A.1.1	1	2	3	4	5	6	7	8	9	
						-48	40	-40	-88	44	-13	-26	28	-28	
						Mx = 0,001 * Wu * (L ²) * x									
						(KN.m)									
						-3,719	3,099	-3,099	-6,818	3,409	-1,007	-2,014	2,169	-2,169	
						Koefisien Momen Penulangan Arah Y									
						(x)									
						a	b	c	d	e	f	g	h	i	
						-38	38	-38	-67	28	-15	-18	23	-23	
						Mx = 0,001 * Wu * (L ²) * x									
(KN.m)															
-2,944	2,944	-2,944	-5,191	2,169	-1,162	-1,394	1,782	-1,782							
2	300 x 400	Lantai Utama	8,608	1,333	A.2.1	Koefisien Momen penulangan Arah X									
						(x)									
						1	2	3	4	5	6	7	8	9	
						-28	28	-26	-13	44	-88	-40	40	-48	
						Mx = 0,001 * Wu * (L ²) * x									
						(KN.m)									
						-2,169	2,169	-2,014	-1,007	3,409	-6,818	-3,099	3,099	-3,719	
						Koefisien Momen Penulangan Arah Y									
						(x)									
						a	b	c	d	e	f	g	h	i	
-38	38	-38	-67	28	-15	-18	23	-23							
Mx = 0,001 * Wu * (L ²) * x															
(KN.m)															
-2,944	2,944	-2,944	-5,191	2,169	-1,162	-1,394	1,782	-1,782							

No.	DIMENSI (cm)	FUNGSI	Wu (KN/m ²)	Ly / Lx	TIPE	Koefisien Momen penulangan Arah X									
						(x)									
3	300 x 400	Lantai Utama	8,608	1,333	A.3.1	1	2	3	4	5	6	7	8	9	
						-48	40	-40	-88	44	-13	-26	28	-28	
						$M_x = 0,001 * W_u * (L^2) * x$									
						(KN.m)									
						-3,719	3,099	-3,099	-6,818	3,409	-1,007	-2,014	2,169	-2,169	
						Koefisien Momen Penulangan Arah Y									
						(x)									
						a	b	c	d	e	f	g	h	i	
						-23	23	-18	-15	28	-67	-38	38	-38	
						$M_x = 0,001 * W_u * (L^2) * x$									
(KN.m)															
-1,782	1,782	-1,394	-1,162	2,169	-5,191	-2,944	2,944	-2,944							
4	300 x 400	Lantai Utama	8,608	1,333	A.4.1	Koefisien Momen penulangan Arah X									
						(x)									
						1	2	3	4	5	6	7	8	9	
						-28	28	-26	-13	44	-88	-40	40	-48	
						$M_x = 0,001 * W_u * (L^2) * x$									
						(KN.m)									
						-2,169	2,169	-2,014	-1,007	3,409	-6,818	-3,099	3,099	-3,719	
						Koefisien Momen Penulangan Arah Y									
						(x)									
						a	b	c	d	e	f	g	h	i	
-23	23	-18	-15	28	-67	-38	38	-38							
$M_x = 0,001 * W_u * (L^2) * x$															
(KN.m)															
-1,782	1,782	-1,394	-1,162	2,169	-5,191	-2,944	2,944	-2,944							
5	300 x 350	Lantai Utama	8,608	1,167	B.1.1	Koefisien Momen penulangan Arah X									
						(x)									
						1	2	3	4	5	6	7	8	9	
						-41	36	-36	-76	37	-13	-21	24	-24	
						$M_x = 0,001 * W_u * (L^2) * x$									
						(KN.m)									
						-3,176	2,789	-2,789	-5,888	2,866	-1,007	-1,627	1,859	-1,859	
						Koefisien Momen Penulangan Arah Y									
						(x)									
						a	b	c	d	e	f	g	h	i	
-36	35	-35	-65	27	-14	-17	22	-22							
$M_x = 0,001 * W_u * (L^2) * x$															
(KN.m)															
-2,789	2,712	-2,712	-5,036	2,092	-1,085	-1,317	1,704	-1,704							
6	300 x 350	Lantai Utama	8,608	1,167	B.2.1	Koefisien Momen penulangan Arah X									
						(x)									
						1	2	3	4	5	6	7	8	9	
						-24	24	-21	-13	37	-76	-36	36	-41	
						$M_x = 0,001 * W_u * (L^2) * x$									
						(KN.m)									
						-1,859	1,859	-1,627	-1,007	2,866	-5,888	-2,789	2,789	-3,176	
						Koefisien Momen Penulangan Arah Y									
						(x)									
						a	b	c	d	e	f	g	h	i	
-36	35	-35	-65	27	-14	-17	22	-22							
$M_x = 0,001 * W_u * (L^2) * x$															
(KN.m)															
-2,789	2,712	-2,712	-5,036	2,092	-1,085	-1,317	1,704	-1,704							
7	300 x 350	Lantai Utama	8,608	1,167	B.3.1	Koefisien Momen penulangan Arah X									
						(x)									
						1	2	3	4	5	6	7	8	9	
						-41	36	-36	-76	37	-13	-21	24	-24	
						$M_x = 0,001 * W_u * (L^2) * x$									
						(KN.m)									
						-3,176	2,789	-2,789	-5,888	2,866	-1,007	-1,627	1,859	-1,859	
						Koefisien Momen Penulangan Arah Y									
						(x)									
						a	b	c	d	e	f	g	h	i	
-22	22	-17	-14	27	-65	-35	35	-36							
$M_x = 0,001 * W_u * (L^2) * x$															
(KN.m)															
-1,704	1,704	-1,317	-1,085	2,092	-5,036	-2,712	2,712	-2,789							

No.	DIMENSI (cm)	FUNGSI	Wu (KN/m ²)	Ly / Lx	TIPE	Koefisien Momen penulangan Arah X									
8	300 x 350	Lantai Utama	8,608	1,167	B.4.1	(x)									
						1	2	3	4	5	6	7	8	9	
						-24	24	-21	-13	37	-76	-36	36	-41	
						$Mx = 0,001 * Wu * (L^2) * x$									
						(KN.m)									
						-1,859	1,859	-1,627	-1,007	2,866	-5,888	-2,789	2,789	-3,176	
						Koefisien Momen Penulangan Arah Y									
						(x)									
						a	b	c	d	e	f	g	h	i	
						-22	22	-17	-14	27	-65	-35	35	-36	
$Mx = 0,001 * Wu * (L^2) * x$															
(KN.m)															
-1,704	1,704	-1,317	-1,085	2,092	-5,036	-2,712	2,712	-2,789							
9	300 x 300	Lantai Utama	8,608	1	C.1.1	Koefisien Momen penulangan Arah X									
						(x)									
						1	2	3	4	5	6	7	8	9	
						-33	31	-31	-60	27	-12	-16	20	-20	
						$Mx = 0,001 * Wu * (L^2) * x$									
						(KN.m)									
						-2,557	2,402	-2,402	-4,648	2,092	-0,930	-1,240	1,549	-1,549	
						Koefisien Momen Penulangan Arah Y									
						(x)									
						a	b	c	d	e	f	g	h	i	
-33	31	-31	-60	27	-12	-16	20	-20							
$Mx = 0,001 * Wu * (L^2) * x$															
(KN.m)															
-2,557	2,402	-2,402	-4,648	2,092	-0,930	-1,240	1,549	-1,549							
10	300 x 300	Lantai Utama	8,608	1	C.2.1	Koefisien Momen penulangan Arah X									
						(x)									
						1	2	3	4	5	6	7	8	9	
						-20	20	-16	-12	27	-60	-31	31	-33	
						$Mx = 0,001 * Wu * (L^2) * x$									
						(KN.m)									
						-1,549	1,549	-1,240	-0,930	2,092	-4,648	-2,402	2,402	-2,557	
						Koefisien Momen Penulangan Arah Y									
						(x)									
						a	b	c	d	e	f	g	h	i	
-33	31	-31	-60	27	-12	-16	20	-20							
$Mx = 0,001 * Wu * (L^2) * x$															
(KN.m)															
-2,557	2,402	-2,402	-4,648	2,092	-0,930	-1,240	1,549	-1,549							
11	300 x 300	Lantai Utama	8,608	1	C.3.1	Koefisien Momen penulangan Arah X									
						(x)									
						1	2	3	4	5	6	7	8	9	
						-33	31	-31	-60	27	-12	-16	20	-20	
						$Mx = 0,001 * Wu * (L^2) * x$									
						(KN.m)									
						-2,557	2,402	-2,402	-4,648	2,092	-0,930	-1,240	1,549	-1,549	
						Koefisien Momen Penulangan Arah Y									
						(x)									
						a	b	c	d	e	f	g	h	i	
-20	20	-16	-12	27	-60	-31	31	-33							
$Mx = 0,001 * Wu * (L^2) * x$															
(KN.m)															
-1,549	1,549	-1,240	-0,930	2,092	-4,648	-2,402	2,402	-2,557							
12	300 x 300	Lantai Utama	8,608	1	C.4.1	Koefisien Momen penulangan Arah X									
						(x)									
						1	2	3	4	5	6	7	8	9	
						-20	20	-16	-12	27	-60	-31	31	-33	
						$Mx = 0,001 * Wu * (L^2) * x$									
						(KN.m)									
						-1,549	1,549	-1,240	-0,930	2,092	-4,648	-2,402	2,402	-2,557	
						Koefisien Momen Penulangan Arah Y									
						(x)									
						a	b	c	d	e	f	g	h	i	
-20	20	-16	-12	27	-60	-31	31	-33							
$Mx = 0,001 * Wu * (L^2) * x$															
(KN.m)															
-1,549	1,549	-1,240	-0,930	2,092	-4,648	-2,402	2,402	-2,557							

No.	DIMENSI (cm)	FUNGSI	Wu (KN/m ²)	Ly / Lx	TIPE	Koefisien Momen penulangan Arah X																		
						(x)																		
13	150 x 300	Lantai Utama	8,608	2	E.1.1	1	2	3	4	5	6	7	8	9	-63	45	-45	-110	59	-10	-41	33	-33	
						$M_x = 0,001 * W_u * (L^2) * x$																		
						(KN.m)																		
						-4,881	3,486	-3,486	-8,522	4,571	-0,775	-3,176	2,557	-2,557	Koefisien Momen Penulangan Arah Y									
						(x)																		
						a	b	c	d	e	f	g	h	i	-38	-38	-38	-66	28	-16	-17	23	-23	
						$M_x = 0,001 * W_u * (L^2) * x$																		
						(KN.m)																		
						-2,944	-2,944	-2,944	-5,113	2,169	-1,240	-1,317	1,782	-1,782	Plat D.1									
						14	150 x 300	Lantai Utama	8,608	2	E.2.1	Koefisien Momen penulangan Arah X												
(x)																								
1	2	3	4	5	6							7	8	9	-33	33	-41	-10	59	-110	-45	45	-63	
$M_x = 0,001 * W_u * (L^2) * x$																								
(KN.m)																								
-2,557	2,557	-3,176	-0,775	4,571	-8,522							-3,486	3,486	-4,881	Koefisien Momen Penulangan Arah Y									
(x)																								
a	b	c	d	e	f							g	h	i	-38	-38	-38	-66	28	-16	-17	23	-23	
$M_x = 0,001 * W_u * (L^2) * x$																								
(KN.m)																								
-2,944	-2,944	-2,944	-5,113	2,169	-1,240	-1,317	1,782	-1,782	Plat D.2															
15	150 x 300	Lantai Utama	8,608	2	E.3.1	Koefisien Momen penulangan Arah X																		
						(x)																		
						1	2	3	4	5	6	7	8	9	-63	45	-45	-110	59	-10	-41	33	-33	
						$M_x = 0,001 * W_u * (L^2) * x$																		
						(KN.m)																		
						-4,881	3,486	-3,486	-8,522	4,571	-0,775	-3,176	2,557	-2,557	Koefisien Momen Penulangan Arah Y									
						(x)																		
						a	b	c	d	e	f	g	h	i	-23	23	-17	-16	28	-66	-38	38	-38	
						$M_x = 0,001 * W_u * (L^2) * x$																		
						(KN.m)																		
-1,782	1,782	-1,317	-1,240	2,169	-5,113	-2,944	2,944	-2,944	Plat D.3															
16	150 x 300	Lantai Utama	8,608	2	E.4.1	Koefisien Momen penulangan Arah X																		
						(x)																		
						1	2	3	4	5	6	7	8	9	-33	33	-41	-10	59	-110	-45	45	-63	
						$M_x = 0,001 * W_u * (L^2) * x$																		
						(KN.m)																		
						-2,557	2,557	-3,176	-0,775	4,571	-8,522	-3,486	3,486	-4,881	Koefisien Momen Penulangan Arah Y									
						(x)																		
						a	b	c	d	e	f	g	h	i	-23	23	-17	-16	28	-66	-38	38	-38	
						$M_x = 0,001 * W_u * (L^2) * x$																		
						(KN.m)																		
-1,782	1,782	-1,317	-1,240	2,169	-5,113	-2,944	2,944	-2,944	Plat D.4															
17	150 x 150	Lantai Utama	8,608	1	F.1.1	Koefisien Momen penulangan Arah X																		
						(x)																		
						1	2	3	4	5	6	7	8	9	-33	31	-31	-60	27	-12	-16	20	-20	
						$M_x = 0,001 * W_u * (L^2) * x$																		
						(KN.m)																		
						-2,557	2,402	-2,402	-4,648	2,092	-0,930	-1,240	1,549	-1,549	Koefisien Momen Penulangan Arah Y									
						(x)																		
						a	b	c	d	e	f	g	h	i	-33	31	-31	-60	27	-12	-16	20	-20	
						$M_x = 0,001 * W_u * (L^2) * x$																		
						(KN.m)																		
-2,557	2,402	-2,402	-4,648	2,092	-0,930	-1,240	1,549	-1,549	Plat E.1															

No.	DIMENSI (cm)	FUNGSI	Wu (KN/m ²)	Ly / Lx	TIPE	Koefisien Momen penulangan Arah X												
						(x)												
18	150 x 150	Lantai Utama	8,608	1	F.2.1	1	2	3	4	5	6	7	8	9	$M_x = 0,001 * W_u * (L^2) * x$			
						-20	20	-16	-12	27	-60	-31	31	-33	(KN.m)			
						-1,549	1,549	-1,240	-0,930	2,092	-4,648	-2,402	2,402	-2,557	Koefisien Momen Penulangan Arah Y			
						(x)												
						a	b	c	d	e	f	g	h	i	$M_x = 0,001 * W_u * (L^2) * x$			
						-33	31	-31	-60	27	-12	-16	20	-20	(KN.m)			
						-2,557	2,402	-2,402	-4,648	2,092	-0,930	-1,240	1,549	-1,549	Koefisien Momen Penulangan Arah X			
						(x)												
						1	2	3	4	5	6	7	8	9	$M_x = 0,001 * W_u * (L^2) * x$			
						-20	20	-16	-12	27	-60	-31	31	-33	(KN.m)			
Plat E.2																		
19	150 x 150	Lantai Utama	8,608	1	F.3.1	1	2	3	4	5	6	7	8	9	$M_x = 0,001 * W_u * (L^2) * x$			
						-33	31	-31	-60	27	-12	-16	20	-20	(KN.m)			
						-2,557	2,402	-2,402	-4,648	2,092	-0,930	-1,240	1,549	-1,549	Koefisien Momen Penulangan Arah Y			
						(x)												
						a	b	c	d	e	f	g	h	i	$M_x = 0,001 * W_u * (L^2) * x$			
						-20	20	-16	-12	27	-60	-31	31	-33	(KN.m)			
						-1,549	1,549	-1,240	-0,930	2,092	-4,648	-2,402	2,402	-2,557	Koefisien Momen Penulangan Arah X			
						(x)												
						1	2	3	4	5	6	7	8	9	$M_x = 0,001 * W_u * (L^2) * x$			
						-33	31	-31	-60	27	-12	-16	20	-20	(KN.m)			
Plat E.3																		
20	150 x 150	Lantai Utama	8,608	1	F.4.1	1	2	3	4	5	6	7	8	9	$M_x = 0,001 * W_u * (L^2) * x$			
						-20	20	-16	-12	27	-60	-31	31	-33	(KN.m)			
						-1,549	1,549	-1,240	-0,930	2,092	-4,648	-2,402	2,402	-2,557	Koefisien Momen Penulangan Arah Y			
						(x)												
						a	b	c	d	e	f	g	h	i	$M_x = 0,001 * W_u * (L^2) * x$			
						-20	20	-16	-12	27	-60	-31	31	-33	(KN.m)			
						-1,549	1,549	-1,240	-0,930	2,092	-4,648	-2,402	2,402	-2,557	Koefisien Momen Penulangan Arah X			
						(x)												
						1	2	3	4	5	6	7	8	9	$M_x = 0,001 * W_u * (L^2) * x$			
						-20	20	-16	-12	27	-60	-31	31	-33	(KN.m)			
Plat E.4																		
21	300 x 400	Lantai Utama	8,608	1,333	G.1.1	1	2	3	4	5	6	7	8	9	$M_x = 0,001 * W_u * (L^2) * x$			
						-26	26	-26	-77	38	-13	-26	26	-26	(KN.m)			
						-2,014	2,014	-2,014	-5,965	2,944	-1,007	-2,014	2,014	-2,014	Koefisien Momen Penulangan Arah Y			
						(x)												
						a	b	c	d	e	f	g	h	i	$M_x = 0,001 * W_u * (L^2) * x$			
						-36	26	-36	-65	23	-65	-17	15	-17	(KN.m)			
						-2,789	2,014	-2,789	-5,036	1,782	-5,036	-1,317	1,162	-1,317	Koefisien Momen Penulangan Arah X			
						(x)												
						1	2	3	4	5	6	7	8	9	$M_x = 0,001 * W_u * (L^2) * x$			
						-26	26	-26	-13	38	-77	-26	26	-26	(KN.m)			
Plat F.1																		
22	300 x 400	Lantai Utama	8,608	1,333	G.2.1	1	2	3	4	5	6	7	8	9	$M_x = 0,001 * W_u * (L^2) * x$			
						-26	26	-26	-13	38	-77	-26	26	-26	(KN.m)			
						-2,014	2,014	-2,014	-1,007	2,944	-5,965	-2,014	2,014	-2,014	Koefisien Momen Penulangan Arah Y			
						(x)												
						a	b	c	d	e	f	g	h	i	$M_x = 0,001 * W_u * (L^2) * x$			
						-36	26	-36	-65	23	-65	-17	15	-17	(KN.m)			
						-2,789	2,014	-2,789	-5,036	1,782	-5,036	-1,317	1,162	-1,317	Koefisien Momen Penulangan Arah X			
						(x)												
						1	2	3	4	5	6	7	8	9	$M_x = 0,001 * W_u * (L^2) * x$			
						-26	26	-26	-13	38	-77	-26	26	-26	(KN.m)			
Plat F.2																		

Sumber : Dokumentasi Pribadi (Program Microsoft Exel)

5.3.7 Perhitungan Penulangan Plat

$$\begin{aligned} \text{Tebal plat (h)} &= 12 \text{ cm} \quad \rightarrow 120 \quad \text{mm} \\ F_c &= 25 \text{ Mpa} \quad \rightarrow 250 \quad \text{kg/cm}^2 \\ F_y &= 240 \text{ Mpa} \quad \rightarrow 2400 \quad \text{Kg / cm}^2 \\ \rho_{\min} &= \frac{1,4}{f_y} = \frac{1,4}{240} = 0,00583 \end{aligned}$$

(Buku Gideon jilid 1, tabel 6, hal 51)

$$\text{Tebal Selimut Beton} = p = 20 \text{ mm}$$

(Buku Gideon jilid 1, tabel 3, hal 44)

$$\text{Diameter Tulangan arah x} = \emptyset 10 \quad \rightarrow 10 \text{ mm}$$

Tinggi evektif arah x

$$\begin{aligned} d_x &= h - p - \frac{1}{2} \emptyset_{D_x} \\ &= 120 - 20 - \frac{1}{2} 10 \\ &= 95 \text{ mm} \end{aligned}$$

$$\text{Diameter tulangan arah y} = \emptyset 10 \quad \rightarrow 10 \text{ mm}$$

Tinggi evektif arah y

$$\begin{aligned} d_y &= h - p - \emptyset_{D_y} - \frac{1}{2} \emptyset_{D_y} \\ &= 120 - 20 - 10 - \frac{1}{2} 10 \\ &= 85 \text{ mm} \end{aligned}$$

(Buku Gideon jilid 1 , hal 43-44)

5.3.7.1 Tulangan Yang Dihasilkan

Perhitungan tulangan pada plat lantai secara manual dengan dibantu program excel. Perhitungan tulangan pada interpolasi untuk menentukan (ρ), sesuai dengan tabel 5.1h, buku Gideon jilid 4 pada halaman 51. Adapun rumus dalam interpolasi :

$\frac{M_u}{b \times d^2} = A$	\rightarrow	$\rho = a$
$\frac{M_u}{b \times d^2} = X$	\rightarrow	Interpolasi
$\frac{M_u}{b \times d^2} = B$	\rightarrow	$\rho = b$
ρ	$= a + \frac{X-A}{100} \times (b - a)$	



Tabel 5.4. Penentuan ρ pada Mutu beton $f'c$ 25

Mutu BETON $f'c$ 25 $\phi = 1$

M_u / bd^2	$f'c = 24 \text{ MPa}$		$f'c = 40 \text{ MPa}$		ρ_{min}	ρ_{max}
	ρ	a_s	ρ	a_s		
100	0.0004	0.239	0.0003	0.399	0.006	0.998
200	0.0008	0.239	0.0005	0.398	0.011	0.995
300	0.0013	0.238	0.0008	0.397	0.017	0.993
400	0.0017	0.238	0.0010	0.396	0.022	0.990
500	0.0021	0.237	0.0013	0.395	0.028	0.988
600	0.0025	0.237	0.0015	0.394	0.034	0.986
700	0.0030	0.236	0.0018	0.393	0.039	0.983
800	0.0034	0.235	0.0020	0.392	0.045	0.981
900	0.0038	0.235	0.0023	0.391	0.051	0.978
1000	0.0043	0.234	0.0026	0.390	0.057	0.976
1100	0.0047	0.234	0.0028	0.389	0.063	0.973
1200	0.0051	0.233	0.0031	0.388	0.068	0.971
1300	0.0056	0.232	0.0034	0.387	0.074	0.968
1400	0.0060	0.232	0.0036	0.377	0.080	0.966
1500	0.0065	0.231	0.0039	0.385	0.086	0.963
1600	0.0069	0.231	0.0042	0.384	0.092	0.961
1700	0.0074	0.230	0.0044	0.383	0.098	0.958
1800	0.0078	0.229	0.0047	0.382	0.104	0.956
1900	0.0083	0.229	0.0050	0.381	0.110	0.953
2000	0.0088	0.228	0.0053	0.380	0.116	0.950
2200	0.0097	0.227	0.0058	0.378	0.129	0.945
2400	0.0106	0.226	0.0064	0.376	0.141	0.940
2600	0.0116	0.224	0.0070	0.374	0.154	0.935
2800	0.0126	0.223	0.0075	0.372	0.167	0.929
3000	0.0135	0.222	0.0081	0.369	0.180	0.924
3200	0.0145	0.220	0.0087	0.367	0.193	0.918
3400	0.0155	0.219	0.0093	0.365	0.206	0.912
3600	0.0165	0.218	0.0099	0.363	0.220	0.907
3800	0.0176	0.216	0.0105	0.360	0.234	0.901
4000	0.0186	0.215	0.0112	0.358	0.247	0.895
4200	0.0197	0.213	0.0118	0.356	0.262	0.889
4400	0.0208	0.212	0.0125	0.353	0.276	0.883
4600	0.0219	0.210	0.0131	0.351	0.291	0.877
4800	0.0230	0.209	0.0138	0.348	0.305	0.870
5000	0.0241	0.207	0.0145	0.346	0.320	0.864
5200	0.0253	0.206	0.0152	0.343	0.336	0.857
5400	0.0265	0.204	0.0159	0.340	0.351	0.851
5600	0.0277	0.203	0.0166	0.338	0.367	0.844
5800	0.0289	0.201	0.0173	0.335	0.384	0.837
6000	0.0301	0.199	0.0181	0.332	0.400	0.830
6200	0.0314	0.197	0.0188	0.329	0.417	0.823
6400	0.0327	0.196	0.0196	0.326	0.435	0.815
6600	0.0340	0.194	0.0204	0.323	0.452	0.808
6800	0.0354	0.192			0.471	0.800
7000	0.0368	0.190			0.489	0.792
7200	0.0383	0.188			0.509	0.784
7400	0.0398	0.186			0.528	0.775
7600	0.0413	0.184			0.549	0.767

Sumber : buku struktur beton bertulang (Gideon Kusuma) hal.51

Sedangkan untuk mencari tulangan pada plat lantai dibantu dengan tabel 13a, buku Gideon jilid 1 pada halaman 82.

Tabel 5.5. Diameter Batang dalam mm² per meter lebar Plat

Jarak pusat ke pusat dalam mm	Diameter dalam mm							
	6	8	10	12	14	16	19	20
50	565	1005	1571	2262	3079	4022	5671	6284
75	377	670	1047	1508	2053	2681	3780	4189
100	283	503	785	1131	1539	2011	2835	3142
125	226	402	628	905	1232	1608	2268	2513
150	188	335	524	754	1026	1340	1890	2094
175	162	287	449	646	880	1149	1620	1795
200	141	251	393	565	770	1005	1418	1571
225	126	223	349	503	684	894	1260	1396
250	113	201	314	452	616	804	1134	1257

Sumber : buku struktur beton bertulang (Gideon Kusuma)

Dalam menentukan diameter dan jumlah tulangan disesuaikan dengan perencanaan yang dibuat. Adapun hasil dari perhitungan tulangan, sebagai berikut :

Perhitungan pada plat **tipe A.1** dengan dimensi 300 x 400 cm, lantai utama.

1. Penulangan Arah X (4)

$$\text{Momen Lapangan (M}_{lx}) = -6,818 \quad \text{KN.m}$$

$$\frac{M_u}{b \times d^2} = \frac{-6,818}{1,0 \times 0,095^2} = -755,406 \quad \text{KN/m}^2$$

$$\frac{M_u}{b \times d^2} = 700 \quad \rightarrow \quad \rho = 0,0030$$

$$\frac{M_u}{b \times d^2} = 755,406 \quad \rightarrow \quad \text{Interpolasi}$$

$$\frac{M_u}{b \times d^2} = 800 \quad \rightarrow \quad \rho = 0,0034$$

$$\rho = 0,0030 + \frac{55,457}{100} \times (0,0034 - 0,0030)$$

$$= 0,0032... \quad \rightarrow \quad \rho_{\min} > \rho$$

$$\text{As} = \rho_{\min} \times b \times dx$$

$$= 0,0058 \times 1000 \times 95$$

$$= 554 \text{ mm}^2$$

Didapat dari tabel 13a Tulangan yang dipakai $\varnothing 10 - 125$ (As = 628 mm²)

2. Penulangan Arah X (5)

$$\text{Momen Tumpuan (M}_{tx}) = 3,409 \quad \text{KN.m}$$

$$\frac{M_u}{b \times d^2} = \frac{3,409}{1,0 \times 0,095^2} = 377,703 \quad \text{KN/m}^2$$

$$\frac{M_u}{b \times d^2} = 300 \quad \rightarrow \quad \rho = 0,0013$$

$$\frac{M_u}{b \times d^2} = 377,703 \quad \rightarrow \quad \text{Interpolasi}$$

$$\frac{M_u}{b \times d^2} = 400 \quad \rightarrow \quad \rho = 0,0017$$

$$\rho = 0,0013 + \frac{77,703}{100} \times (0,0017 - 0,0013)$$

$$= 0,0018... \quad \rightarrow \quad \rho_{\min} > \rho$$

$$\text{As} = \rho_{\min} \times b \times dx$$

$$= 0,0058 \times 1000 \times 95$$

$$= 554 \text{ mm}^2$$

Didapat dari tabel 13a Tulangan yang dipakai $\varnothing 10 - 125$ (As = 628 mm²)

3. Penulangan Arah X (3)

$$\text{Momen Lapangan (M}_{lx}) = -3,099 \quad \text{KN.m}$$

$$\frac{M_u}{b \times d^2} = \frac{-3,099}{1,0 \times 0,095^2} = -343,366 \quad \text{KN/m}^2$$

$$\frac{M_u}{b \times d^2} = 300 \quad \rightarrow \quad \rho = 0,0013$$

$$\frac{M_u}{b \times d^2} = 343,366 \quad \rightarrow \quad \text{Interpolasi}$$

$$\frac{M_u}{b \times d^2} = 400 \quad \rightarrow \quad \rho = 0,0017$$

$$\rho = 0,0013 + \frac{43,366}{100} \times (0,0017 - 0,0013)$$

$$= 0,0019... \quad \rightarrow \quad \rho_{\min} > \rho$$

$$A_s = \rho_{\min} \times b \times d_x$$

$$= 0,0058 \times 1000 \times 95$$

$$= 554 \text{ mm}^2$$

Didapat dari tabel 13a Tulangan yang dipakai $\varnothing 10 - 125$ ($A_s = 628 \text{ mm}^2$)

4. Penulangan Arah Y (d)

$$\text{Momen Lapangan (M}_{ly}) = -5,191 \quad \text{KN.m}$$

$$\frac{M_u}{b \times d^2} = \frac{-5,191}{1,0 \times 0,085^2} = -718,425 \quad \text{KN/m}^2$$

$$\frac{M_u}{b \times d^2} = 700 \quad \rightarrow \quad \rho = 0,0030$$

$$\frac{M_u}{b \times d^2} = -718,425 \quad \rightarrow \quad \text{Interpolasi}$$

$$\frac{M_u}{b \times d^2} = 800 \quad \rightarrow \quad \rho = 0,0034$$

$$\rho = 0,0030 + \frac{18,425}{100} \times (0,0034 - 0,0030)$$

$$= 0,0031... \quad \rightarrow \quad \rho_{\min} > \rho$$

$$A_s = \rho_{\min} \times b \times d_x$$

$$= 0,0058 \times 1000 \times 85$$

$$= 496 \text{ mm}^2$$

Didapat dari tabel 13a Tulangan yang dipakai $\varnothing 10 - 125$ ($A_s = 628 \text{ mm}^2$)

5. Penulangan Arah Y (b)

$$\text{Momen Tumpuan (M}_{tx}) = 2,944 \quad \text{KN.m}$$

$$\frac{M_u}{b \times d^2} = \frac{2,944}{1,0 \times 0,085^2} = 407,465 \quad \text{KN/m}^2$$

$$\frac{M_u}{b \times d^2} = 400 \quad \rightarrow \quad \rho = 0,0017$$

$$\frac{M_u}{b \times d^2} = 407,465 \quad \rightarrow \quad \text{Interpolasi}$$

$$\frac{M_u}{b \times d^2} = 500 \quad \rightarrow \quad \rho = 0,0021$$

$$\rho = 0,0017 + \frac{7,465}{100} \times (0,0021 - 0,0017)$$

$$= 0,0017... \rightarrow \rho_{\min} > \rho$$

$$A_s = \rho_{\min} \times b \times d_x$$

$$= 0,0058 \times 1000 \times 85$$

$$= 496 \text{ mm}^2$$

Didapat dari tabel 13a Tulangan yang dipakai $\varnothing 10 - 125$ ($A_s = 628 \text{ mm}^2$)

6. Penulangan Arah Y (c)

$$\text{Momen Lapangan (M}_{lx}) = -2,944 \text{ KN.m}$$

$$\frac{M_u}{b \times d^2} = \frac{-2,944}{1,0 \times 0,085^2} = -407,465 \text{ KN/m}^2$$

$$\frac{M_u}{b \times d^2} = 400 \rightarrow \rho = 0,0017$$

$$\frac{M_u}{b \times d^2} = 407,465 \rightarrow \text{Interpolasi}$$

$$\frac{M_u}{b \times d^2} = 500 \rightarrow \rho = 0,0021$$

$$\rho = 0,0017 + \frac{7,465}{100} \times (0,0021 - 0,0017)$$

$$= 0,0017... \rightarrow \rho_{\min} > \rho$$

$$A_s = \rho_{\min} \times b \times d_x$$

$$= 0,0058 \times 1000 \times 85$$

$$= 496 \text{ mm}^2$$

Didapat dari tabel 13a Tulangan yang dipakai $\varnothing 10 - 125$ ($A_s = 628 \text{ mm}^2$)

Tabel 5.6. Hasil Perhitungan Tulangan Plat

No.	TIPE PLAT	Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	INTERPOLASI				ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)
							Mu / (b*d^2)	ρ'	Mu / (b*d^2)	ρ''					
1	A.1.1	4	-6,818	1	95	-755,406	700	0,0030	800	0,0034	0,0032	0,0085	544	∅ 10 - 125	628
		5	3,409	1	95	377,703	300	0,0013	400	0,0017	0,0016	0,0085	544	∅ 10 - 125	628
		3	-3,099	1	95	-343,366	300	0,0013	400	0,0017	0,0015	0,0085	544	∅ 10 - 125	628
		Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	Mu / (b*d^2)	ρ'	Mu / (b*d^2)	ρ''	ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)
		d	-5,191	1	85	-718,425	700	0,0030	800	0,0034	0,0031	0,0085	496	∅ 10 - 125	628
		b	2,944	1	85	407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	∅ 10 - 125	628
c	-2,944	1	85	-407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	∅ 10 - 125	628		
2	A.2.1	7	-3,099	1	95	-343,366	300	0,0013	400	0,0017	0,0015	0,0085	544	∅ 10 - 125	628
		5	3,409	1	95	377,703	300	0,0013	400	0,0017	0,0016	0,0085	544	∅ 10 - 125	628
		6	-6,818	1	95	-755,406	700	0,0030	800	0,0034	0,0032	0,0085	544	∅ 10 - 125	628
		Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	Mu / (b*d^2)	ρ'	Mu / (b*d^2)	ρ''	ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)
		d	-5,191	1	85	-718,425	700	0,0030	800	0,0034	0,0031	0,0085	496	∅ 10 - 125	628
		b	2,944	1	85	407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	∅ 10 - 125	628
c	-2,944	1	85	-407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	∅ 10 - 125	628		

No.	TIPE PLAT	Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	INTERPOLASI			ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)	
							Mu / (b*d^2)	ρ'	Mu / (b*d^2)						ρ''
3	A.3.1	4	-6,818	1	95	-755,406	700	0,0030	800	0,0034	0,0032	0,0085	544	Ø 10 - 125	628
		5	3,409	1	95	377,703	300	0,0013	400	0,0017	0,0016	0,0085	544	Ø 10 - 125	628
		3	-3,099	1	95	-343,366	300	0,0013	400	0,0017	0,0015	0,0085	544	Ø 10 - 125	628
	Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	Mu / (b*d^2)	ρ'	Mu / (b*d^2)	ρ''	ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)	
	g	-2,944	1	85	-407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	Ø 10 - 125	628	
	h	2,944	1	85	407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	Ø 10 - 125	628	
	f	-5,191	1	85	-718,425	700	0,0030	800	0,0034	0,0031	0,0085	496	Ø 10 - 125	628	
4	A.4.1	7	-3,099	1	95	-343,366	300	0,0013	400	0,0017	0,0015	0,0085	544	Ø 10 - 125	628
		5	3,409	1	95	377,703	300	0,0013	400	0,0017	0,0016	0,0085	544	Ø 10 - 125	628
		6	-6,818	1	95	-755,406	700	0,0030	800	0,0034	0,0032	0,0085	544	Ø 10 - 125	628
	Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	Mu / (b*d^2)	ρ'	Mu / (b*d^2)	ρ''	ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)	
	g	-2,944	1	85	-407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	Ø 10 - 125	628	
	h	2,944	1	85	407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	Ø 10 - 125	628	
	f	-5,191	1	85	-718,425	700	0,0030	800	0,0034	0,0031	0,0085	496	Ø 10 - 125	628	
5	A.1.2	4	-8,718	1	95	-966,021	900	0,0038	1000	0,0043	0,0041	0,0085	544	Ø 10 - 125	628
		5	4,359	1	95	483,010	400	0,0017	500	0,0021	0,0020	0,0085	544	Ø 10 - 125	628
		3	3,963	1	95	439,100	400	0,0017	500	0,0021	0,0019	0,0085	544	Ø 10 - 125	628
	Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	Mu / (b*d^2)	ρ'	Mu / (b*d^2)	ρ''	ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)	
	d	-6,638	1	85	-718,425	700	0,0030	800	0,0034	0,0031	0,0085	496	Ø 10 - 125	628	
	b	3,765	1	85	407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	Ø 10 - 125	628	
	c	-3,765	1	85	-407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	Ø 10 - 125	628	
6	A.2.2	7	-3,963	1	95	-439,100	400	0,0017	500	0,0021	0,0019	0,0085	544	Ø 10 - 125	628
		5	4,359	1	95	483,010	400	0,0017	500	0,0021	0,0020	0,0085	544	Ø 10 - 125	628
		6	-8,718	1	95	-966,021	900	0,0038	1000	0,0043	0,0041	0,0085	544	Ø 10 - 125	628
	Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	Mu / (b*d^2)	ρ'	Mu / (b*d^2)	ρ''	ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)	
	d	-6,638	1	85	-918,730	900	0,0038	1000	0,0043	0,0039	0,0085	496	Ø 10 - 125	628	
	b	3,765	1	85	521,071	500	0,0021	600	0,0025	0,0022	0,0085	496	Ø 10 - 125	628	
	c	-3,765	1	85	-521,071	500	0,0021	600	0,0025	0,0022	0,0085	496	Ø 10 - 125	628	
7	A.3.2	4	-8,718	1	95	-966,021	900	0,0038	1000	0,0043	0,0041	0,0085	544	Ø 10 - 125	628
		5	4,359	1	95	483,010	400	0,0017	500	0,0021	0,0020	0,0085	544	Ø 10 - 125	628
		3	3,963	1	95	439,100	400	0,0017	500	0,0021	0,0019	0,0085	544	Ø 10 - 125	628
	Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	Mu / (b*d^2)	ρ'	Mu / (b*d^2)	ρ''	ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)	
	g	-3,765	1	85	-521,071	500	0,0021	600	0,0025	0,0022	0,0085	496	Ø 10 - 125	628	
	h	3,765	1	85	521,071	500	0,0021	600	0,0025	0,0022	0,0085	496	Ø 10 - 125	628	
	f	-6,638	1	85	-918,730	900	0,0038	1000	0,0043	0,0039	0,0085	496	Ø 10 - 125	628	
8	A.4.2	7	-3,963	1	95	-439,100	400	0,0017	500	0,0021	0,0019	0,0085	544	Ø 10 - 125	628
		5	4,359	1	95	483,010	400	0,0017	500	0,0021	0,0020	0,0085	544	Ø 10 - 125	628
		6	-8,718	1	95	-966,021	900	0,0038	1000	0,0043	0,0035	0,0085	544	Ø 10 - 125	628
	Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	Mu / (b*d^2)	ρ'	Mu / (b*d^2)	ρ''	ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)	
	g	-3,765	1	85	-521,071	500	0,0021	600	0,0021	0,0021	0,0085	496	Ø 10 - 125	628	
	h	3,765	1	85	521,071	500	0,0021	600	0,0021	0,0021	0,0085	496	Ø 10 - 125	628	
	f	-6,638	1	85	-918,730	900	0,0038	1000	0,0034	0,0037	0,0085	496	Ø 10 - 125	628	

No.	TIPE PLAT	Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	INTERPOLASI			ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)	
							Mu / (b*d^2)	ρ'	Mu / (b*d^2)						ρ''
9	B.1.1	4	-5,888	1	95	-652,396	600	0,0025	700	0,0030	0,0028	0,0085	544	∅ 10 - 125	628
		5	2,866	1	95	317,614	300	0,0013	400	0,0017	0,0014	0,0085	544	∅ 10 - 125	628
		3	-2,789	1	95	-309,030	300	0,0013	400	0,0017	0,0013	0,0085	544	∅ 10 - 125	628
		Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	Mu / (b*d^2)	ρ'	Mu / (b*d^2)	ρ''	ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)
		d	-5,036	1	85	-696,980	600	0,0025	700	0,0030	0,0030	0,0085	496	∅ 10 - 125	628
		b	2,712	1	85	375,297	300	0,0013	400	0,0017	0,0016	0,0085	496	∅ 10 - 125	628
		c	-2,712	1	85	-375,297	300	0,0013	400	0,0017	0,0016	0,0085	496	∅ 10 - 125	628
10	B.2.1	7	-2,789	1	95	-309,030	300	0,0013	400	0,0017	0,0013	0,0085	544	∅ 10 - 125	628
		5	2,866	1	95	317,614	300	0,0013	400	0,0017	0,0014	0,0085	544	∅ 10 - 125	628
		6	-5,888	1	95	-652,396	600	0,0025	700	0,0030	0,0028	0,0085	544	∅ 10 - 125	628
		Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	Mu / (b*d^2)	ρ'	Mu / (b*d^2)	ρ''	ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)
		d	-5,036	1	85	-696,980	600	0,0025	700	0,0030	0,0030	0,0085	496	∅ 10 - 125	628
		b	2,712	1	85	375,297	300	0,0013	400	0,0017	0,0016	0,0085	496	∅ 10 - 125	628
		c	-2,712	1	85	-375,297	300	0,0013	400	0,0017	0,0016	0,0085	496	∅ 10 - 125	628
11	B.3.1	4	-5,888	1	95	-652,396	600	0,0025	700	0,0030	0,0028	0,0085	544	∅ 10 - 125	628
		5	2,866	1	95	317,614	300	0,0013	400	0,0017	0,0014	0,0085	544	∅ 10 - 125	628
		3	-2,789	1	95	-309,030	300	0,0013	400	0,0017	0,0013	0,0085	544	∅ 10 - 125	628
		Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	Mu / (b*d^2)	ρ'	Mu / (b*d^2)	ρ''	ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)
		g	-2,712	1	85	-375,297	300	0,0013	400	0,0017	0,0016	0,0085	496	∅ 10 - 125	628
		h	2,712	1	85	375,297	300	0,0013	400	0,0017	0,0016	0,0085	496	∅ 10 - 125	628
		f	-5,036	1	85	-696,980	600	0,0025	700	0,0030	0,0030	0,0085	496	∅ 10 - 125	628
12	B.4.1	7	-2,789	1	95	-309,030	300	0,0013	400	0,0017	0,0013	0,0085	544	∅ 10 - 125	628
		5	2,866	1	95	317,614	300	0,0013	400	0,0017	0,0014	0,0085	544	∅ 10 - 125	628
		6	-5,888	1	95	-652,396	600	0,0025	700	0,0030	0,0028	0,0085	544	∅ 10 - 125	628
		Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	Mu / (b*d^2)	ρ'	Mu / (b*d^2)	ρ''	ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)
		g	-2,712	1	85	-375,297	300	0,0013	400	0,0017	0,0016	0,0085	496	∅ 10 - 125	628
		h	2,712	1	85	375,297	300	0,0013	400	0,0017	0,0016	0,0085	496	∅ 10 - 125	628
		f	-5,036	1	85	-696,980	600	0,0025	700	0,0030	0,0030	0,0085	496	∅ 10 - 125	628
13	C.1.1	4	-4,648	1	95	-515,049	300	0,0021	600	0,0025	0,0022	0,0085	544	∅ 10 - 125	628
		5	2,092	1	95	231,772	200	0,0008	300	0,0013	0,0010	0,0085	544	∅ 10 - 125	628
		3	-2,402	1	95	-266,109	200	0,0008	300	0,0013	0,0011	0,0085	544	∅ 10 - 125	628
		Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	Mu / (b*d^2)	ρ'	Mu / (b*d^2)	ρ''	ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)
		d	-4,648	1	85	-643,366	600	0,0025	700	0,0030	0,0027	0,0085	496	∅ 10 - 125	628
		b	2,402	1	85	332,406	300	0,0013	400	0,0017	0,0014	0,0085	496	∅ 10 - 125	628
		c	-2,402	1	85	-332,406	300	0,0013	400	0,0017	0,0014	0,0085	496	∅ 10 - 125	628
14	C.2.1	7	-2,402	1	95	-266,109	200	0,0008	300	0,0013	0,0011	0,0085	544	∅ 10 - 125	628
		5	2,092	1	95	231,772	200	0,0008	300	0,0013	0,0010	0,0085	544	∅ 10 - 125	628
		6	-4,648	1	95	-515,049	300	0,0021	600	0,0025	0,0022	0,0085	544	∅ 10 - 125	628
		Kode Tabel	Momen (Mx) (KN.m)	b (m)	d (mm)	Mu / (b*d^2) (KN/m^2)	Mu / (b*d^2)	ρ'	Mu / (b*d^2)	ρ''	ρ	ρ min	As (mm^2)	TULANGAN	As' (mm^2)
		d	-4,648	1	85	-643,366	600	0,0025	700	0,0030	0,0027	0,0085	496	∅ 10 - 125	628
		b	2,402	1	85	332,406	300	0,0013	400	0,0017	0,0014	0,0085	496	∅ 10 - 125	628
		c	-2,402	1	85	-332,406	300	0,0013	400	0,0017	0,0014	0,0085	496	∅ 10 - 125	628

No.	TIPE PLAT	Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As (mm ²)	TULANGAN	As' (mm ²)	
			(KN.m)				(m)	(mm)	(KN/m ²)						Mu / (b*d ²)
15	C.3.1	4	-4,648	1	95	-515,049	500	0,0021	600	0,0025	0,0022	0,0085	544	∅ 10 - 125	628
		5	2,092	1	95	231,772	200	0,0008	300	0,0013	0,0010	0,0085	544	∅ 10 - 125	628
		3	-2,402	1	95	-266,109	200	0,0008	300	0,0013	0,0011	0,0085	544	∅ 10 - 125	628
		Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As	TULANGAN	As'	
		g	-2,402	1	85	-332,406	300	0,0013	400	0,0017	0,0014	0,0085	496	∅ 10 - 125	628
		h	2,402	1	85	332,406	300	0,0013	400	0,0017	0,0014	0,0085	496	∅ 10 - 125	628
		f	-4,648	1	85	-643,366	600	0,0025	700	0,0030	0,0027	0,0085	496	∅ 10 - 125	628

No.	TIPE PLAT	Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As (mm ²)	TULANGAN	As' (mm ²)	
			(KN.m)				(m)	(mm)	(KN/m ²)						Mu / (b*d ²)
16	C.4.1	7	-2,402	1	95	-266,109	200	0,0008	300	0,0013	0,0011	0,0085	544	∅ 10 - 125	628
		5	2,092	1	95	231,772	200	0,0008	300	0,0013	0,0010	0,0085	544	∅ 10 - 125	628
		6	-4,648	1	95	-515,049	500	0,0021	600	0,0025	0,0022	0,0085	544	∅ 10 - 125	628
		Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As	TULANGAN	As'	
		g	-2,402	1	85	-332,406	300	0,0013	400	0,0017	0,0014	0,0085	496	∅ 10 - 125	628
		h	2,402	1	85	332,406	300	0,0013	400	0,0017	0,0014	0,0085	496	∅ 10 - 125	628
		f	-4,648	1	85	-643,366	600	0,0025	700	0,0030	0,0027	0,0085	496	∅ 10 - 125	628

No.	TIPE PLAT	Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As (mm ²)	TULANGAN	As' (mm ²)	
			(KN.m)				(m)	(mm)	(KN/m ²)						Mu / (b*d ²)
17	D.1.1	4	-7,592	1	95	-841,247	800	0,0034	900	0,0038	0,0036	0,0085	544	∅ 10 - 125	628
		5	3,874	1	95	429,208	400	0,0017	500	0,0021	0,0018	0,0085	544	∅ 10 - 125	628
		3	-3,331	1	95	-369,119	300	0,0013	400	0,0017	0,0016	0,0085	544	∅ 10 - 125	628
		Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As	TULANGAN	As'	
		d	-5,191	1	85	-718,425	700	0,0030	800	0,0034	0,0031	0,0085	496	∅ 10 - 125	628
		b	3,021	1	85	418,188	400	0,0017	500	0,0021	0,0018	0,0085	496	∅ 10 - 125	628
		c	-3,021	1	85	-418,188	400	0,0017	500	0,0021	0,0018	0,0085	496	∅ 10 - 125	628

No.	TIPE PLAT	Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As (mm ²)	TULANGAN	As' (mm ²)	
			(KN.m)				(m)	(mm)	(KN/m ²)						Mu / (b*d ²)
18	D.2.1	7	-3,331	1	95	-369,119	300	0,0013	400	0,0017	0,0016	0,0085	544	∅ 10 - 125	628
		5	3,874	1	95	429,208	400	0,0017	500	0,0021	0,0018	0,0085	544	∅ 10 - 125	628
		6	-7,592	1	95	-841,247	800	0,0034	900	0,0038	0,0036	0,0085	544	∅ 10 - 125	628
		Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As	TULANGAN	As'	
		d	-5,191	1	85	-718,425	700	0,0030	800	0,0034	0,0031	0,0085	496	∅ 10 - 125	628
		b	3,021	1	85	418,188	400	0,0017	500	0,0021	0,0018	0,0085	496	∅ 10 - 125	628
		c	-3,021	1	85	-418,188	400	0,0017	500	0,0021	0,0018	0,0085	496	∅ 10 - 125	628

No.	TIPE PLAT	Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As (mm ²)	TULANGAN	As' (mm ²)	
			(KN.m)				(m)	(mm)	(KN/m ²)						Mu / (b*d ²)
19	D.3.1	4	-7,592	1	95	-841,247	800	0,0034	900	0,0038	0,0036	0,0085	544	∅ 10 - 125	628
		5	3,874	1	95	429,208	400	0,0017	500	0,0021	0,0018	0,0085	544	∅ 10 - 125	628
		3	-3,331	1	95	-369,119	300	0,0013	400	0,0017	0,0016	0,0085	544	∅ 10 - 125	628
		Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As	TULANGAN	As'	
		g	-3,021	1	85	-418,188	400	0,0017	500	0,0021	0,0018	0,0085	496	∅ 10 - 125	628
		h	3,021	1	85	418,188	400	0,0017	500	0,0021	0,0018	0,0085	496	∅ 10 - 125	628
		f	-5,191	1	85	-718,425	700	0,0030	800	0,0034	0,0031	0,0085	496	∅ 10 - 125	628

No.	TIPE PLAT	Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As (mm ²)	TULANGAN	As' (mm ²)	
			(KN.m)				(m)	(mm)	(KN/m ²)						Mu / (b*d ²)
20	D.4.1	7	-2,402	1	95	-266,109	200	0,0008	300	0,0013	0,0011	0,0085	544	∅ 10 - 125	628
		5	2,092	1	95	231,772	200	0,0008	300	0,0013	0,0010	0,0085	544	∅ 10 - 125	628
		6	-4,648	1	95	-515,049	500	0,0021	600	0,0025	0,0022	0,0085	544	∅ 10 - 125	628
		Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As	TULANGAN	As'	
		g	-3,021	1	85	-418,188	400	0,0017	500	0,0021	0,0018	0,0085	496	∅ 10 - 125	628
		h	3,021	1	85	418,188	400	0,0017	500	0,0021	0,0018	0,0085	496	∅ 10 - 125	628
		f	-5,191	1	85	-718,425	700	0,0030	800	0,0034	0,0031	0,0085	496	∅ 10 - 125	628

No.	TIPE PLAT	Kode Tabel	Momen (Mx)	b (m)	d (mm)	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As (mm ²)	TULANGAN	As' (mm ²)	
			(KN.m)			(KN/m ²)	Mu / (b*d ²)	ρ'	Mu / (b*d ²)						ρ''
21	E.1.1	4	-8,522	1	95	-944,257	900	0,0038	1000	0,0043	0,0040	0,0085	544	Ø 10 - 125	628
		5	4,571	1	95	506,465	500	0,0021	600	0,0025	0,0021	0,0085	544	Ø 10 - 125	628
		3	-3,486	1	95	-386,287	300	0,0013	400	0,0017	0,0016	0,0085	544	Ø 10 - 125	628
		Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As	TULANGAN	As'	
		d	(KN.m)	(m)	(mm)	(KN/m ²)	Mu / (b*d ²)	ρ'	Mu / (b*d ²)	ρ''		(mm ²)		(mm ²)	
		d	-5,113	1	85	-707,703	700	0,0030	800	0,0034	0,0030	0,0085	496	Ø 10 - 125	628
b	-2,944	1	85	-407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	Ø 10 - 125	628		
c	-2,944	1	85	-407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	Ø 10 - 125	628		
22	E.2.1	7	-3,486	1	95	-386,287	300	0,0013	400	0,0017	0,0016	0,0085	544	Ø 10 - 125	628
		5	4,571	1	95	506,465	500	0,0021	500	0,0021	0,0021	0,0085	544	Ø 10 - 125	628
		6	-8,522	1	95	-944,257	900	0,0038	1000	0,0043	0,0040	0,0085	544	Ø 10 - 125	628
		Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As	TULANGAN	As'	
		d	(KN.m)	(m)	(mm)	(KN/m ²)	Mu / (b*d ²)	ρ'	Mu / (b*d ²)	ρ''		(mm ²)		(mm ²)	
		d	-5,113	1	85	-707,703	700	0,0030	800	0,0034	0,0030	0,0085	496	Ø 10 - 125	628
b	-2,944	1	85	-407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	Ø 10 - 125	628		
c	-2,944	1	85	-407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	Ø 10 - 125	628		
23	E.3.1	4	-8,522	1	95	-944,257	900	0,0038	1000	0,0043	0,0040	0,0085	544	Ø 10 - 125	628
		5	4,571	1	95	506,465	500	0,0021	600	0,0025	0,0021	0,0085	544	Ø 10 - 125	628
		3	-3,486	1	95	-386,287	300	0,0013	400	0,0017	0,0016	0,0085	544	Ø 10 - 125	628
		Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As	TULANGAN	As'	
		g	(KN.m)	(m)	(mm)	(KN/m ²)	Mu / (b*d ²)	ρ'	Mu / (b*d ²)	ρ''		(mm ²)		(mm ²)	
		g	-2,944	1	85	-407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	Ø 10 - 125	628
h	2,944	1	85	407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	Ø 10 - 125	628		
f	-5,113	1	85	-707,703	700	0,0030	800	0,0034	0,0030	0,0085	496	Ø 10 - 125	628		
24	E.4.1	7	-3,486	1	95	-386,287	300	0,0013	400	0,0017	0,0016	0,0085	544	Ø 10 - 125	628
		5	4,571	1	95	506,465	500	0,0021	500	0,0021	0,0021	0,0085	544	Ø 10 - 125	628
		6	-8,522	1	95	-944,257	900	0,0038	1000	0,0043	0,0040	0,0085	544	Ø 10 - 125	628
		Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As	TULANGAN	As'	
		g	(KN.m)	(m)	(mm)	(KN/m ²)	Mu / (b*d ²)	ρ'	Mu / (b*d ²)	ρ''		(mm ²)		(mm ²)	
		g	-2,944	1	85	-407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	Ø 10 - 125	628
h	2,944	1	85	407,465	400	0,0017	500	0,0021	0,0017	0,0085	496	Ø 10 - 125	628		
f	-5,113	1	85	-707,703	700	0,0030	800	0,0034	0,0030	0,0085	496	Ø 10 - 125	628		
25	F.1.1	4	-4,648	1	95	-515,049	800	0,0034	900	0,0038	0,0023	0,0085	544	Ø 10 - 125	628
		5	2,092	1	95	231,772	400	0,0017	500	0,0021	0,0010	0,0085	544	Ø 10 - 125	628
		3	-2,402	1	95	-266,109	300	0,0013	400	0,0017	0,0012	0,0085	544	Ø 10 - 125	628
		Kode Tabel	Momen (Mx)	b	d	Mu / (b*d ²)	INTERPOLASI			ρ	ρ min	As	TULANGAN	As'	
		d	(KN.m)	(m)	(mm)	(KN/m ²)	Mu / (b*d ²)	ρ'	Mu / (b*d ²)	ρ''		(mm ²)		(mm ²)	
		d	-4,648	1	85	-643,366	700	0,0030	800	0,0034	0,0028	0,0085	496	Ø 10 - 125	628
b	2,402	1	85	332,406	400	0,0017	500	0,0021	0,0014	0,0085	496	Ø 10 - 125	628		
c	-2,402	1	85	-332,406	400	0,0017	500	0,0021	0,0014	0,0085	496	Ø 10 - 125	628		