

Bab VI

KESIMPULAN

Berdasarkan Analisa yang sudah dilakukan didapatkan hasil sebagai berikut:

6.1 Perancangan Bangunan Gedung

Berdasarkan perhitungan didapatkan hasil sebagai berikut:

1. Penulangan plat tangga dan bordes didapatkan hasil sebagai berikut
 - a. Tulangan tangga tumpuan, tangga lapangan, bordes tumpuan, dan bordes lapangan digunakan tulangan pokok D13-150.
 - b. Tulangan tangga tumpuan, tangga lapangan, bordes tumpuan, dan bordes lapangan digunakan tulangan susut P10-400.
 - c. Tulangan pondasi digunakan tulangan pokok D13-200 dan tulangan susut digunakan P10-125.
 - d. Tulangan sengkang tumpuan digunakan P8-125.
2. Penulangan plat lantai didapatkan hasil sebagai berikut
 - a. Tulangan plat lantai 1A, 1B, 1C, 2D, 2E, 3F, dan 3G tulangan pokok digunakan P13-100.
 - b. Tulangan plat lantai 1A, 1B, 1C, 2D, 2E, 3F, dan 3G tulangan bagi digunakan P6-100.
3. Penulangan balok didapatkan hasil sebagai berikut
 - a. Tulangan tumpuan pada balok ukuran 30x30 digunakan tulangan 2D16.
 - b. Tulangan tumpuan pada balok ukuran 45x30 dan 60x40 digunakan tulangan 5D19.
 - c. Tulangan tumpuan pada balok ukuran 75x50 digunakan tulangan 6D22.
 - d. Tulangan tumpuan pada balok ukuran 90x60 dan 100x70 digunakan tulangan 5D22.
 - e. Tulangan lapangan pada balok ukuran 30x30, 45x30, 60x40, 75x50, 90x60, dan 100x70 digunakan tulangan 4D22.
 - f. Tulangan Sengkang tumpuan pada balok ukuran 30x30, 45x30, dan 75x50 digunakan tulangan 2P10-100.
 - g. Tulangan Sengkang tumpuan pada balok ukuran 60x40 digunakan tulangan 2P10-150.

- h. Tulangan Sengkang tumpuan pada balok ukuran 90x60 dan 100x70 digunakan tulangan 2P10-250.
4. Penulangan kolom didapatkan hasil sebagai berikut
 - a. Tulangan pada kolom ukuran 400x400 digunakan 16D22.
 - b. Tulangan pada kolom ukuran 550x550 digunakan 24D25.
 - c. Tulangan pada kolom ukuran 600x600 digunakan 24D29.
 - d. Tulangan pada kolom ukuran 650x650 digunakan 28D29.
 - e. Tulangan pada kolom ukuran 700x700 digunakan 28D32.
 - f. Tulangan pada kolom ukuran 750x750 dan 800x800 digunakan 24D36.
 - g. Tulangan pada kolom ukuran 1100x1100 digunakan 32D40.
 - h. Tulangan sengkang pada semua kolom digunakan 2D10.
 5. Profil atap didapatkan hasil sebagai berikut:
 - a. Profil gording yang akan digunakan yaitu C 150x50x20 dengan ketebalan 3,0 mm.
 - b. Profil kuda-kuda yaitu dengan *double* profil siku 2L 50x50x5.
 - c. Sambungan pada struktur atap ini menggunakan sambungan baut dengan diameter $\frac{1}{2}$ inch(12,7mm) dan dengan A-325($f_u=825$ MPa).

6.2 Perancangan Jalan

Berdasarkan perhitungan didapatkan hasil sebagai berikut:

1. Pada tikungan pertama didapatkan nilai $L_c > 25m$, $p > 0.1m$, dan $e = 0.1$ maka digunakan jenis tikungan *Spiral-Circl-Spiral* (SCS).
2. Pada tikungan kedua didapatkan nilai $L_c < 20$, maka digunakan jenis tikungan *Spiral-Spiral* (SS).
3. Besar volume galian sebesar $16437,152 \text{ m}^3$ dan volume timbunan sebesar $2352,232 \text{ m}^3$ dengan selisih volume galian lebih besar daripada timbunan sebesar $14084,92 \text{ m}^3$.

6.3 Perancangan Bangunan Air

Berdasarkan perhitungan didapatkan hasil sebagai berikut:

1. Jenis distribusi yang digunakan adalah *Log-Person* tipe III.
2. Tinggi mercu bendung 4meter.
3. Debit rencana adalah $256,225 \text{ m}^3/\text{s}$.
4. Stabilitas bendung didapatkan sebagai berikut

- a. Stabilitas Terhadap Gempa dengan koefisien gempa (E) didapatkan hasil 0,1696 dan dengan gaya gempa didapatkan hasil 7,9124 KN.
- b. Stabilitas Terhadap Geser dengan gempa didapatkan hasil $2,45 > 1,5$ dan tanpa gempa didapatkan hasil $1,5 > 1,1$ (syarat).
- c. Stabilitas Terhadap Guling didapatkan hasil $3,58 > 1,5$ (syarat).
- d. Stabilitas Terhadap Angkat (Uplift) didapatkan hasil $3,37 > 1,5$ (syarat).
- e. Stabilitas Terhadap Rembesan didapatkan hasil $9,51 > 4$ (syarat).

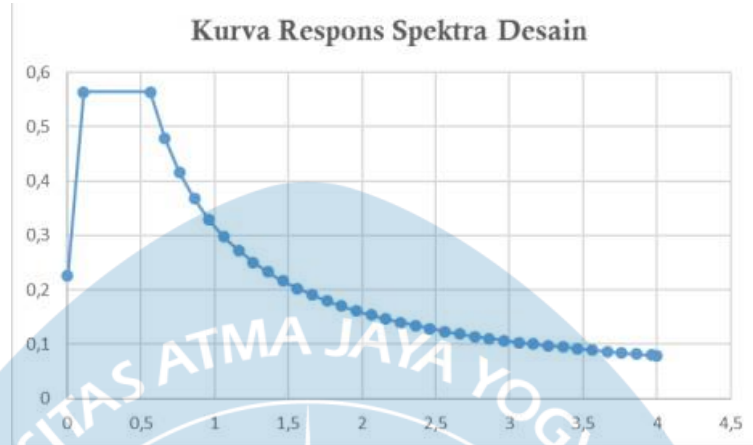
6.4 Perancangan Biaya dan Waktu

Berdasarkan perhitungan didapatkan hasil sebagai berikut:

1. RAB total proyek sebesar Rp 6.430.093.348
2. Durasi total pengerjaan proyek sebanyak 121 hari kalender

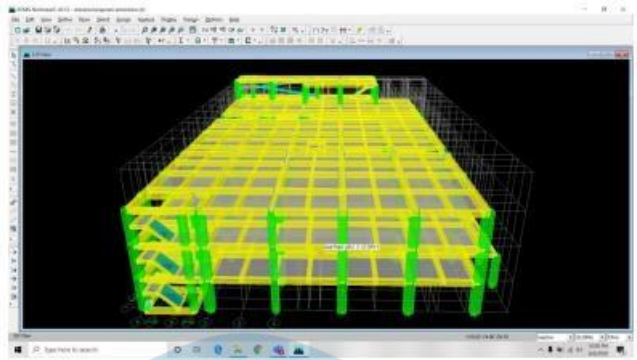
LAMPIRAN I

PERANCANGAN BANGUNAN GEDUNG

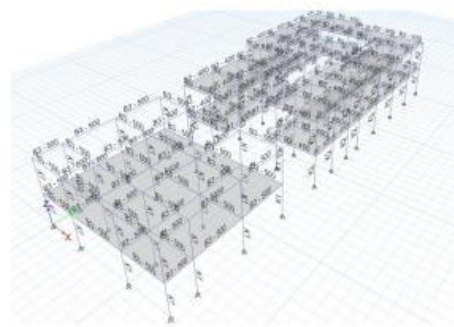
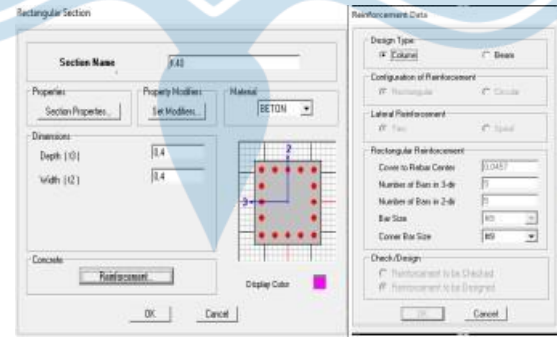
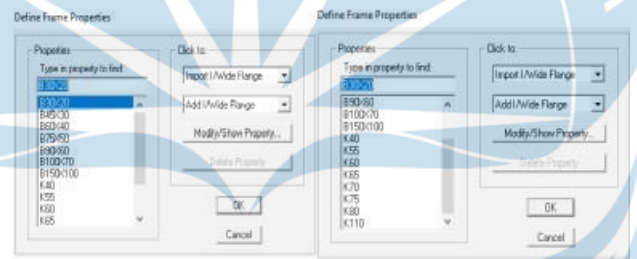


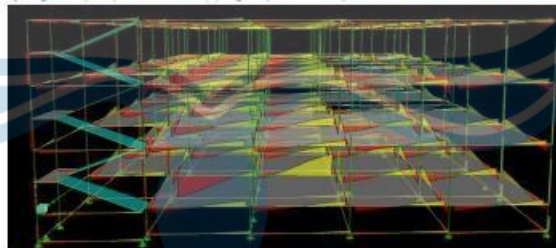
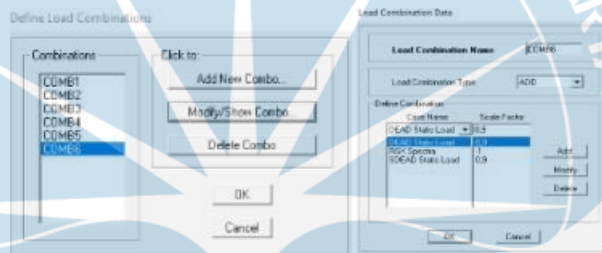
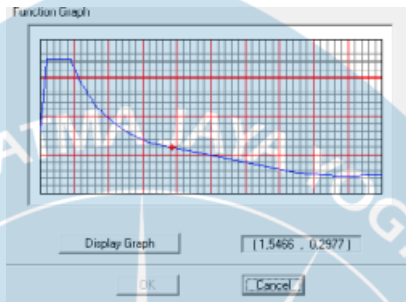
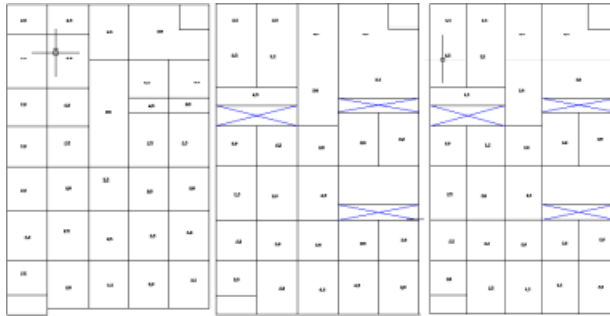
T (detik)	Keterangan	S_a (g)	Keterangan
0	awal	0.325	$0.4 S_{DS}$
0.112	$T_0 = 0.2 S_{D1}/S_{DS}$	0.812	S_{DS}
0.562	$T_s = S_{D1}/S_{DS}$	0.812	S_{DS}
0.662	$T_s+0.1$	0.689	$S_a = S_{D1}/T$
0.762	$T_s+0.2$	0.599	$S_a = S_{D1}/T$
0.862	$T_s+0.3$	0.529	$S_a = S_{D1}/T$
0.962	$T_s+0.4$	0.474	$S_a = S_{D1}/T$
1.062	$T_s+0.5$	0.429	$S_a = S_{D1}/T$
1.162	$T_s+0.6$	0.392	$S_a = S_{D1}/T$
1.262	$T_s+0.7$	0.361	$S_a = S_{D1}/T$
1.362	$T_s+0.8$	0.335	$S_a = S_{D1}/T$
1.462	$T_s+0.9$	0.312	$S_a = S_{D1}/T$
1.562	$T_s+0.10$	0.292	$S_a = S_{D1}/T$
1.762	$T_s+0.11$	0.274	$S_a = S_{D1}/T$
1.862	$T_s+0.12$	0.259	$S_a = S_{D1}/T$
1.962	$T_s+0.13$	0.245	$S_a = S_{D1}/T$
2.062	$T_s+0.14$	0.232	$S_a = S_{D1}/T$
2.162	$T_s+0.15$	0.221	$S_a = S_{D1}/T$
2.262	$T_s+0.16$	0.202	$S_a = S_{D1}/T$
2.362	$T_s+0.17$	0.193	$S_a = S_{D1}/T$
2.462	$T_s+0.18$	0.185	$S_a = S_{D1}/T$
2.562	$T_s+0.19$	0.178	$S_a = S_{D1}/T$
2.662	$T_s+0.20$	0.171	$S_a = S_{D1}/T$

2.762	$T_s+0.21$	0.165	$S_a = S_{D1}/T$
2.862	$T_s+0.22$	0.159	$S_a = S_{D1}/T$
2.962	$T_s+0.23$	0.154	$S_a = S_{D1}/T$
3.062	$T_s+0.24$	0.149	$S_a = S_{D1}/T$
3.162	$T_s+0.25$	0.144	$S_a = S_{D1}/T$
3.262	$T_s+0.26$	0.14	$S_a = S_{D1}/T$
3.362	$T_s+0.27$	0.136	$S_a = S_{D1}/T$
3.462	$T_s+0.28$	0.132	$S_a = S_{D1}/T$
3.562	$T_s+0.29$	0.128	$S_a = S_{D1}/T$
3.662	$T_s+0.30$	0.124	$S_a = S_{D1}/T$
3.762	$T_s+0.31$	0.121	$S_a = S_{D1}/T$
3.862	$T_s+0.32$	0.118	$S_a = S_{D1}/T$
3.962	$T_s+0.33$	0.115	$S_a = S_{D1}/T$
4	$T = 4$	0.114	$S_a = S_{D1}/T$



Beton : f_c' 25 MPa / K300
 Baja Tulangan Ulir : f_y 360 MPa
 Baja Tulangan Polos : f_y 360 MPa

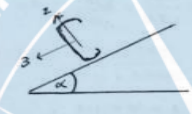




Case	Mode	Periode (detik)	UX	UY	RZ
Modal	1	0.983058	0.0585	0.0073	0.0104
Modal	2	0.515943	78.7161	0.0043	0.1748
Modal	3	0.443228	0.5215	0.5159	0.4609
Modal	4	0.433493	0.0001	80.0175	0.0001
Modal	5	0.160099	9.0977	0.0036	0.0535
Modal	6	0.147623	0.1123	0.3176	0.0003
Modal	7	0.145222	0.2271	3.5882	0.0092
Modal	8	0.142182	0.9078	0.5309	0.0028
Modal	9	0.140057	0.0081	0.0019	0.0803
Modal	10	0.137332	0.0206	3.9823	0.0149
Modal	11	0.132246	0.0093	0.1176	0.0429
Modal	12	0.128487	0.0101	0.9892	0
Total			0.89689	0.900763	0.8501

- Faktor skala gaya (*scale factor*) – kondisi awal
 $SF_{x(awal)} = g \times I / R = 9810 \times 1,5 / 8 = 1839,375$
 $SF_{y(awal)} = g \times I / R = 9810 \times 1,5 / 8 = 1839,375$
- Base shear gaya lateral ekuivalen (ELF)
 $V_{ElFx} = 4.607,651 \text{ kN}$ $0,85V_{ElFx} = 3.916,504 \text{ kN}$
 $V_{ElFy} = 4.607,651 \text{ kN}$ $0,85V_{ElFy} = 3.916,504 \text{ kN}$
- Base shear spektrum respons ragam (RS) – Kondisi awal
 $V_{R(x(awal))} = 1.857,685 \text{ kN} < 0,85V_{ElFx} = 3.916,504 \text{ kN}$
 $V_{R(y(awal))} = 2.254,654 \text{ kN} < 0,85V_{ElFy} = 3.916,504 \text{ kN}$
- Perhitungan ulang faktor skala gaya (*scale factor*) – Trial 1
 $SF_{x(trial 1)} = g \times I / R \times 0,85V_{ElFx} / V_{R(x(awal))}$
 $= 9810 \times 1,5 / 8 \times 3.916,504 / 1.857,685 = 3.877,901$
 $SF_{y(trial 1)} = g \times I / R \times 0,85V_{ElFy} / V_{R(y(awal))}$
 $= 9810 \times 1,5 / 8 \times 3.916,504 / 2.254,654 = 3.195,133$
- Base shear spektrum respons ragam (RS) – Trial 1
 $V_{R(x(awal))} = 3.916,504 \text{ kN} \geq 0,85V_{ElFx} = 3.916,504 \text{ kN}$ (OK)
 $V_{R(y(awal))} = 3.916,504 \text{ kN} \geq 0,85V_{ElFy} = 3.916,504 \text{ kN}$ (OK)

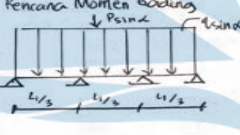
Beban Gording



• Berat sendiri = diperkirakan = 0,1 kN/m
 • Berat atap = $\frac{\alpha}{\cos \alpha} \times \text{berat atap metal}$
 $= \frac{0,85}{\cos 40} \times 0,03206 = 0,21262$

• Berat sagrad & kawat = diperkirakan = 0,015 kN/m
 Sehingga dead load (D) rencana gording = 0,3626 kN
 live load (L) rencana gording = 1,0 kN

Rencana Momen Gording



$M_{xD} = \frac{1}{8} \times q \times \cos \alpha \times (L)^2 = \frac{1}{8} \times 0,362 \times \cos 40 \times 2,06^2 = 0,14735 \text{ kNm}$
 $M_{yD} = \frac{1}{8} \times q \times \sin \alpha \times \frac{(L)^2}{2} = \frac{1}{8} \times 0,362 \times \sin 40 \times \frac{2,06^2}{2} = 0,03091 \text{ kNm}$
 $M_{xL} = \frac{1}{4} \times P \times \cos \alpha \times L = \frac{1}{4} \times 1 \times \cos 40 \times 2,06 = 0,50328 \text{ kNm}$
 $M_{yL} = \frac{1}{4} \times P \times \sin \alpha \times \frac{L}{2} = \frac{1}{4} \times 1 \times \sin 40 \times \frac{2,06}{2} = 0,21115 \text{ kNm}$

Kombinasi

$M_{xu} = 1,4 \times M_{xD} = 1,4 \times 0,14735 = 0,20629 \text{ kNm}$
 $M_{yu} = 1,4 \times M_{yD} = 1,4 \times 0,03091 = 0,04327 \text{ kNm}$
 $M_{xu} = 1,2 M_{xD} + 1,6 M_{xL} = 1,2(0,14735) + 1,6(0,50328) = 0,94209 \text{ kNm}$
 $M_{yu} = 1,2 M_{yD} + 1,4 M_{yL} = 1,2(0,03091) + 1,4(0,21115) = 0,374934 \text{ kNm}$

Maka yang dipilih $M_{xu} = 0,374934 \text{ kNm}$

Dipilih gording C yang berdimensi 150 x 50 x 20 dengan ketebalan 3,0 mm, dari tabel profil diperoleh properti penampang = $I_x = 265 \times 10^4 \text{ mm}^4$
 $I_y = 27 \times 10^4 \text{ mm}^4$
 $W_3 = 35,4 \times 10^3 \text{ mm}^3$
 $W_2 = 7,8 \times 10^4 \text{ mm}^3$

Cek Tegangan profil C

$$f_b = \frac{M_{x1}}{W_{b1}} + \frac{M_{y1}}{W_{b2}} \leq f_y \quad \beta = 0,9$$

$$f_b = \frac{0,982069}{0,9 \times 55400} + \frac{0,574934}{0,9 \times 7800} \leq 210 \text{ Mpa}$$

$$: 84,2333 \leq 210 \text{ Mpa}$$

Cek Defleksi Gording

$$\delta_y = \frac{5}{384} \times \frac{q \times \cos \alpha \times L^4}{EI} \times \frac{1}{48} \times \frac{P \times \cos \alpha \times L^3}{EI}$$

$$\delta_y = \frac{5}{384} \times \frac{0,3426 \times \cos 40 \times 2,06^4}{2 \times 10^5 \text{ Mpa} \times 265 \times 10^4} + \frac{11}{48} \times \frac{1 \times \cos 40 \times 2,06^3}{2 \times 10^5 \text{ Mpa} \times 27 \times 10^4}$$

$$: 2,7064 \text{ mm}$$

$$\delta_x = \frac{5}{384} \times \frac{q \times \sin \alpha \times \left(\frac{L}{2}\right)^4}{EI} + \frac{1}{48} \times \frac{P \times \sin \alpha \times \left(\frac{L}{2}\right)^3}{EI}$$

$$\delta_x = \frac{5}{384} \times \frac{0,3426 \times \sin 40 \times \left(\frac{2,06}{2}\right)^4}{2 \times 10^5 \text{ Mpa} \times 265 \times 10^4} + \frac{1}{48} \times \frac{1 \times \cos 40 \times \left(\frac{2,06}{2}\right)^3}{2 \times 10^5 \text{ Mpa} \times 27 \times 10^4}$$

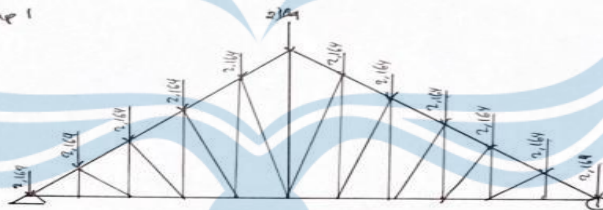
$$= 0,27743 \text{ mm}$$

$$\delta = \sqrt{\delta_x^2 + \delta_y^2} \leq \frac{1}{240} \times L_1$$

$$\delta = \sqrt{0,27743^2 + 2,7064^2} \leq \frac{1}{240} \times 2,06$$

$$= 2,72065 \leq 8,58333 \text{ mm}$$

1.2 Pencana kuda-kuda
Atap 1

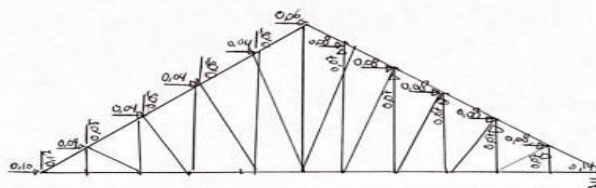


Pembebanan :

- Berat penutup atap = jarak antara kuda-kuda \times jarak antar gording \times 0,5
= $2,2486 \times 1,108 \times 0,5 = 1,241 \text{ kN}$
- Berat gording = berat atap \times jarak antar kuda-kuda
= $0,05 \times 2,06 = 0,103 \text{ kN}$
- Berat penggantung = jarak antar kuda-kuda \times jarak antar gording \times 0,7
= $2,06 \times 1,108 \times 0,07 = 0,16 \text{ kN}$
- Berat plafond = $0,2 \times 0,35 = 0,17 \text{ kN}$
- p = 2,104

Untuk beban angin ditentukan koefisien angin tump (C_{ti}) sebesar 0,4 dan koefisien angin hisap (C_{is}) sebesar 0,6

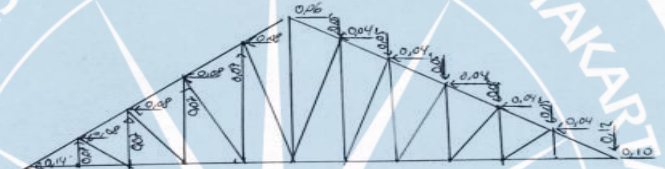
Beban angin dari kiri joint



Beban angin dari kiri besarnya $W_1, W_2, W_3, W_4, W_5, W_6$ dihitung sesuai dengan besar tiupan (Q_w) sebesar $0,4 \text{ kN/m}^2$ dan koefisien beban angin (C_{fi} atau C_{fs}) gording-gording dan pangsang gording.

$$\begin{aligned} W_1 &= \frac{a/2 + b}{\cos \alpha} \times C_{fi} \times L_1 \times Q_w = 0,15 \text{ kN} \\ W_2 &= \frac{a}{\cos \alpha} \times C_{fi} \times L_1 \times Q_w = 0,07 \text{ kN} \\ W_3 &= \frac{1}{2} \times \frac{a}{\cos \alpha} \times C_{fi} \times L_1 \times Q_w = 0,03 \text{ kN} \\ W_4 &= \frac{1}{2} \times \frac{a}{\cos \alpha} \times C_{fs} \times L_1 \times Q_w = 0,05 \text{ kN} \\ W_5 &= \frac{a}{\cos \alpha} \times C_{fs} \times L_1 \times Q_w = 0,10 \text{ kN} \\ W_6 &= \frac{a/2 + b}{\cos \alpha} \times C_{fs} \times L_1 \times Q_w = 0,18 \text{ kN} \end{aligned}$$

Untuk beban angin dari kanan beban $W_1, W_2, W_3, W_4, W_5, W_6$ arahnya dibalik seperti gambar.



Pembebanan di SAP

$$\text{Combo 1} = 1,4 \text{ DL} + 1,4 \text{ ADL}$$

$$\text{Combo 2} = 1,2 \text{ DL} + 1,2 \text{ ADL} + 1,6 \text{ LL}$$

$$\text{Combo 3} = 1,2 \text{ DL} + 1,2 \text{ ADL} + 1,6 \text{ LL} + 0,8 \text{ Wfi}$$

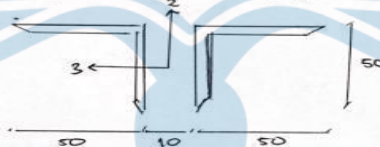
$$\text{Combo 4} = 1,2 \text{ DL} + 1,2 \text{ ADL} + 0,8 \text{ LL} + 1,4 \text{ Wfs}$$

4.5 Rencana Elemen Kuda-Kuda

Atap 1

- Rencana baja batang tarik

Gaya batang adalah gaya batang bernilai positif



Sketsa profil batang 2L 50 x 50 x 5

$$A_g = 2 \times 4,802 = 9,604 \text{ cm}^2$$

$$C_x = 1,41 \text{ cm}$$

$$I_2 = I_3 = 11,1 \text{ cm}^4$$

$$I_{02} = 2(I_2) + A_g(C_x + 0,5)^2 = 57,24 \text{ cm}^4$$

$$I_{03} = 2(I_3) + A_g(0) = 22,20 \text{ cm}^4$$

$$r_{\min} = \sqrt{\frac{I_{03}}{A_g}} = \sqrt{\frac{22,2}{9,6}} = 1,52 \text{ cm}$$

Cek Batang Tarik

$$\bullet f_y = 210 \text{ Mpa}$$

$$\bullet N_{0 \text{ max}} = 24,89 \text{ kN}$$

$$\bullet f_t = \frac{N_u}{A_g} \leq f_y$$

$$f_t = \frac{24,89}{0,9 \times 9,604 \times 10^2} \leq 210$$

$$28,8005 \leq 210$$

memenuhi syarat

Cek telangsingan Batang Tarik

$$\bullet L_f = 850,00 \text{ mm}$$

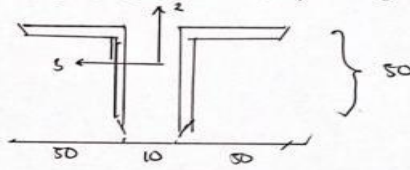
$$\bullet r_{\min} = 1,52 \text{ cm}$$

$$\bullet \lambda = \frac{850,00}{1,52}$$

$$= 55,9273 \leq 210$$

memenuhi syarat

- Rencana gaya batang tekan
Gaya batang tekan adalah gaya batang yang mengalami gaya yang bernilai negatif. Batang tersebut adalah batang no.



Sketsa profil batang 2L 50 x 50 x 5

$$A_g = 2 \times 4,802 = 9,604 \text{ cm}^2$$

$$C_x = 1,41 \text{ cm}$$

$$I_2 = I_3 = 11,1 \text{ cm}^4$$

$$I_{g2} = 2(I_2) + A_g (C_x + 0,5)^2 = 57,24 \text{ cm}^4$$

$$I_{g1} = 2(I_3) + A_g (0)$$

$$r_{min} = \sqrt{\frac{I_{g2}}{A_g}} = \sqrt{\frac{22,2}{9,6}}$$

$$= 1,52 \text{ cm}$$

Cek Kelangsingan Batang Tekan

$$\sigma_{fc} = \frac{W \times N_u}{\phi A_g} < f_y \quad \phi = 0,85$$

$$\sigma_{fc} = \frac{1}{\pi} \times \frac{1108,000}{1,52} \times \sqrt{\frac{210}{200000}}$$

$$= 0,751564$$

$$\sigma_{fc} = \frac{0,7516 \times 28,27 \times 10}{0,85 \times 9,604 \times 10^2} \leq 210$$

$$\sigma_{fc} = \frac{1108,000}{1,52 \times 10}$$

$$= 72,8947 < 200$$

Bagian II

Pelat Lantai

Lantai 1

$$L_y = 7200 \text{ mm}$$

$$L_x = 7200 \text{ mm}$$

$$M_{ix} = 20,91 \text{ mm}$$

$$M_{iy} = 20,91 \text{ mm}$$

Selubung beton = 20 mm

$$d = (6140) - 20 \text{ mm} - 18/2$$

$$= 113,5 \text{ mm}$$

$$f_y = 360 \text{ Mpa}$$

$$f_c = 25 \text{ Mpa}$$

• Pembagian arsa x

$$\text{Asumsi menggunakan P 13} \rightarrow A_s = 132,786 \text{ mm}^2$$

$$d_x = 110,20 - 18/2$$

$$= 113,5 \text{ mm}$$

$$P_n \text{ perlu} = \frac{20,91 \times 10^6}{0,8 \times 1000 \times 113,5^2} = 2,0269 \text{ mm}$$

$$P_{\text{perlu}} = \frac{0,85 \times 25}{360 \text{ Mpa}} \times \left(1 - \sqrt{1 - \frac{2,0269}{0,85 \times 25}}\right)$$

$$= 0,0059$$

$$P_{\text{max}} = 0,75 \times \frac{0,85 \times 25 \text{ Mpa}}{360} \times \frac{600}{600 - 360} = 0,02551$$

$$P_{\text{min}} = 0,0020$$

$$\text{Dipakai } P_{\text{perlu}} = 0,0059$$

$$A_s \text{ perlu} = P_{\text{perlu}} \times 1000 \times d$$

$$= 0,0059 \times 1000 \times 113,5 = 669,67 \text{ mm}^2$$

$$S = \frac{A_s}{A_c \text{ perlu}}$$

$$= \frac{132,786}{669,67} = 1,98, 3016 \text{ mm}$$

• Perhitungan alah y

Asumsi menggunakan P13 → $A_s = 86,75 \text{ mm}^2$
 $d_x = 140 - 20 - (13/2) - 13$
 $= 100,5 \text{ mm}$

$R_n \text{ perlu} = \frac{20,91 \times 10^4}{0,8 \times 1000 \times 100} = 2,5877 \text{ mm}^2$

$P \text{ perlu} = \frac{0,85 \times 25}{360 \text{ Mpa}} \times \left(1 - \sqrt{1 - \frac{2,5,877}{0,85 \times 25}} \right)$
 $= 0,0077$

$P_{\text{max}} = 0,75 \times \frac{0,85 \times 25}{360} \times \frac{600}{1000 \times 50} = 0,02351$

$P_{\text{min}} = 0,0020$

$A_s \text{ perlu} = P \text{ perlu} \times 1000 \times d_x$
 $= 0,0077 \times 1000 \times 100,5$
 $= 773,85 \text{ mm}^2$

$S = \frac{A_s \times 1000}{A_s \text{ perlu}}$
 $= \frac{152,76 \times 1000}{773,85} = 171,59 \text{ mm}$

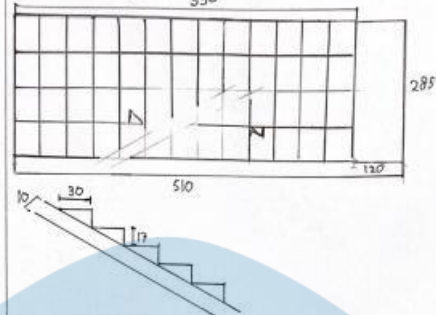
PEMBEBANAN PADA MASING – MASING PELAT

Fungsi Plat	Macam Pembebanan	Tebal mm	Load Val KN/m²	DL KN/m²	DL Plat KN/m²	LL KN/m²	Wu=1,2D+1,6L
Lantai 1	Beban Sendiri	140	24	3,36		2,87	
	Beban Pasir	50	18	0,9			
	Beban Lantai+Spesi	50	21	1,05			
	Beban Platond			0,2			
	Lain-lain						
	Σ			5,51	2,15	2,87	11,204
Lantai 2	Beban Sendiri	140	24	3,36		3,83	
	Beban Pasir	50	18	0,9			
	Beban Lantai+Spesi	50	21	1,05			
	Beban Platond			0,2			
	Lain-lain						
	Σ			5,51	2,15	3,83	12,74
Lantai 3	Beban Sendiri	140	24	3,36		3,83	
	Beban Pasir	50	18	0,9			
	Beban Lantai+Spesi	50	21	1,05			
	Beban Platond			0,2			
	Lain-lain						
	Σ			5,51	2,15	3,83	12,74

ANALISIS PERHITUNGAN PLAT

Tipe Plat	Kondisi Tumpuan	Lr	ARAH	KOEF 0,001x	M _x kNm	M _y kNm	M _{xy} kNm	γ _{xy}	λ	DIPASANG	T. POROK mm²	T. BAWA mm²	
LANTAI 1A	1.0	7290	M _x	35	20,91	46,3846	94,3833	280		P13-100	1327,8571	P6-100	
			M _y	35	20,91	46,3846	83,75	280		P13-100	1327,8571	P6-100	
			M _{xy}	38	23,60	62,4903	83,75	280		P13-100	1327,8571	P6-100	
			M _x	38	23,60	62,4903	83,75	280		P13-100	1327,8571	P6-100	
			M _y	38	23,60	62,4903	83,75	280		P13-100	1327,8571	P6-100	
			M _{xy}	38	23,60	62,4903	83,75	280		P13-100	1327,8571	P6-100	
	1.3	9780	M _x	59	31,65	47,9029	94,5833	280		P13-100	1327,8571	P6-100	
			M _y	59	31,65	47,9029	83,75	280		P13-100	1327,8571	P6-100	
			M _{xy}	38	23,60	62,4903	83,75	280		P13-100	1327,8571	P6-100	
			M _x	38	23,60	62,4903	83,75	280		P13-100	1327,8571	P6-100	
			M _y	38	23,60	62,4903	83,75	280		P13-100	1327,8571	P6-100	
			M _{xy}	38	23,60	62,4903	83,75	280		P13-100	1327,8571	P6-100	
LANTAI 1C	2.0	9600	M _x	83	0,28	23,3396	94,5833	280		P13-100	1327,8571	P6-100	
			M _y	83	0,28	23,3396	83,75	280		P13-100	1327,8571	P6-100	
			M _{xy}	38	23,60	62,4903	83,75	280		P13-100	1327,8571	P6-100	
			M _x	38	23,60	62,4903	83,75	280		P13-100	1327,8571	P6-100	
			M _y	38	23,60	62,4903	83,75	280		P13-100	1327,8571	P6-100	
			M _{xy}	38	23,60	62,4903	83,75	280		P13-100	1327,8571	P6-100	
	1.0	9600	9600	M _x	35	23,78	52,7436	94,5833	280		P13-100	1327,8571	P6-100
				M _y	35	23,78	52,7436	83,75	280		P13-100	1327,8571	P6-100
				M _{xy}	38	23,78	52,7436	83,75	280		P13-100	1327,8571	P6-100
				M _x	38	23,78	52,7436	83,75	280		P13-100	1327,8571	P6-100
				M _y	38	23,78	52,7436	83,75	280		P13-100	1327,8571	P6-100
				M _{xy}	38	23,78	52,7436	83,75	280		P13-100	1327,8571	P6-100
LANTAI 2E	1.3	9780	M _x	59	35,31	54,5383	94,5833	280		P13-100	1327,8571	P6-100	
			M _y	59	35,31	54,5383	83,75	280		P13-100	1327,8571	P6-100	
			M _{xy}	38	26,83	71,0374	83,75	280		P13-100	1327,8571	P6-100	
			M _x	38	26,83	71,0374	83,75	280		P13-100	1327,8571	P6-100	
			M _y	38	26,83	71,0374	83,75	280		P13-100	1327,8571	P6-100	
			M _{xy}	38	26,83	71,0374	83,75	280		P13-100	1327,8571	P6-100	
	1.1	9600	9600	M _x	42	35,75	65,7317	94,5833	280		P13-100	1327,8571	P6-100
				M _y	42	35,75	65,7317	83,75	280		P13-100	1327,8571	P6-100
				M _{xy}	37	37,95	70,5153	83,75	280		P13-100	1327,8571	P6-100
				M _x	37	37,95	70,5153	83,75	280		P13-100	1327,8571	P6-100
				M _y	37	37,95	70,5153	83,75	280		P13-100	1327,8571	P6-100
				M _{xy}	37	37,95	70,5153	83,75	280		P13-100	1327,8571	P6-100
1.3	9780	9780	M _x	59	36,90	54,5383	110,4167	280		P13-100	1327,8571	P6-100	
			M _y	59	36,90	54,5383	83,75	280		P13-100	1327,8571	P6-100	

Bagian III Perhitungan Tangga
Perencanaan Tangga 390



7. Denah Ruang Tangga
- lebar bordes = 0,25 m
 - tinggi optrede = 170 mm
 - tinggi landai = 4900 mm
 - lebar optrede = 300 mm
 - jumlah anak tangga = 26
 - lebar tangga = 167,5 mm
 - $D/A = 0,57$ m
 - Sudut Pembelangan (sk) = 30
 - tebal plat tangga (h_{pl}) = 0,1 m
 - berat volume beton = 24 kN/m³
 - berat volume ubin = 21 kN/m³

Rencana Beban Tangga
Beban Q_{tg}

• Berat sendiri tangga = $\frac{h_{pl}}{\cos \alpha} \times \text{berat vol beton}$
 $= \frac{0,1}{0,986} \times 24 = 2,76 \text{ kN/m}^2$

• Berat nos tangga = $0,5 \times \text{berat vol. beton} \times D$
 $= 0,5 \times 24 \times 0,2 = 2,40 \text{ kN/m}^2$

• Berat ubin + spesi = $0,5 \times \text{berat vol. ubin}$
 $= 0,5 \times 21 = 1,05 \text{ kN/m}^2$

• Berat railing (diperkirakan) = 1,00 kN/m²
 Beban Q_{tg} = 7,21 kN/m²

Beban Q_{sd}

• Berat sendiri tangga = h_{pl} × berat vol. beton
 $= 0,1 \times 24 = 2,4 \text{ kN/m}^2$

• Berat ubin + spesi = 0,05 × berat vol. ubin
 $= 0,05 \times 21 = 1,05 \text{ kN/m}^2$

• Berat railing (diperkirakan) = 1,00 kN/m²
 Beban Q_{sd} = 4,45 kN/m²

Ditentukan pembebanan di: Etaboc

• M_x DL maks = 15,07 kNm
 • M_x LL maks = 10,78 kNm
 • V_x DL maks = 13,76 kNm
 • V_x LL maks = 10,91 kNm

Perovisa Penulangan Tangga

• M_x 1,4 M DL = 1,4 × 15,07 = 21,098
 • M_x 1,2 M DL + 1,6 M LL = 1,2 × 15,07 + 1,6 × 10,78
 $= 35,332 \leftarrow \text{Mux terpilih}$

• V_x 1,4 V DL = 1,4 × 13,76 = 19,264
 • V_x 1,2 V DL + 1,6 V LL = 1,2 × 13,76 + 1,6 × 10,91
 $= 33,968 \leftarrow \text{Vux terpilih}$

Rencana Penulangan Tangga Tumpu

M_{tit} = 0,5 × M_{uk}
 = 0,5 × 35,532 = 17,767 kNm

Ditentukan

• Tulangan pokok = D13 → A_s = 132,7 mm²

• Tulangan balok = D10 → A_s = 78,5 mm²

• f_y tulangan pokok = 360 Mpa

• f_y tulangan susut = 340 Mpa

• f'_c = 25 Mpa → b = 100 mm ; h = 100 mm

• D_s = h - (s_b + (0,5 × tulangan pokok))

= 100 - (10 + 0,5 × 13)

= 73,5 mm

• P_n perlu = $\frac{17,767 \times 10^6}{0,8 \times 1000 \times 73,5} = 3,6335$

• P_{perlu} = $\frac{0,85 \times 25}{360} \left(1 - \sqrt{1 - \frac{2 \times 3,6335}{0,85 \times 25}} \right) = 0,1111$

• P_{min} = $\frac{1,4}{360} = 0,0039$

• P_{max} = $0,75 \times \frac{0,85 \times 25}{360} \times \frac{600}{600 + 360} = 0,0233$

Digunakan P_{perlu} = 0,1111

A_s perlu = P_{perlu} × b × d_s

= 0,1111 × 1000 × 73,5 = 816,166 mm²

S = $\frac{A_s \times 1000}{A_s \text{ perlu}} = \frac{132,7 \times 1000}{816,166} = 161,9933$

maka digunakan D13-150

Cek geser

• V_e = $\frac{1}{6} \times \sqrt{f'_c} \times 1000 \times 73,5$
 = 61,15 kN

• Red V_e = 0,75 × 61,15
 = 45,8625 kN

• Red V_e > V_u = 15,2675 > 33,868 aman

Tulangan susut

Asumsi digunakan P10-100 → A_s = 78,5 mm²

A_s susut = 0,002 × b × d_s

= 0,002 × 1000 × 73,5 = 147 mm²

S = $\frac{78,5 \times 1000}{147} = 533,9456$

maka digunakan P10-100

Rencana Penulangan Tangga Lapangan

M_{uk} = 0,8 × M_{uk}

= 0,8 × 35,532 = 28,4256 kNm

• P_n perlu = $\frac{28,4256 \times 10^6}{0,8 \times 1000 \times 73,5} = 3,8135$

• P_{perlu} = $\frac{0,85 \times 25}{360} \left(1 - \sqrt{1 - \frac{2 \times 3,8135}{0,85 \times 25}} \right) = 0,01931$

• P_{min} = $\frac{1,4}{360} = 0,0039$

• P_{max} = $0,75 \times \frac{0,85 \times 25}{360} \times \frac{600}{600 + 360} = 0,0235$

• Digunakan P_{perlu} = 0,01931

A_s perlu = P_{perlu} × 1000 × d_s

= 0,01931 × 1000 × 73,5 = 1413,888 mm²


S = $\frac{132,7 \times 1000}{1413,888} = 93,8778$

Digunakan D15-150

Perhitungan Balok Bordes

- Berat sendiri = $0,25 \times 0,35 \times 24$
= 2,1 kN/m
- Berat tumpuan di B = 13,04 kN/m + dari
- Beban dinding = $\left(\frac{2,6}{2} - h\right) \times 2,5$
= $(1,8 - 0,35) \times 2,5 = 3,125$ kN/m
- Total Beban DL = 18,765 kN/m $c = 1$
- Total Beban LL = 10,91 kN/m

Perencana Balok Tumpuan



- $b_{ho} = 250$ mm
- $h = 350$ mm
- Tulangan pokok = D13
- Tulangan samping = P10
- Selimut beton = 40 mm
- $d_s = 40 + 8 + 1/2 = 56,5$ mm
- $d = 350 - 56,5 = 293,5$ mm

$M_u = 1,2 DL + 1,6 LL$
= $1,2(18,765) + 1,6(10,91) = 39,974$ kN/m

$M_u = \frac{1}{2} \times l \times l^2$
= $\frac{1}{2} \times 39,974 \times 2,85^2 = 40,5861$ kN/m

$M_{ui} = 0,8 \times M_u$
= $0,8 \times 40,5861 = 32,4689$

$R_n = \frac{M_{ui} \times 10^6}{0,9 \times b \times h^2}$
= $\frac{32,4689 \times 10^6}{0,9 \times 250 \times 293,5^2} = 1,6752$

$\rho_{perlu} = \frac{0,85 \times 25}{360 \text{ mpa}} \times \left(1 - \sqrt{1 - \frac{2 \times 1,6752}{0,85 \times 25}}\right) = 0,00485$

$\rho_{min} = \frac{1,4}{360 \text{ mpa}} = 0,0039$

$\rho_{max} = 0,429 + \frac{0,85 \times 25}{360} = 0,2152$

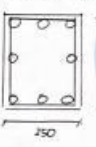
Maka digunakan $\rho_{min} = 0,0039$

$A_s \text{ min} = \rho_{min} \times b \times d$
= $0,0039 \times 250 \times 293,5 = 285,347 \text{ mm}^2$

$s = \frac{A_s \text{ min}}{\frac{1}{4} \pi \times 13^2}$
= $\frac{285,347}{\frac{1}{4} \pi \times 13^2} = 2,14893 = 2 \text{ buah}$

Digunakan tulangan tumpuan 2D13

Perencana Senggang Tumpuan



- $d_s = 40 + 8 + 1/2 = 56,5$ mm
- $d = 350 - 56,5 = 293,5$ mm
- $V_c = 0,17 \sqrt{f'_c} \times b \times d / 1000$
= $0,17 \sqrt{25} \times 250 \times 293,5 / 1000$
= 4,3688 kN
- $\rho_{Uc} = 0,75 \times 61,348$
= 46,776 kN

$V_u = 0,5 \times M_u \times l$
= $0,5 \times 39,974 \times 2,85 = 56,963$ kN

$V_s = \frac{56,963 - 46,776}{0,15} = 29,174$ kN

$V_s \text{ max} = 0,46 \sqrt{f'_c} \times b \times d$
= $0,46 \sqrt{25} \times 250 \times 293,5 = 242,132$ kN

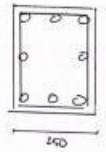
$V_s < V_s \text{ max}$

$A_v = 2 \times \frac{1}{4} \pi \times 13^2$
= 100,571 mm²

$s = \frac{A_v \times 394 \times d}{V_u}$
= $\frac{100,571 \times 394 \times 293,5}{29,174} = 242,827$ mm

Spesi maksimum = $d/2$
 $= 293,5/2 = 146,75 \text{ mm}$

Maka digunakan sengkang diameter 28B-125
 Penentuan Penulangan Sengkang Lapangan



$$d_s = 40 + 6 + 13/2 = 56,5 \text{ mm}$$

$$d = 350 - 56,5 = 293,5 \text{ mm}$$

$$V_c = 0,17 \sqrt{f_c} \times k_w \times d/1000$$

$$= 0,17 \sqrt{25} \times 150 \times 293,5/1000$$

$$= 62,3668 \text{ kN}$$

$$\phi V_c = 0,75 \times 62,3668 = 46,7764 \text{ kN}$$

$$V_u = 0,5 \times W_u \times (L - 0,5)$$

$$= 0,5 \times 29,974 \times (2,85 - 0,5) = 22,4815$$

$$V_s = V_u / 0,75 \times \phi V_c$$

$$= 8,8012$$

$$V_{s \text{ max}} = 0,46 \sqrt{f_c} \times k_w \times d$$

$$= 0,46 \sqrt{25} \times 150 \times 293,5 = 291,136$$

$$A_u = 1/4 \times 77 \times 9^2$$

$$= 59,2657 \text{ mm}^2$$

$$s = \frac{A_u \times 10^3}{V_s}$$

$$= \frac{59,2657 \times 240 \times 293,5}{8,8012} = 402,4565 \text{ mm}$$

Spesi maksimum = $d/2$
 $= 293,5/2 = 146,75 \text{ mm}$

Maka digunakan sengkang diameter 28-125

Perencanaan Perkuasi Tangga

- Beban mati (DL) tangga = 17,120 kN/m
- Beban hidup (LL) tangga = 2,010 kN/m
- Beban dinding = $k_{dg} \times d + \gamma \text{ beton}$
 $= 0,15 \times 2,00 \times 24$
 $= 2,70 \text{ kN/m}$
- Beban Q_{eq} = 20,200 kN/m

Beban D_{ty}

$$d = 2,00 \text{ m}$$

$$h = 0,150 \text{ m}$$

$$B = 1,50 \text{ m}$$

$$k_{ty} = 0,150 \text{ m}$$

$$\gamma \text{ tanah} = 18 \text{ kN/m}^3$$

$$\gamma \text{ beton} = 350 \text{ kN/m}^3$$

$$\text{mutu beton} = 25 \text{ Mpa}$$

$$\text{selisut beton} = 20 \text{ mm}$$

$$\text{tulangan pokok} = 360 \text{ Mpa}$$

$$\text{tulangan susut} = 240 \text{ Mpa}$$

$$p_{\text{netto}} = \gamma \text{ tanah} \times (d - h) \times (B - k_{ty}) + \gamma \text{ beton} \times h$$

$$= 360 - (2 - 0,15) \times 1 \times (1,5 - 0,15) + 25 = 316,25 \text{ kN/m}^2$$

$$p = \frac{M_{ty}}{P_n} = 0,6$$

$$k_1 = 2 \times e$$

$$= 2 \times 0,484 = 0,973 \text{ m}$$

$$f_{\text{D maks}} = \frac{M_{ty}}{I} + 6 \frac{Q_{\text{eq}} \times e}{B^2} \leq \bar{\sigma} \text{ maks}$$

$$= \frac{26,72}{1,50} + 6 \frac{20,20 \times 0,973}{1,5^2} = 55,027 \leq 316,690$$

f_{D min} :

$$= \frac{26,28}{1,50} - 6 \frac{20,20}{1,5^2} = 30,494 > 0$$

Rencana Penulangan Pondasi

$$M_u = \frac{1}{2} \frac{B_{max} + B_{min}}{2} \left(\frac{a_c}{2} l_c - \frac{1}{2} b_w \right)^2$$

$$= 21,76 \text{ t.m}$$

$$V_u = \frac{(0,4 \text{ m} + 0,6 \text{ m})}{2} \frac{B_c}{2} l_c - \frac{1}{2} b_w$$

$$= 37,470 \text{ kN}$$

Di rencanakan D13

$$e_d = (4 \times 1000) - 2D_{min} - 13/2$$

$$= 123,5 \text{ mm}$$

$$k = \frac{M_u}{0,9 b d^2} = \frac{21,76 \times 10^6}{0,9 \times 1000 \times 123,5^2} = 1,285 \text{ mm}$$

$$P_{perlu} = \frac{0,01 \times 125}{360 \text{ MPa}} \times \left(1 - \sqrt{1 - \frac{2 \times 1,285}{0,01 \times 125}} \right) = 0,00485$$

$$P_{min} = \frac{1,4}{360} = 0,0039$$

$$P_{max} = 0,18 \times \frac{0,85^2 \times 25}{360} = 0,0162$$

Maka digunakan $P_{min} = 0,0039$

$$A_s \text{ min} = P_{min} \times 1000 \times d$$

$$= 0,004 \times 1000 \times 123,5 = 565,66 \text{ mm}^2$$

$$= \frac{1/2 \times 78 \times 16^2 \times 1000}{565,66} = 279,791 \text{ mm}^2$$

Digunakan D13-200

Cek geser

$$V_c = 0,17 \sqrt{f_c} \times 1000 \times d$$

$$= 0,17 \sqrt{25} \times 250 \times 123,5 \times 1000 = 104,975 \text{ kN}$$

$$V_c = 0,75 \times 104,975 = 78,731 \text{ kN}$$

$$V_u \leq V_c : 37,470 < 78,731 \quad \leftarrow \text{aman}$$

Perhitungan Tulangan Sengk

$$P_{min} = 0,004$$

$$A_s \text{ min} = P_{min} \times 1000 \times 16 = 1000$$

$$= 0,004 \times 1000 \times 0,15 \times 1000 = 583,333 \text{ mm}^2$$

Direncanakan F10

$$s = \frac{1}{4} \times 78 \times 10^3 \times 1000$$

$$\frac{583,333}{1} = 139,659 \text{ mm}$$

Digunakan F10-115

Bagian B
Perhitungan Balok

- Balok 510×400
- $f_c' = 25 \text{ Mpa}$
- $f_y = 360 \text{ Mpa (beker)}$
- $f_y = 260 \text{ Mpa (geser)}$
- $b = 400 \text{ mm}$
- $h = 410 \text{ mm}$
- $D_L = 19 \text{ mm}$
- $D_s = 10 \text{ mm}$
- $A_s \text{ tul} = 283,5288 \text{ mm}^2$

Perencanaan Tulangan Tumpuan

$$R_n = \frac{M_u}{0,9 \cdot b \cdot d^2} = \frac{178,226 \times 10^4}{0,9 \times 400 \times 510,5^2} = 1,8997$$

$$P_{\text{min}} = \frac{f_y}{f_c} = \frac{360}{260} = 0,0039$$

$$P_{\text{max}} = \frac{0,429 \times 0,85 \times 25 \text{ Mpa}}{360 \text{ Mpa}} = 0,0294$$

$$P_{\text{perlu}} = \frac{0,85 \cdot f_c'}{f_y} \left[1 - \sqrt{1 - \frac{1,25 R_n}{0,85 \cdot f_c'}} \right]$$

$$= \frac{0,85 \times 25}{360} \left[1 - \sqrt{1 - \frac{1,25 \times 1,8997}{0,85 \times 25}} \right] = 0,0056$$

Digunakan $P_{\text{perlu}} = 0,0056$

$$A_s = P \cdot b \cdot d = 0,0056 \times 400 \times 510,5 = 1143,52 \text{ mm}^2$$

$$n = \frac{A_s \text{ perlu}}{A_s \text{ tul}} = \frac{1143,52}{283,5288} = 4,032 \approx 5 \text{ buah}$$

Maka digunakan SD19

$$x = 400 - \frac{(5 \times 19)}{(5-1)} = \frac{(2 \times 40) - (2 \times 19)}{(5-1)} = 51,25 \text{ mm}$$

$51,25 > 13$ OK!

$A_s \text{ aktual} = 5 \times 283,5288 = 1417,644$

$d_s = 40 + 10(19/2) = 53,5 \text{ mm}$

cek $x_{\text{Min}} > M_u$

$$a = \frac{1417,644 \times 360}{0,85 \times 25 \times 400} = 60,0414 \text{ mm}$$

$$z = 510,5 - \frac{60,0414}{2} = 480,2793 \text{ mm}$$

$T_s = 1417,644 \times 360 = 510351,6 \text{ N}$

$\phi N_n = 0,9 \times 510351,6 \times 10^{-2} \times 480,2793 = 229,6922 \text{ kNm}$

$\phi N_n > M_u$

$229,6922 > 178,226$ OK!

Perencanaan Tulangan Lapangan

$$R_n = \frac{92,229 \times 10^4}{0,9 \times 400 \times 510,5} = 0,9851$$

$$P_{\text{min}} = 0,0039$$

$$P_{\text{max}} = \frac{0,429 \times 0,85 \times 25 \text{ Mpa} + 30 \text{ Mpa}}{360 \text{ Mpa}} = 0,0254$$

$$P_{\text{perlu}} = \frac{0,85 \times 25}{360} \left[1 - \sqrt{1 - \frac{1,25 \times 0,9851}{0,85 \times 25}} \right]$$

$$= 0,0028$$

$$A_s = 0,0028 \times 400 \times 510,5 = 796,56 \text{ mm}^2$$

$$n = \frac{796,56}{283,5288} = 2,809 \approx 3 \text{ buah}$$

Maka digunakan SD19

$A_s \text{ aktual} = 3 \times 283,5288 = 850,5864 \text{ mm}^2$

$d_s = 53,5 \text{ mm}$

$a = 31,0143 \text{ mm}$

$z = 469,2876$

$T_s = 506211,1 \text{ N}$

$$M_u = 0,9 \times 992,4876 \times 10^4 \times 50624,1$$

$$= 135,7247 \text{ kNm}$$

$$\beta M_u > M_u$$

$$135,724 > 92,289 \text{ OK!}$$

• Perencanaan Sengkang Tumpuan

$$V_c = \frac{1}{6} \sqrt{f_c'} \times b \times d$$

$$= \frac{1}{6} \times \sqrt{25} \times 400 \times 510,5 = 170,167 \text{ kN}$$

$$V_s = \frac{N_u}{0,75} = \frac{117,98}{0,75} = 157,307 \text{ kN}$$

$$V_{smax} = \frac{1}{3} \sqrt{f_c'} \times b \times d$$

$$= \frac{1}{3} \times \sqrt{25} \times 400 \times 510,5 = 340,335$$

$$V_s < V_{smax}$$

$$157,307 < 340,335$$

Asumsi menggunakan 2P10

$$A_v = 2 \times \frac{1}{4} \pi \times 10^2 = 157,0797 \text{ mm}^2$$

$$s = \frac{157,0797 \times 340}{157,307} = 335,6$$

$$= \frac{18594,6}{1000} = 18,6 \text{ mm}$$

$$s_{max} = \frac{d}{2} = \frac{510,5}{2} = 255,25 \text{ mm}$$

Maka digunakan 2P10-150

BALOK 30 x 20		BALOK 45 x 30	
Perencanaan Tulangan Tumpuan		Perencanaan Tulangan Tumpuan	
Ra = 1.7500	A _s aktual = 402.128 mm ²	Ra = 1.7299	A _s aktual = 1417.644 mm ²
p _{min} = 0.0039	d _s = 58 mm	p _{min} = 0.0039	d _s = 59.5 mm
p _{max} = 0.0254	a = 36.063 mm	p _{max} = 0.0254	a = 80.0552 mm
p _{perlu} = 0.0021	z = 186.2009 mm	p _{perlu} = 0.0115	z = 528.4794 mm
A _s = 216.24 mm ²	T _s = 144708.04 N	A _s = 1243.73 mm ²	T _s = 510351.84 N
n = 1.0755	φM _s = 25.402 kNm	n = 4.3666	φM _s = 141.1984 kNm
maka digunakan 2D16		maka digunakan 5D19	
x = 68 mm	25.402 > 14.352	x = 26.25 mm	141.8984 > 131.876
Perencanaan Tulangan Lapangan		Perencanaan Tulangan Lapangan	
Ra = 0.7628	A _s aktual = 116.6035 mm ²	Ra = 2.6122	A _s aktual = 883.1899 mm ²
p _{min} = 0.0039	d _s = 56 mm	p _{min} = 0.0039	d _s = 59.5 mm
p _{max} = 0.0254	a = 8 mm	p _{max} = 0.0254	a = 49.8743 mm
p _{perlu} = 0.0021	z = 207.6666 mm	p _{perlu} = 0.0078	z = 355.5629 mm
A _s = 89.04 mm ²	T _s = 30579.085 N	A _s = 843.57 mm ²	T _s = 317948.352 N
n = 3.5152	φM _s = 6.8377 kNm	n = 5.7308	φM _s = 96.0226 kNm
maka digunakan 4D22		maka digunakan 4D22	
x = 6.8377 < 5.928		x = 96.0226 < 91.66	
Perencanaan Sengkang Tumpuan		Perencanaan Sengkang Tumpuan	
V _c = 35.3333 kN	A _v = 157.0797 mm ²	V _c = 90.123 kN	A _v = 157.0797 mm ²
V _s = 36.4800 kN	s = 129 mm	V _s = 280.255 kN	s = 81.5 mm
V _{max} = 71.8133 kN	s _{max} = 136 mm	V _{max} = 180.250 kN	s _{max} = 180.25 mm
35.3333 < 70.67	2109.100	90.123 < 180.25	2710.100

BALOK 60 x 40		BALOK 75 x 50	
Perencanaan Tulangan Tumpuan		Perencanaan Tulangan Tumpuan	
Ra = 1.8997	A _s aktual = 1417.644 mm ²	Ra = 1.562	A _s aktual = 2280.7984 mm ²
p _{min} = 0.0039	d _s = 29.5 mm	p _{min} = 0.0039	d _s = 61 mm
p _{max} = 0.0254	a = 60.8414 mm	p _{max} = 0.0254	a = 72.2788 mm
p _{perlu} = 0.0056	z = 480.4793 mm	p _{perlu} = 0.0058	z = 620.3606 mm
A _s = 1440.52 mm ²	T _s = 210051.34 N	A _s = 1911.1 mm ²	T _s = 820860.840 N
n = 4.0332	φM _s = 220.6922 kNm	n = 5.0735	φM _s = 458.435 kNm
maka digunakan 5D19		maka digunakan 4D22	
x = 51.25 mm	220.6922 > 178.226	x = 53.6 mm	458.435 > 383.819
Perencanaan Tulangan Lapangan		Perencanaan Tulangan Lapangan	
Ra = 0.9631	A _s aktual = 662.0564 mm ²	Ra = 1.4355	A _s aktual = 1835.731747 mm ²
p _{min} = 0.0039	d _s = 59.5 mm	p _{min} = 0.0039	d _s = 61 mm
p _{max} = 0.0254	a = 28.0489 mm	p _{max} = 0.0254	a = 62.1312 mm
p _{perlu} = 0.0028	z = 496.4796 mm	p _{perlu} = 0.0042	z = 627.9344 mm
A _s = 371.76 mm ²	T _s = 236347.517 N	A _s = 1383.8 mm ²	T _s = 60143.4289 N
n = 2.2808	φM _s = 106.5013 kNm	n = 2.0188	φM _s = 373.0741 kNm
maka digunakan 4D22		maka digunakan 4D22	
x = 106.5013 > 92.229		x = 373.0741 > 280.532	
Perencanaan Sengkang Tumpuan		Perencanaan Sengkang Tumpuan	
V _c = 170.1667 kN	A _v = 157.0797 mm ²	V _c = 236.5833 kN	A _v = 157.0797 mm ²
V _s = 157.207 kN	s = 188.6 mm	V _s = 455.5600 kN	s = 81.0 mm
V _{max} = 340.3333 kN	s _{max} = 255.25 mm	V _{max} = 549.1667 kN	s _{max} = 224.5 mm
170.1667 < 340.333	2756.100	274.5833 < 549.1667	2109.100

BALOK 90 x 60		BALOK 100 x 70	
Perencanaan Tulangan Tumpuan		Perencanaan Tulangan Tumpuan	
Ra = 1.2281	A _s aktual = 990.664 mm ²	Ra = 1.3289	A _s aktual = 2453.3605 mm ²
p _{min} = 0.0039	d _s = 61 mm	p _{min} = 0.0039	d _s = 62.5 mm
p _{max} = 0.0254	a = 53.6659 mm	p _{max} = 0.0254	a = 50.3880 mm
p _{perlu} = 0.0036	z = 782.1671 mm	p _{perlu} = 0.0038	z = 877.8001 mm
A _s = 1747.48 mm ²	T _s = 684248.04 N	A _s = 2413.95 mm ²	T _s = 883373.02 N
n = 4.7899	φM _s = 481.6794 kNm	n = 4.9177	φM _s = 498.0405 kNm
maka digunakan 5D22		maka digunakan 5D22	
x = 97.3 mm	481.6794 > 454.003	x = 60 mm	498.0405 > 485.319
Perencanaan Tulangan Lapangan		Perencanaan Tulangan Lapangan	
Ra = 1.0397	A _s aktual = 976.8814 mm ²	Ra = 2.1529	A _s aktual = 4188.2476 mm ²
p _{min} = 0.0039	d _s = 65 mm	p _{min} = 0.0039	d _s = 62.5 mm
p _{max} = 0.0254	a = 54.4800 mm	p _{max} = 0.0254	a = 101.3026 mm
p _{perlu} = 0.003	z = 781.7998 mm	p _{perlu} = 0.0064	z = 856.8187 mm
A _s = 1456.2 mm ²	T _s = 693603.2883 N	A _s = 4805.6 mm ²	T _s = 1307767 N
n = 3.0232	φM _s = 408.0345 kNm	n = 5.8263	φM _s = 1162.095 kNm
maka digunakan 4D22		maka digunakan 4D22	
x = 408.0345 > 365.447		x = 1162.095 > 1108.982	
Perencanaan Sengkang Tumpuan		Perencanaan Sengkang Tumpuan	
V _c = 404.500 kN	A _v = 157.0797 mm ²	V _c = 528.335 kN	A _v = 157.0797 mm ²
V _s = 423.480 kN	s = 108.1 mm	V _s = 577.120 kN	s = 89 mm
V _{max} = 829.000 kN	s _{max} = 436.5 mm	V _{max} = 1058.150 kN	s _{max} = 453.75 mm
404.5 < 829	2710.250	528.335 < 1058.15	3750.50

Bagian 8 Perhitungan kolom
Diagram Interaksi Kolom

• Profil Kolom 400 x 400

- d tulangan = 22 mm
- f_c' = 25 Mpa
- f_y = 360 Mpa
- B = 400 mm
- H = 400 mm
- selimut = 40 mm
- sengkang = 10 mm

- d' = 65 mm
- d = 335 mm
- A_c' = 6284,5714 mm²
- A_s = 6064,5714 mm²
- A_{st} = 1245 mm²
- A_g = 16000 mm²

• Beban Terpusat

$M_u = 0$

$\phi P_n = 0,8(0,85 f_c' (A_g - A_{st}) + (A_{st} f_y)) / 1000$
 $= 0,8(0,85 \times 25 \times (16000 - 1245,145) + (1245,145 \times 360)) / 1000$

$\phi P_n = 3911,0945 \text{ kN}$
 $[0; 3911,0945]$

• Kondisi Seimbang

$c = \frac{600}{600 + f_y} \times d = \frac{600}{600 + 360} \times 335 = 211,875$

$\epsilon_s = 0,003 \times \frac{c - d'}{c} = 0,003 \times \frac{211,875 - 65}{211,875}$
 $= 0,0021463$

$f_s' = \epsilon_s > 0,002$, maka $f_y = f_s' = 360 \text{ MPa}$

$a = \beta_1 \times c = 0,85 \times 211,875$
 $= 180,0938$

$\phi P_n = 0,85 (0,85 f_c' (A_c' - a a) + (A_s f_y)) / 1000$
 $= 0,85 (0,85 \times 25 \times (6284,5714 - 180,0938) + (6064,5714 \times 360)) / 1000$

$\phi P_n = 855,0180 \text{ kN}$

• ϕM_u

$C_c = (0,85 f_c' \times \beta_1 \times a) \times 10^{-3}$
 $= (0,85 \times 25 \times 180,0938) \times 10^{-3} = 3,83,67703 \text{ kN}$

$T_s = (A_s \times f_y) / 1000$
 $= (6064,5714 \times 360) / 1000 = 2190,4457 \text{ kN}$

$C_s = (A_s' \times f_s') / 1000$
 $= (6064,5714 \times 360) / 1000 = 2190,4457 \text{ kN}$

$\phi M_u = (C_c (\frac{h}{2} - \frac{a}{2}) + C_s (\frac{h}{2} - d') + T_s (d - \frac{h}{2})) \times 10^{-2} \times 0,9$
 $= 699,5339 \text{ kNm}$
 $[699,5339; 995,018]$

• Lentur Murni

$R_n = 0$

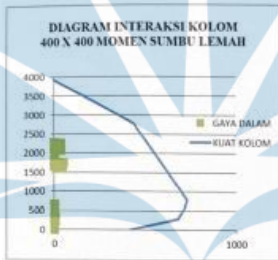
$a = \frac{A_s \times f_y}{0,85 f_c' \times b} = \frac{6064,5714 \times 360}{0,85 \times 25 \times 400}$
 $= 257,6995$

$\phi M_u = A_s \times f_y \times (d - [\frac{a}{2} \times 0,9])$
 $= 6064,5714 \times 360 \times (335 - [\frac{257,6995}{2} \times 0,9]) = 99$

$\phi M_u = 414,2905 \text{ kNm}$
 $[414,2905; 0]$

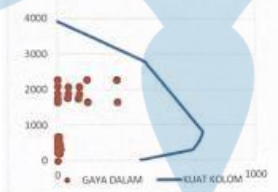
Perencanaan Penulangan Kolom
 Kolom 400 x 400
 Data analisis ETABS diportal.
 $P_u = 5307,57$ kN
 $M_u(z) = 264,0779$ kNm
 $M_u(s) = 297,273$ kNm
 M_u ekuivalen = $M_{u2} + M_{u3} \frac{b}{h} \left(\frac{1-\beta}{\rho} \right)$
 $= 264,0779 + 297,273 \left[\frac{1-0,85}{0,85} \right]$
 $= 816,5378$ kNm
 Mod $\rho = \frac{P_u}{f_c' b h} = \frac{5307,57}{25 \times 400 \times 400} = 1,3264$
 Mod $\rho = \frac{M_u}{f_c' b h^2} = \frac{816,5378}{25 \times 400 \times 400^2} = 0,5104$
 Asumsi $\rho = 3,5\%$
 $A_s \text{ total} = \rho \times A_g$
 $= 3,5\% \times 160000$
 $= 5600 \text{ mm}^2$
 $A_s \text{ tulangan} = \frac{1}{4} \pi d^2$
 $= \frac{1}{4} \pi 22^2 = 380,1327 \text{ mm}^2$
 $n = \frac{5600}{380,1327} = 14,731694 \approx 15 \text{ buah}$
 $= 14 \text{ buah}$

DIAGRAM INTERAKSI KOLOM



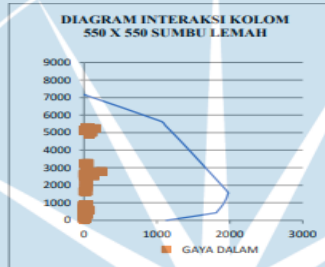
MN	PN
414,2905	1
627,19	287,9449
683,86	330,2111
690,17	372,4774
696,02	414,7436
701,44	457,0099
706,40	499,2761
710,92	541,5424
714,99	583,8086
718,61	626,0749
721,78	668,3411
724,51	710,6074
726,78	752,8736
728,61	795,1399
699,5339	995,018
670,3132065	1194,638
643,3871484	1379,34
618,07799	1553,314
594,1609567	1717,728
571,4427597	1873,587
549,7562697	2021,76
528,9562361	2163,001
508,9158204	2297,968
489,5237683	2427,241
470,6820876	2551,328
452,3041293	2670,679
434,3129923	2785,694
0	3911,595

DIAGRAM INTERAKSI KOLOM
 PROFIL 400 X 400 SUMBU KUAT

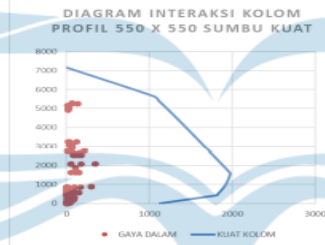


KOLOM 550 X 550

PROFIL KOLOM 55 X 55		PERENCANAAN PENULANGAN KOLOM	
Diameter =	24 mm	Pu =	5305.09 kn
Fc =	25 Mpa	Mu2 =	245.394 kNm
Fy =	360 Mpa	Mu3 =	345.102 kNm
B =	550 mm	Mu ekuivalen =	306.2943529 kNm
H =	550 mm	Nod =	0.7015
Selimut =	40 mm	Mod =	0.0737
Senggang =	10 mm	Asumsi P = 3,5% maka	
d' =	62	As total =	10587.5 mm ²
d =	488	As tulangan =	452.3894 mm ²
Jml TulanganTekan =	24	n =	23.4035 = 24 buah
As' =	10861.714 mm ²	KEADAAN SETIMBANG	
Jml TulanganTarik =	24	Cb =	305
As =	10861.714 mm ²	Ea' =	2.39E-03
Ast =	21723.429 mm ²	y =	0.0018
Ag =	302500 mm ²	Fa' =	360 Mpa
BEBAN TERPUSAT		B1 =	0.85
Ma =	0 kN	ab =	259.2500
Pa =	7169.20694 kN	Pa(b) =	1969.4898 kN
LENTUR MURNI		Mn(b) =	1895.6128 kNm
Pa =	0 kN		
a =	334.564034		
Ma =	1128.66926 kNm		

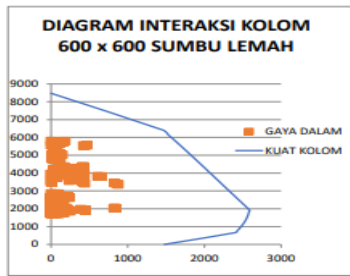


MN	PN
1128.6693	0
1806.95	427.9032411
1830.44	524.7633973
1852.21	621.6235536
1872.28	718.4837098
1890.64	815.3438661
1907.28	912.2040223
1922.22	1009.064179
1935.45	1105.924335
1946.96	1202.784491
1956.77	1299.644647
1964.87	1396.504804
1971.26	1493.36496
1975.93	1590.225116
1895.6129	1969.4899
1803.171574	2384.055143
1717.411278	2770.169235
1637.253114	3131.490133
1561.79559	3471.074531
1490.279557	3791.49649
1422.061181	4094.939071
1356.590845	4383.265864
1293.396525	4658.077366
1232.070567	4920.755821
1172.259071	5172.501202
1113.653316	5414.360292
1055.982773	5647.250376
0	7169.207

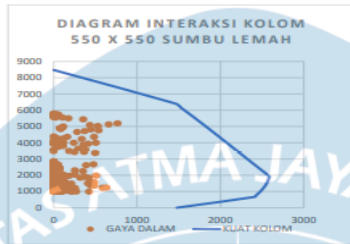


KOLOM 600 X 600

PROFIL KOLOM 60 x 60		PERENCANAAN PENULANGAN KOLOM	
Diameter =	25 mm	Pu =	5794.94 kn
Fc =	25 Mpa	Mu2 =	873.649 kNm
Fy =	360 Mpa	Mu3 =	765.345 kNm
B =	600 mm	Mu ekuivalen =	1008.70988 kNm
H =	600 mm	Nod =	0.6439
Selimut =	40 mm	Mod =	0.1868
Senggang =	10 mm	Asumsi P = 3,5% maka	
d' =	62.5	As total =	12600 mm ²
d =	537.5	As tulangan =	490.8739 mm ²
Jml TulanganTekan =	26	n =	25.6685 = 26 buah
As' =	12767.857 mm ²	KEADAAN SETIMBANG	
Jml TulanganTarik =	26	Cb =	335.9375
As =	12767.857 mm ²	Ea' =	2.44E-03
Ast =	25535.714 mm ²	y =	0.0018
Ag =	360000 mm ²	Fa' =	360 Mpa
BEBAN TERPUSAT		B1 =	0.85
Ma =	0 kN	ab =	285.5469
Pa =	8476.11607 kN	Pa(b) =	2366.4697 kN
LENTUR MURNI		Mn(b) =	2480.1497 kNm
Pa =	0 kN		
a =	360.504202		
Ma =	1477.85801 kNm		

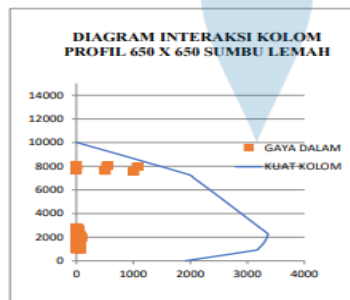


MN	PN
1477.8581	0
2404.31	661.29
2429.73	766.96
2453.29	872.62
2474.99	978.29
2494.81	1083.96
2512.78	1189.62
2528.87	1295.29
2543.11	1400.95
2555.47	1506.62
2565.97	1612.28
2574.61	1717.95
2581.38	1823.61
2586.28	1929.28
2480.1497	2366.47
2368.90	2814.47
2265.44	3232.65
2168.21	3626.21
2076.28	3997.97
1988.88	4350.31
1905.32	4685.27
1825.03	5004.64
1747.50	5309.94
1672.28	5602.53
1598.99	5883.59
1527.29	6154.14
1456.87	6415.10
0	8476.116



KOLOM 650 X 650

PROFIL KOLOM 65 X 65		PERENCANAAN PENULANGAN KOLOM	
Diameter =	29 mm	Pu =	5794.94 kn
Fc =	25 Mpa	Ma2 =	873.649 kNm
Fy =	360 Mpa	Ma3 =	765.345 kNm
B =	650 mm	Mu ekuivalen =	1008.70988 kNm
H =	650 mm	Nod =	0.5487
Selimat =	40 mm	Mod =	0.1470
Sengkan =	10 mm	Asumsi P = 3.5% maka	
d' =	64.5	As total =	14787.5 mm ²
d =	585.5	As tulangan =	660.5199 mm ²
Jml Tulangan Tekan =	23	n =	22.3877 = 23 buah
As' =	15198.071 mm ²	KEADAAN SETIMBANG	
Jml Tulangan Tarik =	23	Cb =	365.9375
As =	15198.071 mm ²	Es' =	2.47E-03
Ast =	30396.143 mm ²	y =	0.0018
Ag =	422500 mm ²	Fv =	360 Mpa
BEBAN TERPUSAT		B1 =	0.85
Mn =	0 kN	ab =	311.0469
Pu =	10022.9056 kN	Pu(b) =	2792.6177 kN
LENTUR MURNI		Ma(b) =	3220.8105 kNm
Pu =	0 kN		
a =	396.112631		
Mn =	1907.84056 kNm		

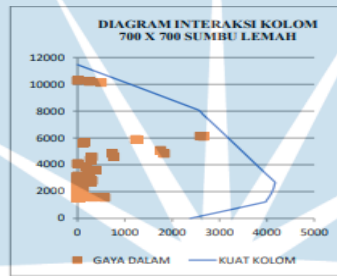


MN	PN
1907.8406	0
3163.94	909.8206116
3191.41	1024.291705
3216.85	1138.762799
3240.27	1253.233893
3261.67	1367.704987
3281.05	1482.17608
3298.41	1596.647174
3313.75	1711.118268
3327.07	1825.589362
3338.37	1940.060455
3347.64	2054.531549
3354.90	2169.002643
3360.13	2283.473737
3220.8106	2792.6178
3086.779621	3282.491433
2961.503454	3741.98794
2843.290229	4176.300111
2731.180389	4588.088262
2624.34493	4979.650763
2522.063928	5352.983566
2423.709168	5709.828362
2328.729994	6051.711819
2236.641694	6379.577769
2147.01592	6695.813785
2059.472725	7000.273252
1973.673914	7294.293797
0	10022.9056

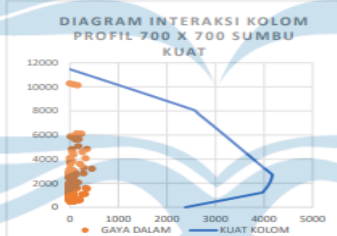


KOLOM 770 X 700

PROFIL KOLOM 70 x 70		PERENCANAAN PENULANGAN KOLOM	
Diameter =	29 mm	Pu =	5307.57 kN
F'c =	25 Mpa	Mu2 =	764.0779 kNm
Fy =	360 Mpa	Mu3 =	297.273 kNm
B =	700 mm	Mu ekuivalen =	816.537841 kNm
H =	700 mm	Nod =	0.4333
Selimut =	40 mm	Mod =	0.0953
Sengkang =	10 mm	Asumsi P = 3,5% maka	
d' =	64.5	As total =	17150 mm ²
d =	635.5	As tulangan =	660.5199 mm ²
Jml TulanganTekan =	26	n =	25.9644 ≈ 26 buah
As' =	17180.429 mm ²	KEADAAN SETIMBANG	
Jml TulanganTarik =	26	Cb =	397.1875
As =	17180.429 mm ²	Es' =	2.51E-03
Ast =	34360.857 mm ²	y =	0.0018
Ag =	490000 mm ²	Fv' =	360 Mpa
BEBAN TERPUSAT		B1 =	0.85
Mn =	0 kNm	ab =	337.6094
Pa =	11467.165 kN	Pn(b) =	3264.2606 kN
LENTUR MURNI		Mn(b) =	3997.4047 kNm
Pa =	0 kN		
a =	415.795246		
Mn =	2380.23104 kNm		

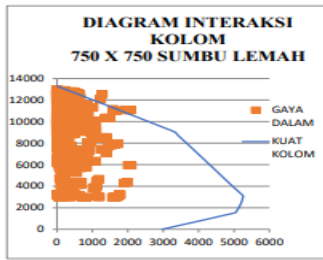


MN	PN
2380.2311	11467.165
3964.24	1221.65167
3993.44	1344.928232
4020.46	1468.204795
4045.31	1591.481357
4067.98	1714.75792
4088.48	1838.034482
4106.80	1961.311045
4127.94	2084.587607
4136.91	2207.86417
4148.70	2331.140732
4158.31	2454.417295
4165.75	2577.693857
4171.01	2700.97042
3997.4048	3264.2607
3836.167669	3804.673014
3692.061272	4289.285877
3555.451641	4749.429012
3425.388365	5187.506652
3301.041592	5605.61805
3181.683502	6005.604356
3066.673092	6389.087099
2955.443607	6757.499985
2847.49209	7112.11533
2742.370655	7454.066143
2639.679147	7784.364687
2539.058947	8103.918146
0	11467.165

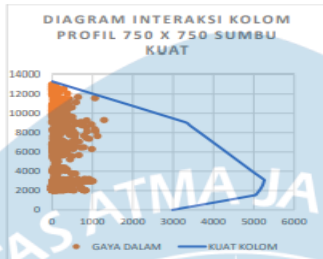


KOLOM 750 X 750

PROFIL KOLOM 75 x 75		PERENCANAAN PENULANGAN KOLOM	
Diameter =	32 mm	Pu =	5794.94 kN
F'c =	25 Mpa	Mu2 =	873.649 kNm
Fy =	360 Mpa	Mu3 =	765.345 kNm
B =	750 mm	Mu ekuivalen =	1008.70988 kNm
H =	750 mm	Nod =	0.4121
Selimut =	40 mm	Mod =	0.0957
Sengkang =	10 mm	Asumsi P = 3,5% maka	
d' =	66	As total =	19687.5 mm ²
d =	684	As tulangan =	804.2478 mm ²
Jml TulanganTekan =	25	n =	24.4794 ≈ 25 buah
As' =	20114.286 mm ²	KEADAAN SETIMBANG	
Jml TulanganTarik =	25	Cb =	427.5
As =	20114.286 mm ²	Es' =	2.54E-03
Ast =	40228.571 mm ²	y =	0.0018
Ag =	562500 mm ²	Fv' =	360 Mpa
BEBAN TERPUSAT		B1 =	0.85
Mn =	0 kNm	ab =	363.3750
Pa =	13301.8879 kN	Pn(b) =	3764.3379 kN
LENTUR MURNI		Mn(b) =	5035.0994 kNm
Pa =	0 kN		
a =	454.346218		
Mn =	2977.1539 kNm		

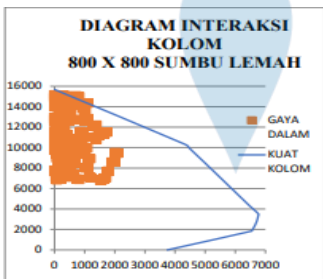


MN	PN
2977.1539	0
5035.26	1528.70279
5066.45	1660.784821
5095.32	1792.866853
5121.85	1924.948884
5146.05	2057.030915
5167.92	2189.112946
5187.45	2321.194978
5204.66	2453.277009
5219.53	2585.35904
5232.07	2717.441071
5242.28	2849.523103
5250.16	2981.605134
5255.71	3113.687165
5035.0994	3764.3379
4848.160854	4339.976994
4676.990731	4868.745486
4514.253384	5372.354161
4358.956181	5853.123083
4210.224896	6313.09557
4067.286567	6754.078262
3929.455241	7177.674420
3796.120072	7585.311786
3666.732311	7978.262912
3540.811863	8357.679969
3417.910119	8724.581441
3297.633853	9079.896429
0	13301.8879

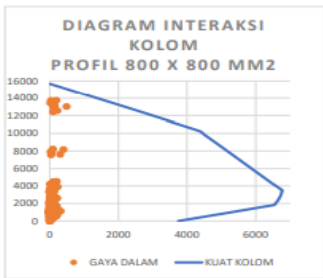


KOLOM 800 X 800

PROFIL KOLOM 80 X 80		PERENCANAAN PENULANGAN KOLOM	
Diameter =	36 mm	Pu =	5307.57 kN
Pc =	25 Mpa	Mu2 =	764.0779 kNm
Fy =	360 Mpa	Mu3 =	297.273 kNm
B =	800 mm	Mu ekuivalen =	816.537841 kNm
H =	800 mm	Nod =	0.3318
Selimit =	40 mm	Mod =	0.0638
Senggang =	10 mm	Asumsi P = 3,5% maka	
ϕ =	68	As total =	22400 mm ²
d =	732	As tulangan =	1017.8761 mm ²
Jml Tulangan Tekan =	24	a =	22.0066 = 23 buah
As' =	24438.857 mm ²	KEADAAN SETIMBANG	
Jml Tulangan Tarik =	24	Ch =	457.5
As =	24438.857 mm ²	Ex' =	2.55E-03
Ast =	48877.714 mm ²	y =	0.0018
Ag =	640000 mm ²	Fy' =	360 Mpa
BEBAN TERPUSAT		B1 =	0.85
Mu =	0 kN	ab =	388.8750
Pu =	15681.8094 kN	Pu(b) =	4297.0688 kN
LENTUR MURNI		Mu(b) =	6480.7312 kNm
Pu =	0 kN		
a =	517.528739		
Mu =	3747.1695 kNm		

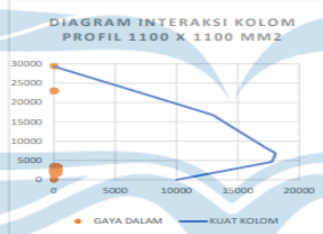
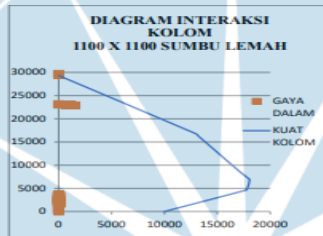


MN	PN
3747.1695	0
6535.59	1834.817214
6568.77	1975.704714
6599.46	2116.592214
6627.66	2257.479714
6653.38	2398.367214
6676.61	2539.254714
6697.35	2680.142214
6715.60	2821.029714
6731.37	2961.917214
6744.65	3102.804714
6755.44	3243.692214
6763.75	3384.579714
6769.56	3525.467214
6480.7312	4297.0688
6251.923457	4942.383211
6041.862483	5536.655429
5841.744768	6103.886808
5650.490446	6646.426457
5467.14121	7166.359044
5290.843679	7665.540986
5120.835417	8145.630863
4956.433136	8608.11508
4797.02268	9054.329649
4642.050504	9485.478737
4491.016371	9902.650542
4343.467091	10306.83092
0	15681.8094



KOLOM 1100 X 1100

PROFIL KOLOM 110 X 110		PERENCANAAN PENULANGAN KOLOM	
Diameter =	40 mm	P_u =	5794.94 kN
P_c =	25 Mpa	Mu_2 =	873.649 kNm
F_y =	360 Mpa	Mu_3 =	765.345 kNm
B =	1100 mm	Mu ekuivalen =	1008.70988 kNm
H =	1100 mm	Nod =	0.1916
Selimum =	40 mm	Mod =	0.0304
Senggang =	10 mm	Asumsi P = 3,5% maka	
d' =	70	As total =	42350 mm ²
d =	1030	As tulangan =	1256.6371 mm ²
Jml TulanganTekan =	36	n =	33.7011 ≈ 34 buah
As' =	45257.143 mm ²	KEADAAN SETIMBANG	
Jml Tulangan Tarik =	36	C_h =	643.75
As =	45257.143 mm ²	E_s' =	2.67E-03
As_t =	90514.286 mm ²	y =	0.0018
Ag =	1210000 mm ²	F_s' =	360 Mpa
BEBAN TERPUSAT		B_1 =	0.85
M_u =	0 kN	ab =	547.1875
P_u =	29314.5914 kN	$F_u(h)$ =	8313.8301 kN
LENTUR MURUNDI		$M_u(h)$ =	17258.6204 kNm
P_u =	0 kN		
a =	697.008403		
M_u =	9992.98708 kNm		



9992.9871	0
17742.63	4622.008973
17786.07	4815.729286
17826.10	5009.449598
17862.71	5203.169911
17895.89	5396.890223
17925.66	5590.610536
17952.01	5784.330848
17974.93	5978.051161
17994.44	6171.771473
18010.53	6365.491786
18023.19	6559.212098
18032.44	6752.932411
18038.27	6946.652723
17258.6204	8313.8301
16823.28321	9164.294952
16410.80833	9971.967963
16012.68026	10752.90864
15627.76336	11508.82571
15255.01672	12241.28535
14893.48455	12951.72566
14542.28762	13641.46958
14200.61574	14311.73613
13867.72112	14963.65046
13542.91249	15598.25266
13225.54985	16216.50573
12915.03978	16819.3025
0	29314.5915

LAMPIRAN II
PERANCANGAN JALAN

Perhitungan klasifikasi jalan

Titik	Koordinat		Sta	Daerah Penguasaan	Ketinggian		Beda Tinggi	Kelandaian Melintang
	X	Y			Kiri	Kanan		
A	11210	5394	10+ 195	20	59.8	60.9	1.1	5.5
1	11222.5	5415.65	10+ 220	20	59.8	60.7	0.9	4.5
2	11235	5437.3	10+ 245	20	59.8	60.6	0.8	4
3	11247.5	5458.95	10+ 270	20	59.7	60.6	0.9	4.5
4	11260	5480.6	10+ 295	20	59.6	61	1.4	7
5	11272.5	5502.3	10+ 320	20	59.9	61.6	1.7	8.5
6	11285	5523.9	10+ 345	20	60.2	61.6	1.4	7
7	11297.5	5545.6	10+ 370	20	60.3	61.6	1.3	6.5
8	11310	5567.2	10+ 395	20	60.3	61.9	1.6	8
9	11322.5	5588.9	10+ 420	20	60.6	62.4	1.8	9
I	11323	5589.7	10+ 421	20	60.6	62.5	1.9	9.5
10	11373	5589.7	10+ 471	20	62	65.2	3.2	16
11	11423	5589.7	10+ 521	20	64.3	64.5	0.2	1
12	11473	5589.7	10+ 571	20	65	62.6	2.4	12
13	11523	5589.7	10+ 621	20	62.5	62.6	0.1	0.5
14	11573	5589.7	10+ 671	20	63	62.9	0.1	0.5
15	11623	5589.7	10+ 721	20	63	63.5	0.5	2.5
16	11673	5589.7	10+ 771	20	63.4	64	0.6	3
17	11723	5589.7	10+ 821	20	63.9	64	0.1	0.5
18	11773	5589.7	10+ 871	20	64	64	0	0
19	11823	5592.7	10+ 921	20	64	64	0	0
20	11873	5592.7	10+ 971	20	64	64	0	0
21	11923	5594.7	10+ 21	20	64	64	0	0
22	11973	5594.7	10+ 71	20	64	65	1	5
23	12023	5594.7	11+ 121	20	64.6	65.3	0.7	3.5
24	12073	5594.7	11+ 171	20	65.2	66	0.8	4
II	12107	5590.1	11+ 205	20	65.7	66.4	0.7	3.5
25	12126.2	5574.1	11+ 230	20	66.3	66.9	0.6	3
26	12145.3	5557.9	11+ 255	20	66.8	67	0.2	1
27	12164.5	5541.9	11+ 280	20	67	66.7	0.3	1.5
28	12183.6	5525.8	11+ 305	20	67	65.7	1.3	6.5
29	12202.8	5509.8	11+ 330	20	66.6	64.5	2.1	10.5
30	12221.9	5493.7	11+ 355	20	64.7	63.5	1.2	6
31	12241.1	5477.6	11+ 380	20	63.4	63.1	0.3	1.5
32	12260.2	5461.6	11+ 405	20	62.8	62.8	0	0
33	12279.4	5445.5	11+ 430	20	62.3	62.6	0.3	1.5
B	12293	5431	11+ 447	20	62.1	62.3	0.2	1
Jumlah								158.5
Rata-Rata								4.284

DIAGRAM SUPERELEVASI SCS

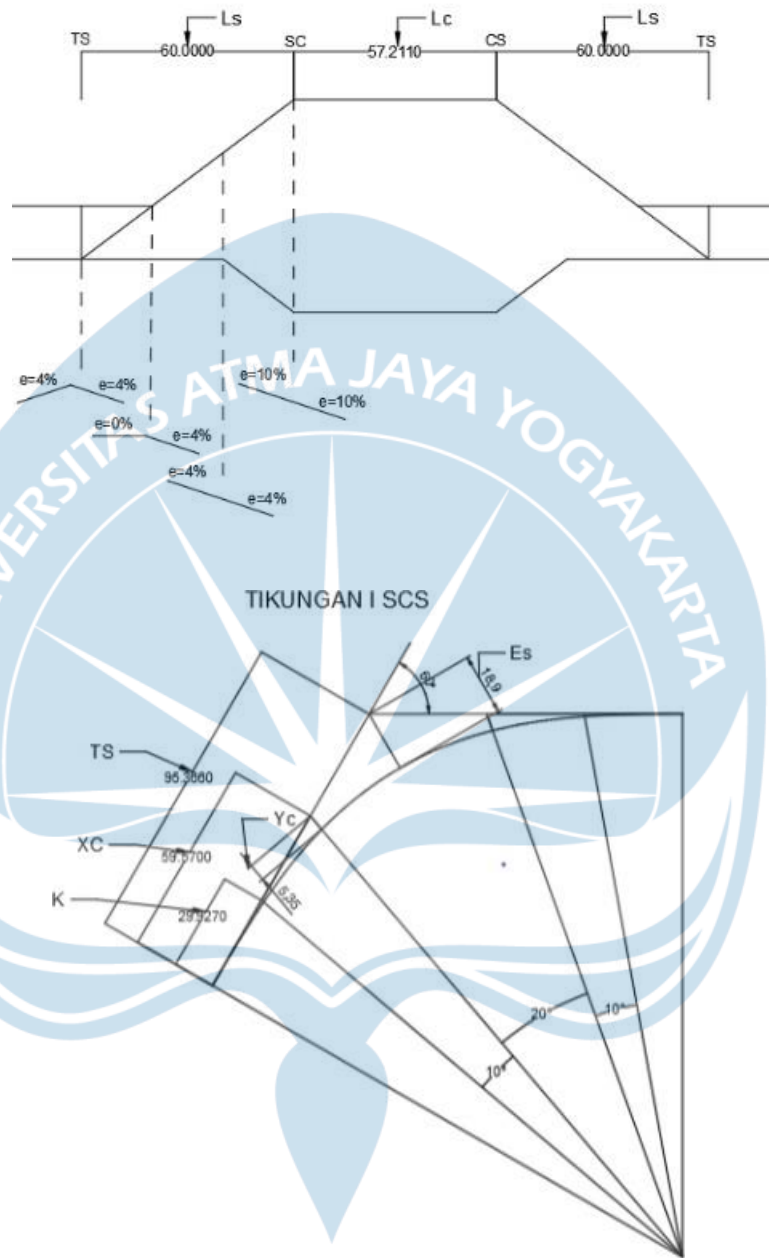
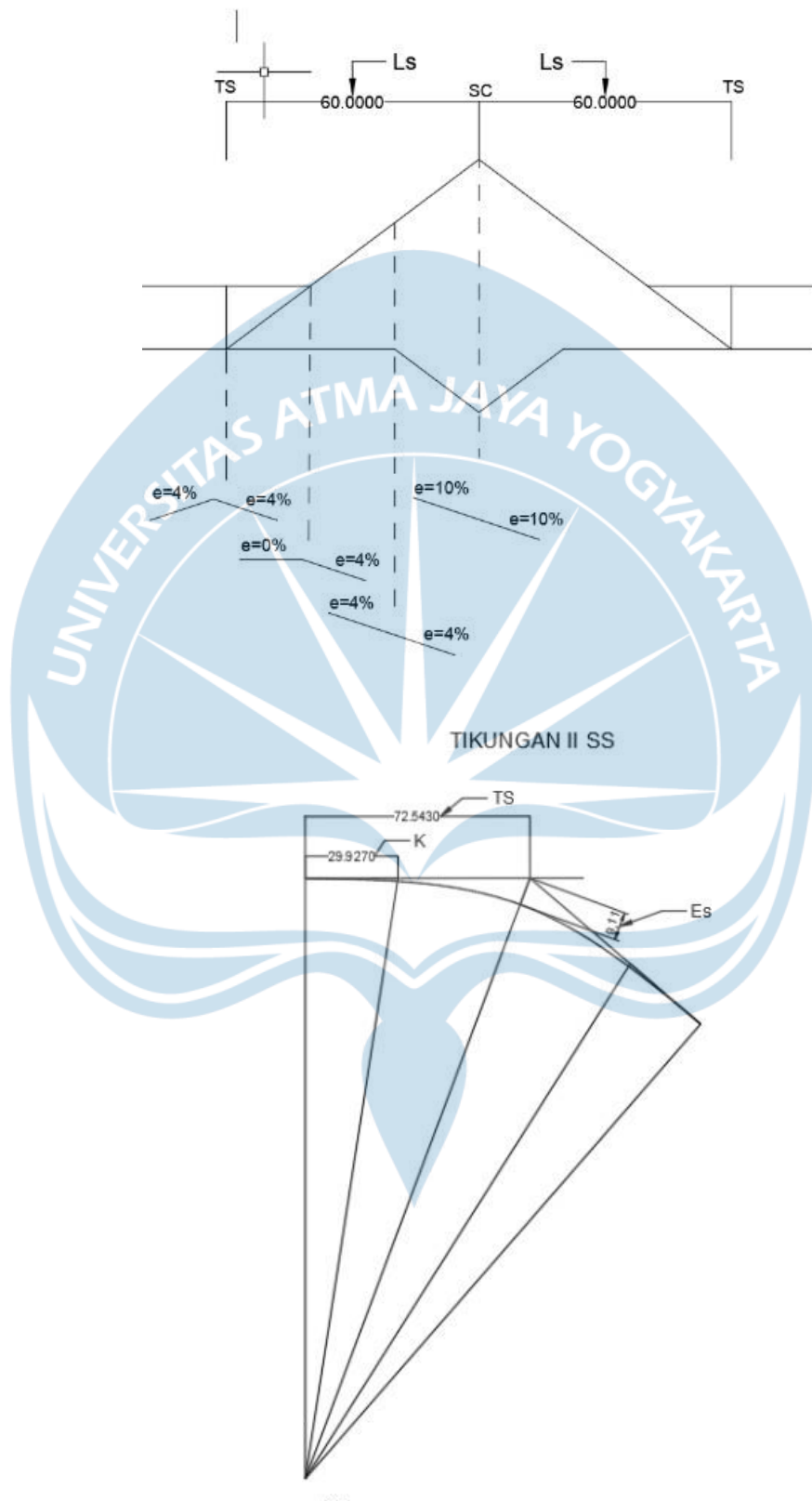


DIAGRAM SUPERELEVASI SS



➤ **Perhitungan STA di tikungan I**

$$\begin{aligned} \text{STA A} &= 10+195 \\ \text{STA I} &= \text{STA A} + d_{A-I} \\ &= 10+195 + 226 \\ &= 10+ 421 \\ \text{STA TS1} &= \text{STA I} - \text{TS} \\ &= 10+421 - 95,37 \\ &= 10+ 325,63 \\ \text{STA SC}_{11} &= \text{STA TS} + L_s \\ &= 10+325,63 + 60 \\ &= 10+ 385,63 \\ \text{STA SC}_{12} &= \text{STA TS} + (L_s/2) \\ &= 10+325,63 + (60/2) \\ &= 10+ 355,63 \\ \text{STA ST1} &= \text{STA I} + \text{TS} \\ &= 10+421 + 95,37 \\ &= 10+ 516,37 \\ \text{STA CS}_{11} &= \text{STA ST} - L_s \\ &= 10+516,37 - 60 \\ &= 10+ 456,37 \\ \text{STA CS}_{12} &= \text{STA ST} - (L_s/2) \\ &= 10+516,37 - (60/2) \\ &= 10+ 486,37 \end{aligned}$$

➤ **Perhitungan STA di tikungan II**

$$\begin{aligned} \text{STA I} &= 10+ 421 \\ \text{STA II} &= \text{STA I} + d_{I-II} \\ &= 10+421 + 784 \\ &= 11+ 205 \\ \text{STA TS2} &= \text{STA II} - \text{TS} \\ &= 11+205 - 72,54 \\ &= 11+ 117,46 \\ \text{STA ST2} &= \text{STA II} + \text{TS} \\ &= 11+205 + 72,54 \\ &= 11+ 262,54 \end{aligned}$$

➤ **Perhitungan Alinyemen Vertikal I**

Diketahui :

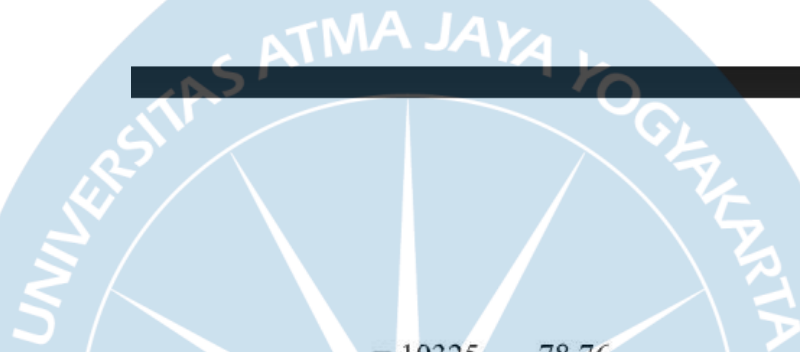
$$\begin{aligned} \text{Titik A} &= \text{STA } 10+ 195 \\ &\quad \text{Elevasi } 59,55 \\ \text{Titik TS1} &= \text{STA } 10+ 325 \\ &\quad \text{Elevasi } 59,55 \\ \text{Titik 3} &= \text{STA } 10+ 551 \\ &\quad \text{Elevasi } 64 \end{aligned}$$

Stasioning Lengkung Vertikal

$$\begin{aligned} \text{STA PLV1} &= \text{STA TS} - Lv \\ &= 10325 - 78,76 \\ &= 10285,6 \quad \text{STA 10+ 285,6} \end{aligned}$$

$$\text{STA A'1} = \text{STA TS} - Lv$$

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$$\begin{aligned} &= 10325 - 78,76 \\ &= 10305,3 \quad \text{STA 10+ 305,3} \\ \text{STA PPV1} &= \text{STA TS} \\ &= 10325 \quad \text{STA 10+ 325} \end{aligned}$$

$$\begin{aligned} \text{STA B'1} &= \text{STA TS} + Lv \\ &= 10325 + 78,76 \\ &= 10344,7 \quad \text{STA 10+ 344,7} \end{aligned}$$

$$\begin{aligned} \text{STA PTV1} &= \text{STA TS} + Lv \\ &= 10325 + 78,76 \\ &= 10364,4 \quad \text{STA 10+ 364,4} \end{aligned}$$

Elevasi Lengkung Vertikal

$$\begin{aligned}\text{Elev. PLV1} &= \text{Elev. TS1} - L_v \times g_1 \\ &= 59,55 - 78,76 \times 0 \\ &= 59,55 \text{ m}\end{aligned}$$

$$\begin{aligned}\text{Elev. A}' &= \text{Elev. TS1} - L_v \times g_1 + y \\ &= 59,55 - 78,76 \times 0 + 0,048 \\ &= 59,6 \text{ m}\end{aligned}$$

$$\begin{aligned}\text{Elev. PPV1} &= \text{Elev. TS} + E_v \\ &= 59,55 + 0,194 \\ &= 59,74 \text{ m}\end{aligned}$$

$$\begin{aligned}\text{Elev. B}' &= \text{Elev. TS1} + L_v \times g_2 + y \\ &= 59,55 + 78,76 \times 1,969 + 0,048 \\ &= 59,99 \text{ m}\end{aligned}$$

$$\begin{aligned}\text{Elev. PTV1} &= \text{Elev. TS1} + L_v \times g_2 \\ &= 59,55 + 78,76 \times 1,969 \\ &= 60,33 \text{ m}\end{aligned}$$

➤ Perhitungan Alinyemen Vertikal II

Diketahui :

$$\begin{aligned}\text{Titik TS1} &= \text{STA } 10+ 325 \\ &\quad \text{Elevasi } 59,55 \\ \text{Titik 3} &= \text{STA } 10+ 551 \\ &\quad \text{Elevasi } 64 \\ \text{Titik 12,5} &= \text{STA } 11+ 26 \\ &\quad \text{Elevasi } 64\end{aligned}$$

Stasioning Lengkung Vertikal

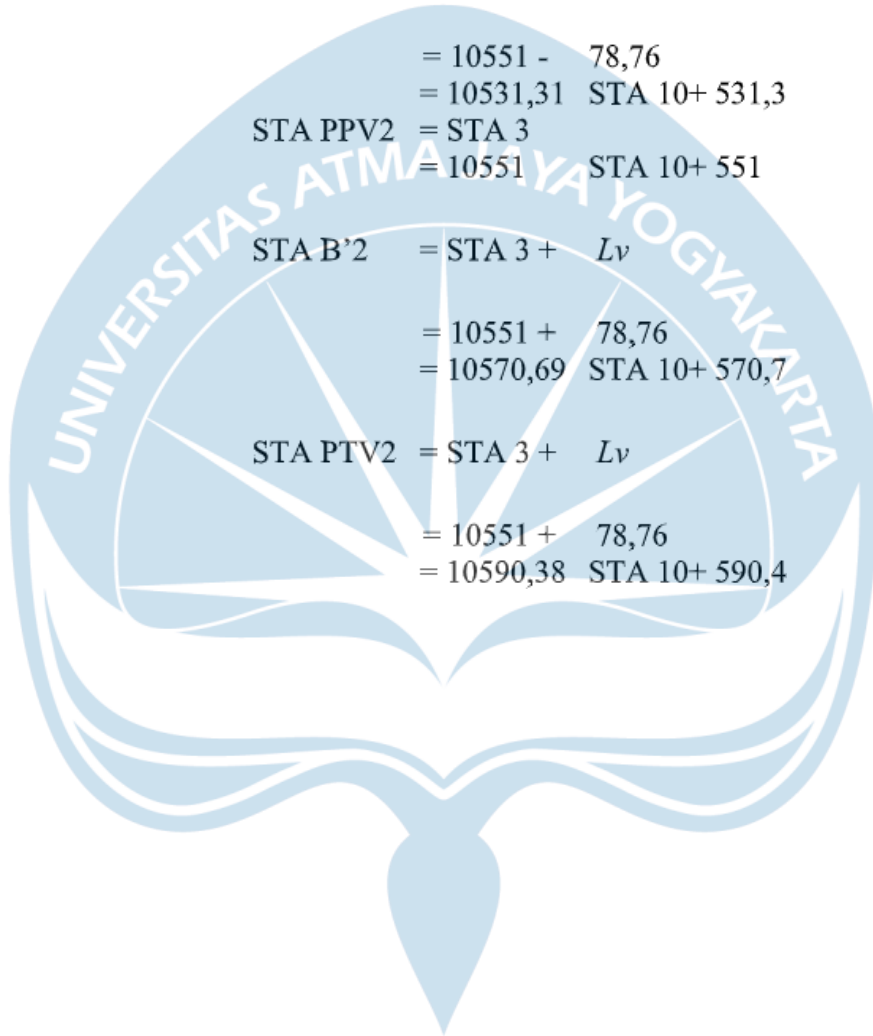
$$\begin{aligned} \text{STA PLV2} &= \text{STA 3} - L_v \\ &= 10551 - 78,76 \\ &= 10511,62 \quad \text{STA 10+ 511,6} \end{aligned}$$

$$\begin{aligned} \text{STA A'2} &= \text{STA 3} - L_v \\ &= 10551 - 78,76 \\ &= 10531,31 \quad \text{STA 10+ 531,3} \end{aligned}$$

$$\begin{aligned} \text{STA PPV2} &= \text{STA 3} \\ &= 10551 \quad \text{STA 10+ 551} \end{aligned}$$

$$\begin{aligned} \text{STA B'2} &= \text{STA 3} + L_v \\ &= 10551 + 78,76 \\ &= 10570,69 \quad \text{STA 10+ 570,7} \end{aligned}$$

$$\begin{aligned} \text{STA PTV2} &= \text{STA 3} + L_v \\ &= 10551 + 78,76 \\ &= 10590,38 \quad \text{STA 10+ 590,4} \end{aligned}$$



Elevasi Lengkung Vertikal

$$\begin{aligned}\text{Elev. PLV2} &= \text{Elev. 3} - L_v \times g_1 \\ &= 64 - 78,76 \times 1,969 \\ &= 63,22 \text{ m}\end{aligned}$$

$$\begin{aligned}\text{Elev. A'2} &= \text{Elev. 3} - L_v \times g_1 + y \\ &= 64 - 78,76 \times 1,969 + 0,048 \\ &= 63,66 \text{ m}\end{aligned}$$

$$\begin{aligned}\text{Elev. PPV2} &= \text{Elev. 3} + E_v \\ &= 64 + 0,194 \\ &= 64,19 \text{ m}\end{aligned}$$

$$\text{Elev. B'2} = \text{Elev. 3} + L_v \times g_2 + y$$

xiii

$$\begin{aligned}&= 64 + 78,76 \times 0 + 0,048 \\ &= 64,05 \text{ m}\end{aligned}$$

$$\begin{aligned}\text{Elev. PTV2} &= \text{Elev. 3} + L_v \times g_2 \\ &= 64 + 78,76 \times 0 \\ &= 64 \text{ m}\end{aligned}$$

➤ Perhitungan Alinyemen Vertikal III

Diketahui :

Titik 3	= STA 10+ 551
	Elevasi 64
Titik 12,5	= STA 11+ 26
	Elevasi 64
Titik B	= STA 11+ 427
	Elevasi 62,2

Stasioning Lengkung Vertikal

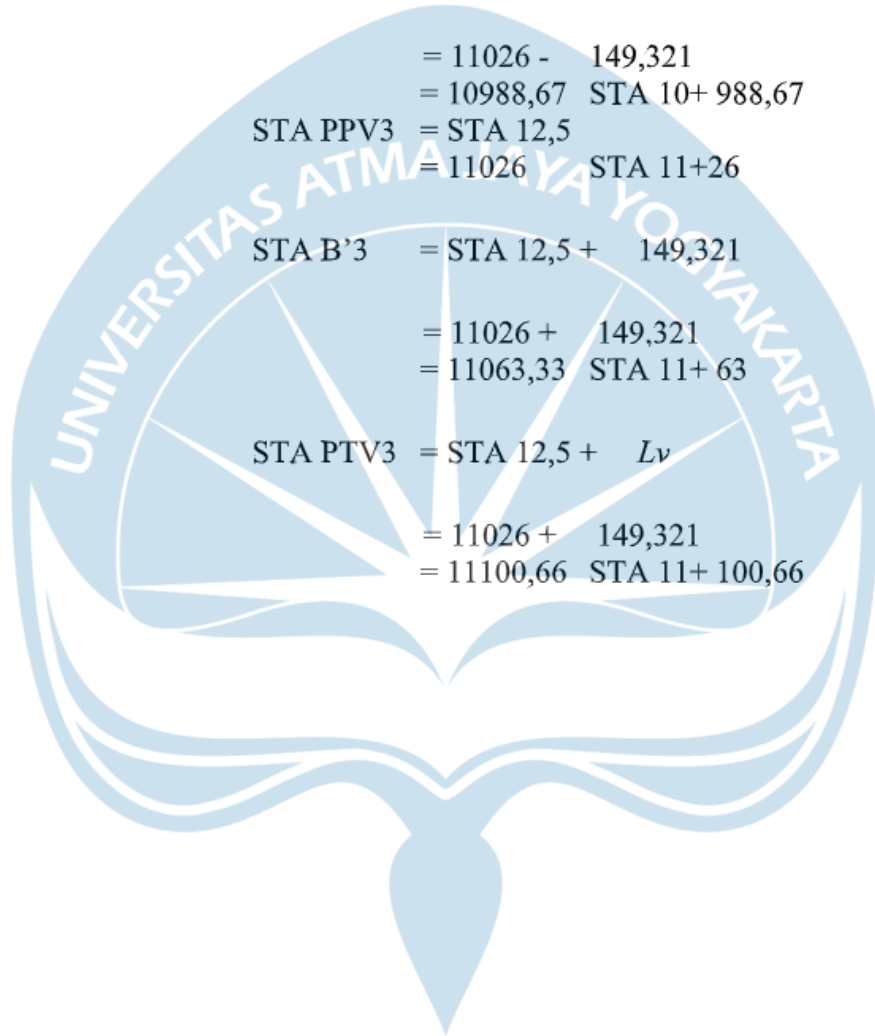
$$\begin{aligned}\text{STA PLV3} &= \text{STA } 12,5 - L_v \\ &= 11026 - 149,321 \\ &= 10951,34 \quad \text{STA } 10+ 951,34\end{aligned}$$

$$\begin{aligned}\text{STA A'3} &= \text{STA } 12,5 - L_v \\ &= 11026 - 149,321 \\ &= 10988,67 \quad \text{STA } 10+ 988,67\end{aligned}$$

$$\begin{aligned}\text{STA PPV3} &= \text{STA } 12,5 \\ &= 11026 \quad \text{STA } 11+26\end{aligned}$$

$$\begin{aligned}\text{STA B'3} &= \text{STA } 12,5 + 149,321 \\ &= 11026 + 149,321 \\ &= 11063,33 \quad \text{STA } 11+ 63\end{aligned}$$

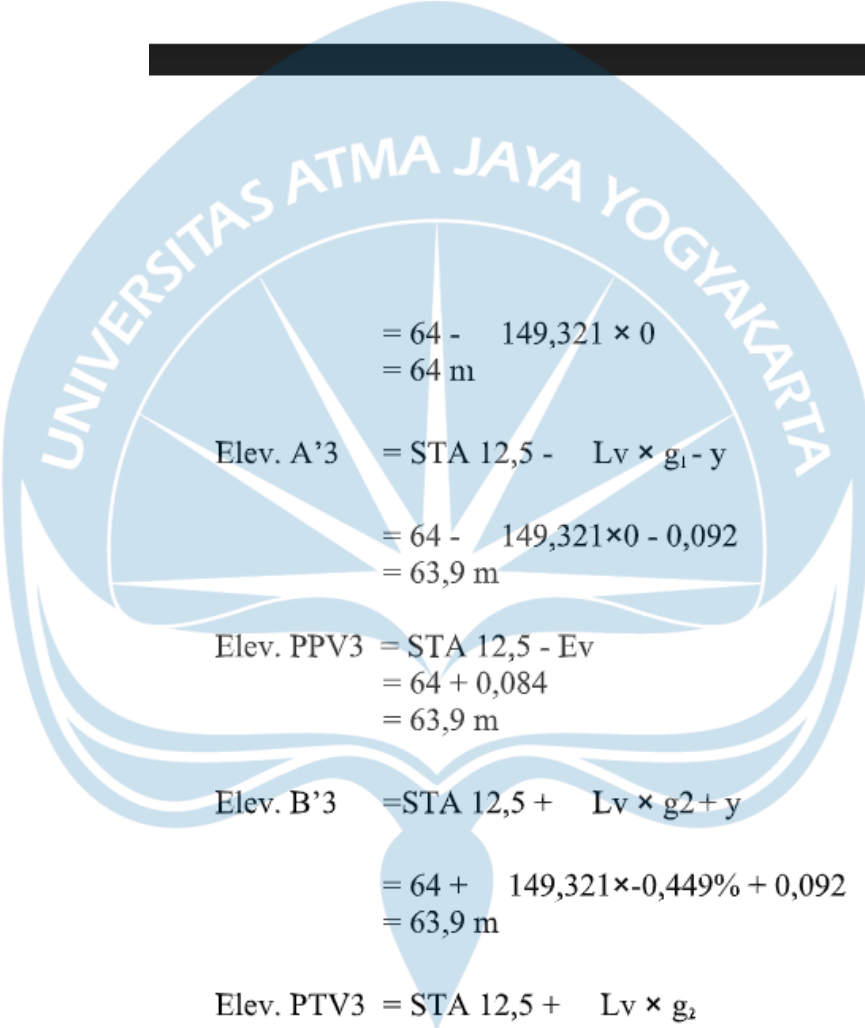
$$\begin{aligned}\text{STA PTV3} &= \text{STA } 12,5 + L_v \\ &= 11026 + 149,321 \\ &= 11100,66 \quad \text{STA } 11+ 100,66\end{aligned}$$



Elevasi Lengkung Vertikal

$$\text{Elev. PLV3} = \text{STA } 12,5 - L_v \times g_1$$

xiii



$$= 64 - 149,321 \times 0$$
$$= 64 \text{ m}$$

$$\text{Elev. A'3} = \text{STA } 12,5 - L_v \times g_1 - y$$
$$= 64 - 149,321 \times 0 - 0,092$$
$$= 63,9 \text{ m}$$

$$\text{Elev. PPV3} = \text{STA } 12,5 - E_v$$
$$= 64 + 0,084$$
$$= 63,9 \text{ m}$$

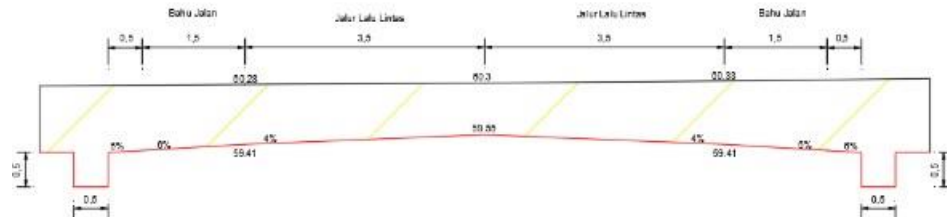
$$\text{Elev. B'3} = \text{STA } 12,5 + L_v \times g_2 + y$$
$$= 64 + 149,321 \times -0,449\% + 0,092$$
$$= 63,9 \text{ m}$$

$$\text{Elev. PTV3} = \text{STA } 12,5 + L_v \times g_2$$
$$= 64 + 149,321 \times -0,449\%$$
$$= 63,66 \text{ m}$$

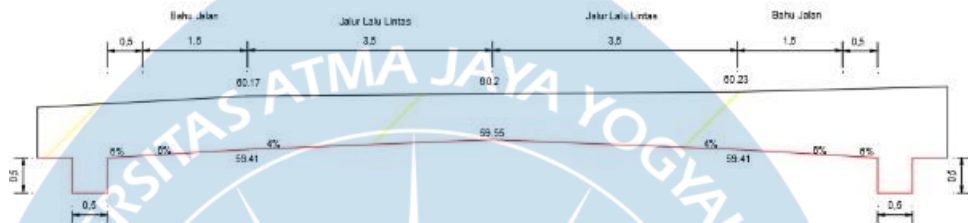
Stasioning potongan melintang

Section	STA	Elevasi			Beda Tinggi	Elevasi Rencana		
		Kiri	Center Line	Kanan		Kiri	Center Line	Kanan
A	10+195	60,28	60,30	60,33	0,05	59,41	59,55	59,41
1	10+245	60,17	60,20	60,23	0,06	59,41	59,55	59,41
2	10+295	60,27	60,30	60,34	0,07	59,41	59,55	59,41
TS1	10+325	60,65	60,70	60,72	0,07	59,41	59,55	59,41
SC12	10+355	60,78	60,80	60,83	0,05	60,22	60,36	60,22
SC11	10+385	60,86	60,90	60,94	0,08	60,62	60,76	60,62
I	10+414	61,38	61,40	61,43	0,05	61,43	61,57	61,43
CS11	10+441	62,78	62,80	62,82	0,04	62,24	62,38	62,24
CS12	10+471	63,95	63,90	63,87	0,08	62,65	62,79	62,65
ST1	10+501	66,95	66,90	66,85	0,10	63,05	63,19	63,05
3	10+551	63,26	63,30	63,35	0,09	63,86	64,00	63,86
4	10+601	62,94	62,90	62,88	0,06	63,86	64,00	63,86
5	10+651	62,62	62,60	62,56	0,06	63,86	64,00	63,86
6	10+701	63,21	63,20	63,19	0,02	63,86	64,00	63,86
7	10+751	63,61	63,60	63,57	0,04	63,86	64,00	63,86
8	10+801	64,00	64,00	64,00	0	63,86	64,00	63,86
9	10+851	64,00	64,00	64,00	0	63,86	64,00	63,86
10	10+901	64,00	64,00	64,00	0	63,86	64,00	63,86
11	10+951	64,00	64,00	64,00	0	63,86	64,00	63,86
12	11+ 1	64,26	64,30	64,34	0,08	63,86	64,00	63,86
13	11+ 51	64,43	64,40	64,39	0,04	63,74	63,88	63,74
14	11+101	64,90	64,90	64,90	0	63,50	63,64	63,50
TS2	11+114	65,10	65,10	65,09	0,01	63,38	63,52	63,38
II	11+184	66,28	66,30	66,32	0,04	63,14	63,28	63,14
ST2	11+254	67,00	67,00	67,00	0	62,90	63,04	62,90
15	11+304	65,32	65,30	65,29	0,03	62,66	62,80	62,66
16	11+354	63,43	63,40	63,38	0,05	62,42	62,56	62,42
17	11+404	62,45	62,40	62,38	0,07	62,18	62,32	62,18
B	11+427	62,22	62,20	62,17	0,05	62,06	62,20	62,06

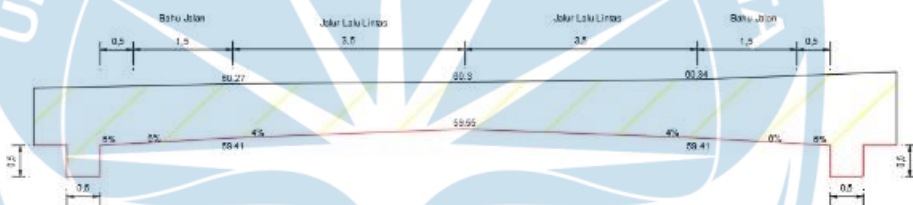
STA 10+195



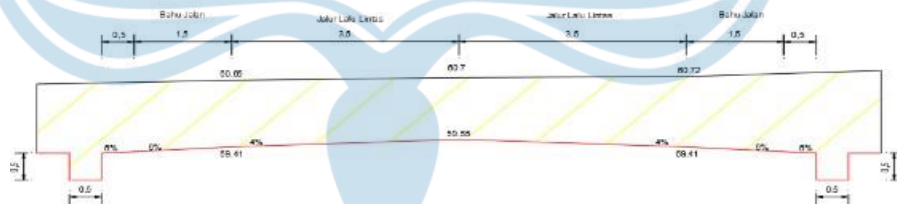
STA 10+245



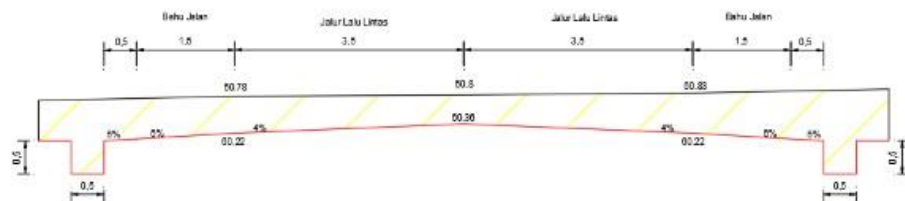
STA 10+295



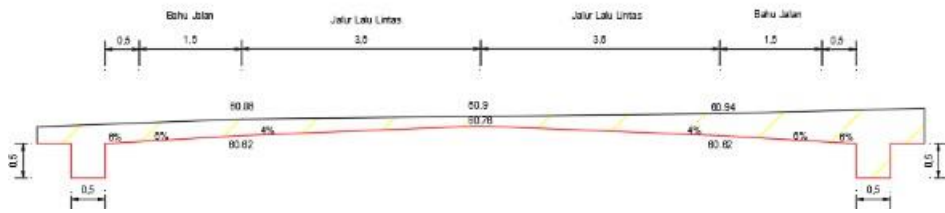
STA 10+325



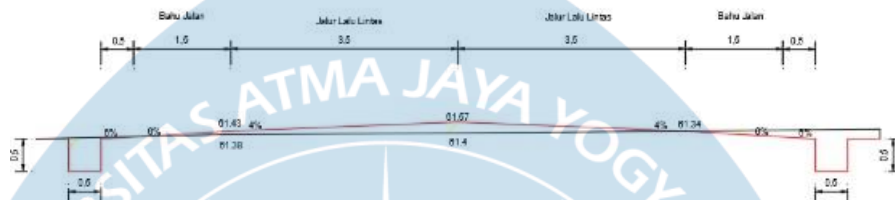
STA 10+355



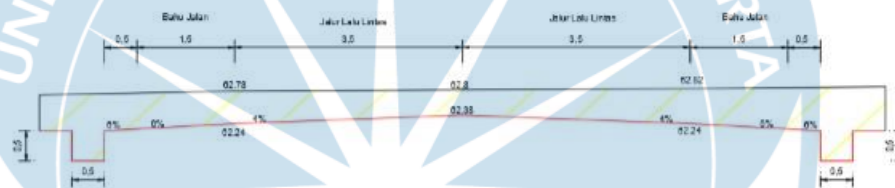
STA 10+385



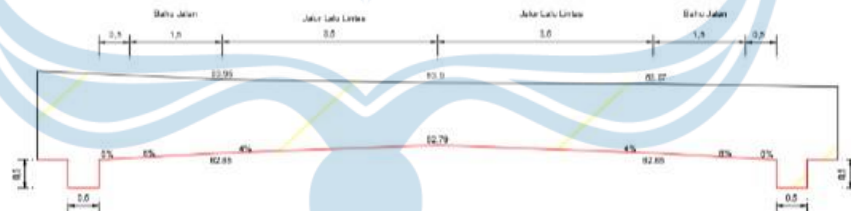
STA 10+414



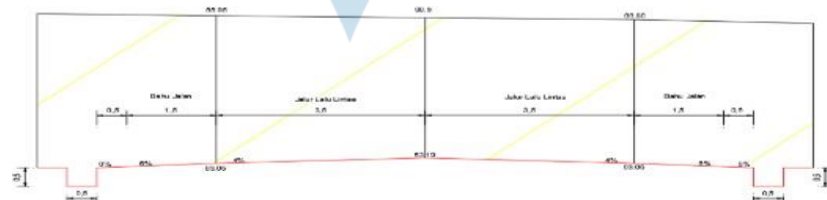
STA 10+441



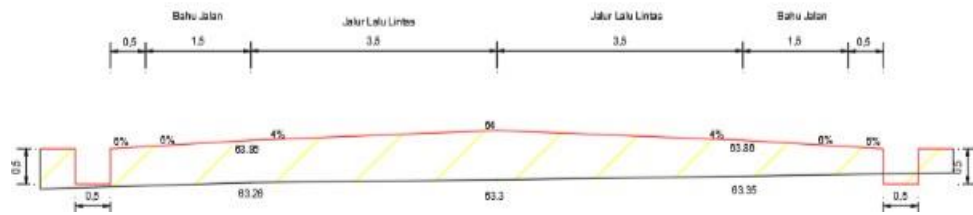
STA 10+471



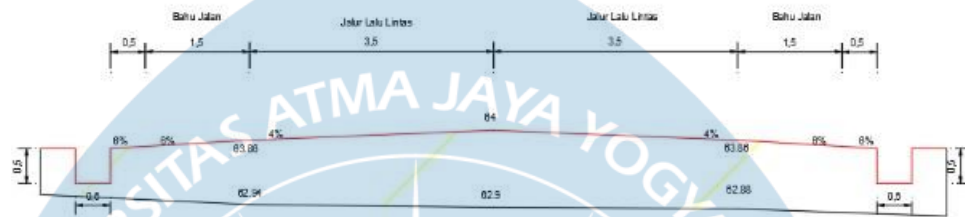
STA 10+501



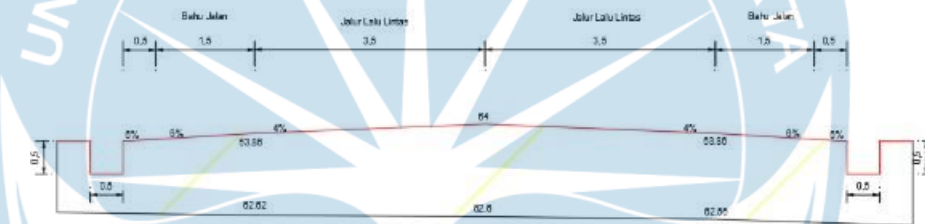
STA 10+551



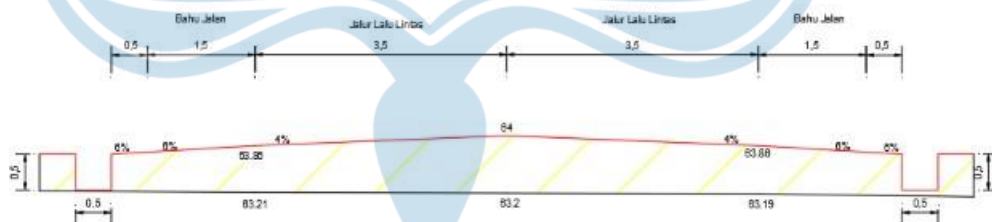
STA 10+601



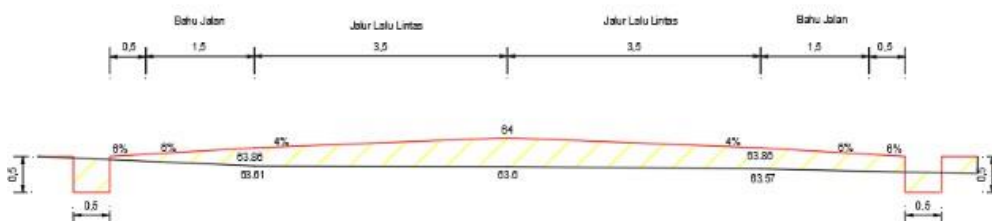
STA 10+651



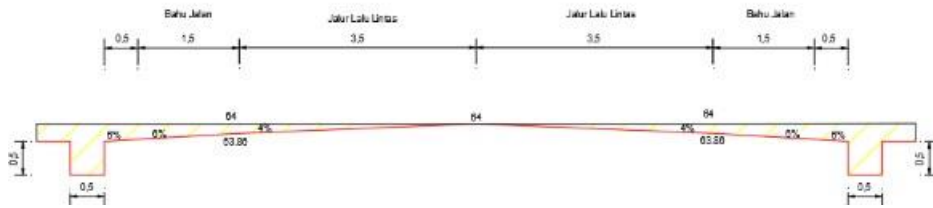
STA 10+701



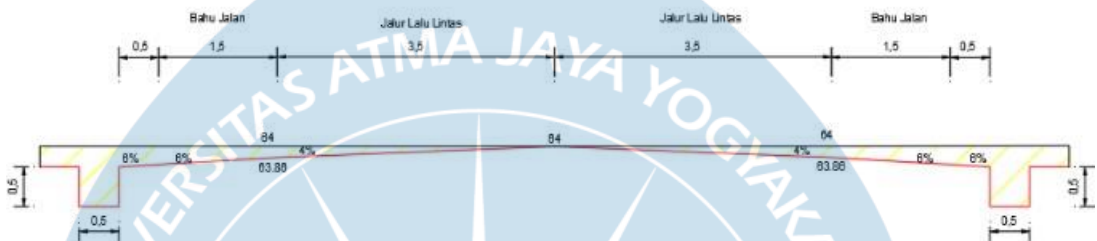
STA 10+751



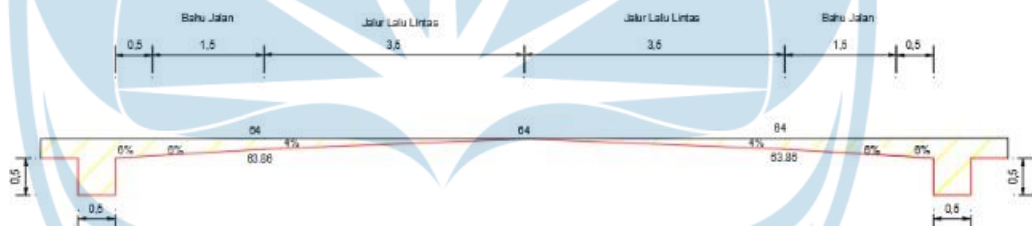
STA 10+801



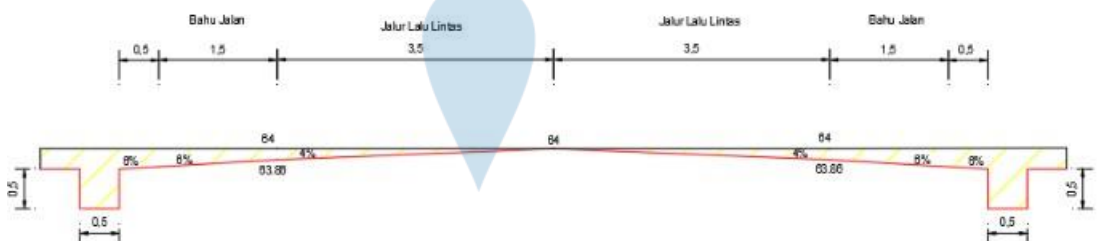
STA 10+851



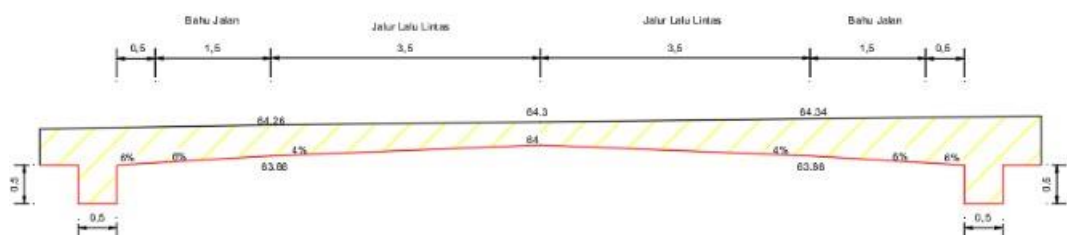
STA 10+901



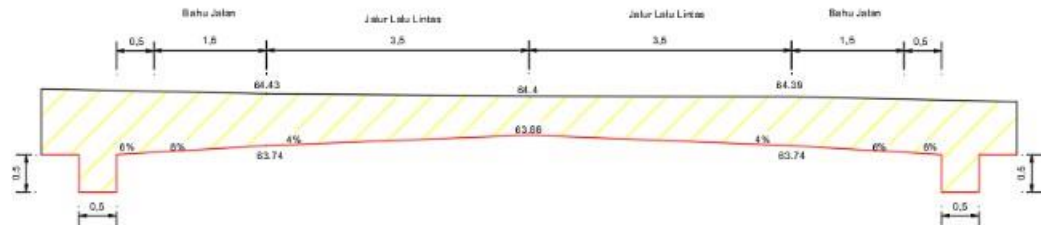
STA 10+951



STA 11+1



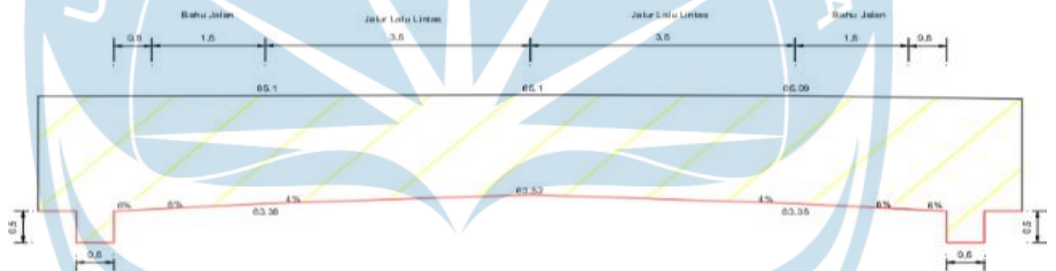
STA 11+51



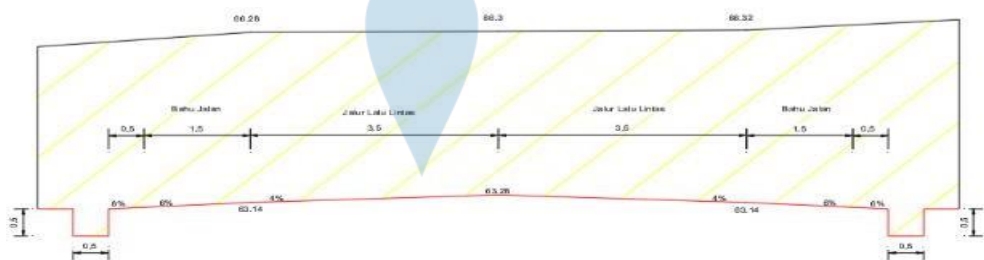
STA 11+101



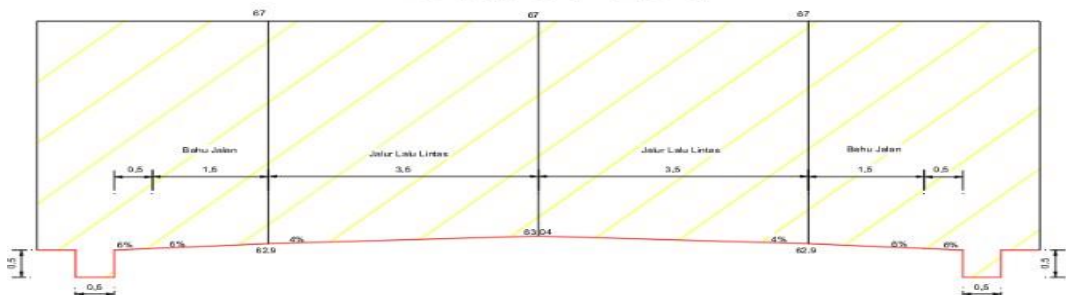
STA 11+114



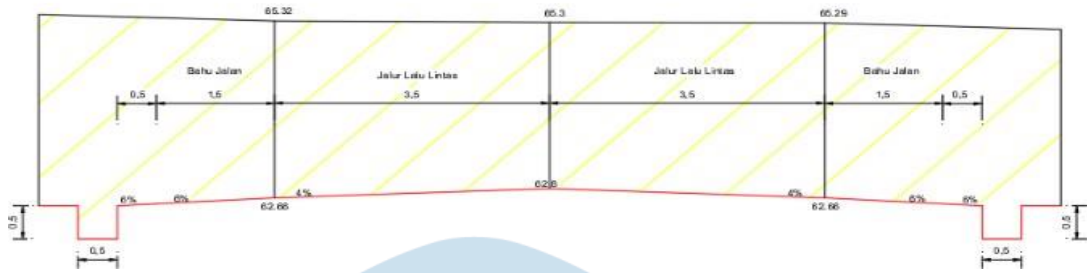
STA 11+184



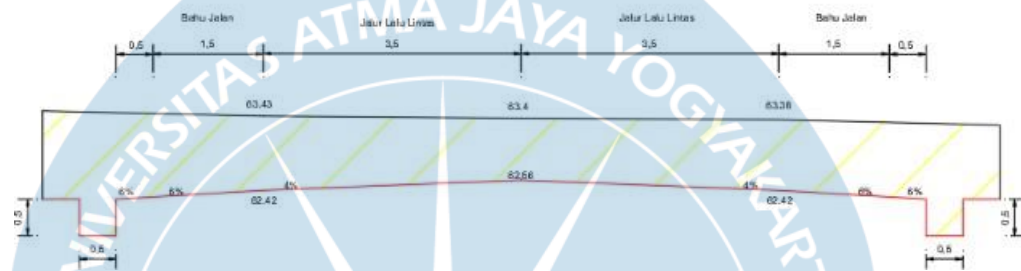
STA 11+254



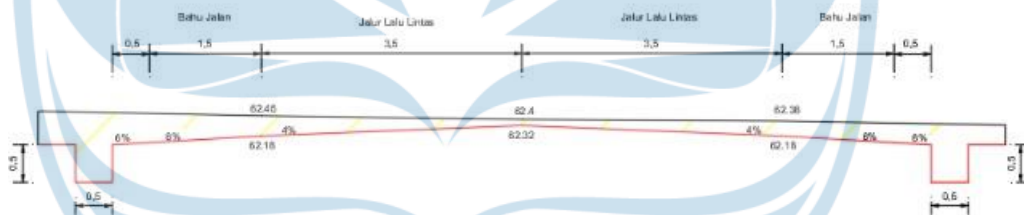
STA 11+304



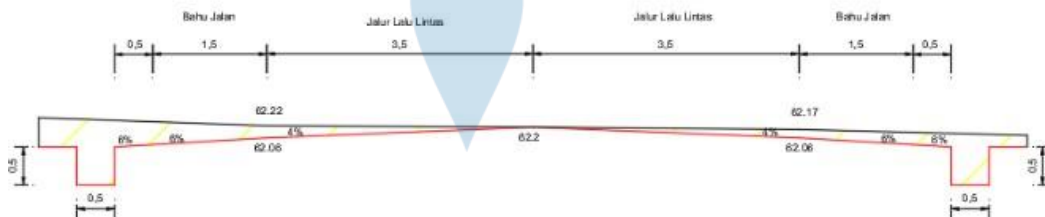
STA 11+354



STA 11+404



STA 11+427



Perhitungan galian dan timbunan

Section	STA	Luas (m ²)		Jarak	Volume (m ³)	
		Cut	Fill		Cut	Fill
A	10+ 195	12,123	0	50	568,625	0
1	10+ 245	10,622	0	50	570,025	0
2	10+ 295	12,179	0	30	440,28	0
TS1	10+ 325	17,173	0	30	378,555	0
SC12	10+ 355	8,064	0	30	182,04	0
SC11	10+ 385	4,072	0	29	70,673	22,0255
I	10+ 414	0,802	1,519	27	114,939	20,5065
CS11	10+ 441	7,712	0	30	369,765	0
CS12	10+ 471	16,939	0	30	1011,135	0
ST1	10+ 501	50,47	0	50	1263,575	171,975
3	10+ 551	0,073	6,879	50	1,825	468,225
4	10+ 601	0	11,85	50	0	698,025
5	10+ 651	0	16,071	50	0	604,95
6	10+ 701	0	8,127	50	9,325	284,85
7	10+ 751	0,373	3,267	50	67,225	81,675
8	10+ 801	2,316	0	50	115,8	0
9	10+ 851	2,316	0	50	115,8	0
10	10+ 901	2,316	0	50	115,8	0
11	10+ 951	2,316	0	50	212,4	0
12	11+ 1	6,18	0	50	383,425	0
13	11+ 51	9,157	0	50	695,85	0
14	11+ 101	18,677	0	13	268,632	0
TS2	11+ 114	22,651	0	70	2243,605	0
II	11+ 184	41,452	0	70	3333,26	0
ST2	11+ 254	53,784	0	50	2215,95	0
15	11+ 304	34,854	0	50	1202,95	0
16	11+ 354	13,264	0	50	419,05	0
17	11+ 404	3,498	0	23	66,6425	0
B	11+ 427	2,297	0	0	0	0
TOTAL		355,68	47,713		16437,1515	2352,232
SELISIH		307,967			14084,9195	

LAMPIRAN III

PERANCANGAN BANGUNAN AIR



Tabel 3.2 Data Tinggi Hujan

Luar: (ha)	% Fase Luas	GODEAN		KALIBAWANG		KENTENG		KALJOHO		BADRAN		PAJANGAN		TEGAL		GEMBONGAN		SEYEGAN		mm	mm
		CH (ha)	% Luasan	CH (ha)	% Luasan	CH (ha)	% Luasan	CH (ha)	% Luasan	CH (ha)	% Luasan	CH (ha)	% Luasan	CH (ha)	% Luasan	CH (ha)	% Luasan	CH (ha)	% Luasan		
190998.0	1910.0	5953.5	0.0	16524.0	0.1	7006.5	0.0	4293.0	0.0	132354	0.7	2875.5	0.0	13770.0	0.1	1296.0	0.0	6925.5	0.0		
Tahun	Tanggal	P1	P1*E1	P1	P2*E2	P3	P3*E3	P4	P4*E4	P5	P5*E5	P7	P7*E7	P8	P8*E8	P6	P6*E6	P6	P6*E6	Total P*E	Curah hujan rata-rata 1 tahun
2001	16-Nov	180.00	12.98	3.00	0.22	29.00	2.09	17.50	1.26	15.00	1.08	27.00	1.95	8.00	0.58	5.00	0.03	15.00	0.54	20.73	Curah Hujan Rata-Rata
	20 Okt	13.00	0.94	105.00	7.57	0.80	0.06	95.80	6.76	40.00	2.88	10.50	0.76	0.00	0.00	0.00	0.00	3.00	0.11	19.08	
	16-Feb	23.00	1.66	6.60	0.48	187.00	13.48	3.50	0.25	0.00	0.00	6.00	0.43	0.00	0.00	5.00	0.03	8.00	0.29	16.62	
	21-Jan	0.00	0.00	8.50	0.61	1.50	0.11	122.30	8.82	60.00	4.33	25.00	0.00	7.00	0.50	2.00	0.01	4.00	0.15	14.53	
	29-Jan	0.00	0.00	0.00	0.00	18.00	1.30	0.00	0.00	93.00	6.70	10.50	0.00	2.00	0.14	1.00	0.01	8.00	0.29	8.44	
	15-Jul	26.00	1.87	4.00	0.29	52.30	3.77	0.30	0.02	90.00	6.49	130.00	0.00	0.00	0.00	79.50	0.54	2.00	0.07	13.06	
	1-Jan	0.00	0.00	0.00	0.00	0.60	0.04	0.00	0.00	0.00	0.00	0.00	0.00	157.00	11.32	0.00	0.00	0.00	0.00	11.36	
	30-Jan	26.00	1.87	4.00	0.29	52.30	3.77	0.30	0.02	1.00	0.07	130.00	0.00	0.00	0.00	119.00	0.81	5.00	0.18	7.02	
	23-Nov	43.00	3.10	0.00	0.00	27.00	1.95	27.00	1.95	0.00	0.00	23.00	0.00	72.00	5.19	18.00	0.12	95.00	3.44	15.75	
2000	5-Feb	88.00	6.34	16.00	1.15	28.70	2.07	10.90	0.79	9.00	0.65	8.30	0.60	16.00	1.15	74.00	0.50	88.00	3.19	16.45	
	21-Jan	0.00	0.00	305.00	14.78	0.50	0.04	47.30	3.41	16.00	1.15	44.90	3.24	30.00	2.16	0.00	0.00	15.00	0.54	25.32	
	12-Mar	0.00	0.00	0.00	0.00	53.00	3.82	1.50	0.11	33.00	2.38	0.00	0.00	4.50	0.32	0.00	0.00	3.00	0.11	6.74	
	2-Sep	0.00	0.00	16.50	1.19	0.00	0.00	127.80	9.93	21.00	1.51	125.60	0.00	16.50	1.19	0.00	0.00	0.00	0.00	13.83	
	5-Jan	17.00	1.23	0.00	0.00	0.30	0.02	0.00	0.00	59.00	4.25	0.00	0.00	0.00	0.00	6.80	0.04	17.00	0.62	6.16	
	2-Nov	0.00	0.00	16.50	1.19	0.00	0.00	137.80	9.93	21.00	1.51	125.60	0.00	16.50	1.19	0.00	0.00	0.00	0.00	13.83	
	21-Nov	0.00	0.00	205.00	14.78	0.50	0.04	4.90	0.35	19.00	1.37	3.10	0.00	205.00	14.78	0.00	0.00	0.00	0.00	31.32	
	25-Feb	0.00	0.00	60.00	4.33	25.00	1.80	11.60	0.84	6.00	0.43	5.40	0.00	60.00	4.33	35.00	0.58	0.00	0.00	12.30	
	5-Feb	88.00	6.34	16.00	1.15	28.70	2.07	10.90	0.79	0.00	0.00	6.70	0.00	16.00	1.15	74.00	0.50	90.00	3.26	15.27	
1999	14-Mar	90	6.49	0.5	0.04	47.00	3.39	3.9	0.28	5	0.36	2.70	0.19	13	0.94	97.00	0.66	80.00	2.90	15.25	34.04
																					12.28

	27-Feb	80.00	5.77	84.00	6.06	55.00	3.97	61.90	4.46	27.00	1.95	54.30	5.91	61.00	4.40	44.00	0.30	10.00	0.36	31.17					
	16-Apr	35	2.82	68.3	4.92	58.00	4.18	17.5	1.26	5	0.36	10.70	0.77	122	8.80	53.00	0.36	30.00	1.09	24.27					
	3-Jan	15	1.08	17.9	1.29	8.00	0.58	79.5	5.73	3	0.22	75.40	0.00	79.5	5.73	3.00	0.02	75.40	2.73	17.38					
	12-Mar	43	3.10	43.2	3.11	0.00	0.00	1.3	0.09	75	5.41	0.70	0.00	1.3	0.09	75.00	0.44	0.70	0.07	12.28					
	3-Jan	15	1.08	17.9	1.29	8.00	0.58	79.5	5.73	3	0.22	75.40	0.00	79.5	5.73	3.00	0.02	75.40	2.73	17.38					
	2-Jan	86	6.20	55.1	3.97	4.00	0.29	30	2.16	12	0.87	22.60	0.00	237	17.09	51.00	0.35	86.00	3.12	34.04					
	28-Feb	60	4.33	10	0.72	12.30	0.89	12.3	0.89	21	1.51	8.40	0.00	29	2.09	109.00	0.74	90.00	3.26	14.43					
	14-Mar	90	6.49	0.5	0.04	47.00	3.39	3.9	0.28	5	0.36	0.00	0.00	13	0.94	97.00	0.66	90.00	3.26	15.41					
	1998	21-Dec	103	7.43	9	0.65	0.00	0.00	29	2.09	3	0.22	21.30	1.54	9	0.65	29.00	0.20	103.00	3.73	16.50				
		14-Jan	0.00	0.00	85.00	6.13	0.00	0.00	0.00	0.00	5.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.49	21.73	6.49		
		3-Apr	0	0.00	6	0.43	70.60	5.05	13	0.94	17	1.23	5.10	0.37	0	0.00	13.00	0.09	0.00	0.00	8.10				
		16-Jun	15	1.08	85	6.13	7.00	0.50	105	7.57	72	5.19	100.80	0.00	0	0.00	105.00	0.71	15.00	0.54	21.73				
		17-Jan	6	0.43	0	0.00	20.00	1.44	8	0.58	75	5.41	6.70	0.00	0	0.00	8.00	0.05	6.00	0.22	8.13				
		16-Jun	15	1.08	85	6.13	7.00	0.50	105	7.57	72	5.19	100.80	0.00	0	0.00	105.00	0.71	15.00	0.54	21.73				
		14-Jun	0	0.00	0	0.00	0.00	0	0.00	5	0.36	0.00	0.00	85	6.13	0.00	0.00	0.00	0.00	0.00	6.49				
		16-Jun	15	1.08	85	6.13	7.00	0.50	105	7.57	72	5.19	91.20	0.00	0	0.00	105.00	0.71	15.00	0.54	21.73				
		21-Dec	103	7.43	9	0.65	0.00	0.00	29	2.09	3	0.22	16.30	0.00	9	0.65	29.00	0.20	103.00	3.73	14.96				
		1997	16-Jan	51	3.68	80.79	5.82	4.00	0.29	9.6	0.69	0	0.00	2.10	0.15	80.79	5.82	12.00	0.08	0.00	16.54				
			3-Feb	13.00	0.94	451.61	32.56	5.00	0.36	7.90	0.54	9.00	0.65	1.30	0.09	451.61	32.56	11.00	0.07	0.00	67.77				
			5-Jan	16	1.15	55.88	4.03	50.00	3.60	12.9	0.93	0	0.00	4.90	0.35	55.88	4.03	22.00	0.15	25.00	0.91	15.15			
			12-Feb	0	0.00	132.72	9.57	3.00	0.22	76.2	5.49	20	1.44	74.30	0.00	132.72	9.57	0.00	0.00	0.00	26.29				
			12-Dec	0	0.00	59.26	4.27	9.00	0.65	9.6	0.69	61	4.40	7.80	0.00	59.26	4.27	2.00	0.01	0.00	14.30				
			12-Feb	0	0.00	132.72	9.57	3.00	0.22	76.2	5.49	20	1.44	74.30	0.00	132.72	9.57	0.00	0.00	0.00	26.29				
			3-Feb	13	0.94	451.61	32.56	5.00	0.36	7.5	0.54	9	0.65	5.10	0.00	451.61	32.56	11.00	0.07	0.00	67.68				
			13-Feb	0	0.00	254.48	18.38	25.00	1.80	21.3	1.54	5	0.36	16.80	0.00	254.48	18.38	160.00	1.09	65.00	2.36	43.83			
			16-Jan	51	3.68	80.79	5.82	4.00	0.29	9.6	0.69	6	0.43	6.20	0.00	80.79	5.82	12.00	0.08	0.00	19.18				
			1996	11-Dec	96	6.92	15	1.08	35.00	2.52	71.4	5.15	3	0.22	64.70	4.66	89	5.77	71.40	0.48	15.00	0.54	27.35	27.35	6.71
			1-Nov	0.00	0.00	75.00	5.41	5.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	75.00	2.72	8.49			

	9-Okt	0	0.00	25	1.80	69.00	4.97	0	0.00	0	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	7.14				
	19-Apr	0	0.00	0	0.00	0.00	0.00	75	5.41	11	0.79	72.60	0.00	0	0.00	75.00	0.51	0.00	0.00	0.00	6.71				
	23-Jan	52	2.31	0	0.00	0.00	0.00	1.6	0.12	55	3.97	0.90	0.00	32	2.31	1.60	0.01	40.00	0.00	8.71					
	19-Apr	0	0.00	0	0.00	0.00	0.00	75	5.41	11	0.79	72.60	0.00	0	0.00	75.00	0.51	0.00	0.00	0.00	6.71				
	11-Dec	96	6.92	15	1.08	0.00	0.00	0	0.00	3	0.22	0.00	0.00	80	5.77	71.40	0.48	15.00	0.54	15.01					
	19-Apr	0	0.00	0	0.00	0.00	0.00	75	5.41	11	0.79	72.60	0.00	0	0.00	75.00	0.51	0.00	0.00	0.00	6.71				
	12-Dec	0	0.00	75	5.41	25.00	1.80	42	3.03	6	0.43	36.90	0.00	0	0.00	42.00	0.20	75.00	2.72	13.67					
		1995	26-Nov	96	6.92	2.6	0.19	11.5	0.83	5.3	0.38	18	1.30	0.00	0	0.00	1.40	0.01	30.00	1.81	11.44				
			21-Jan	43.00	3.10	135.5	9.77	12.00	0.87	83.30	6.01	11.00	0.79	74.60	5.38	120.00	8.65	5.00	0.03	40.00	1.45	36.05			
			3-Feb	0	0.00	8.5	0.61	34.00	2.45	141.5	10.20	0	0.00	123.60	8.91	37	2.67	13.00	0.09	0.00	24.93				
			6-Jan	46	3.32	3.2	0.23	0.00	0.00	146.8	10.38	10	0.72	127.90	0.00	5	0.36	12.00	0.08	0.00	15.29				
			16-Nov	69	4.97	8.5	0.61	0.00	0.00	20.3	1.46	51	3.68	18.80	0.00	28	2.02	0.80	0.01	35.00	1.27	14.02			
			6-Jan	46	3.32	3.2	0.23	0.00	0.00	146.8	10.38	10	0.72	127.90	0.00	5	0.36	12.00	0.08	0.00	15.29				
			20-Jun	43	3.10	135.5	9.77	12.00	0.87	83.3	6.01	25	1.30	76.40	0.00	120	8.65	5.00	0.03	40.00	1.45	31.68			
			4-Feb	29	4.25	0	0.00	0.00	0.00	1.4	0.10	0	0.00	0.00	0	0.00	138.00	0.94	3.00	0.11	5.40				
			26-Nov	92	6.63	2.4	0.17	9.5	0.68	5.3	0.38	0	0.00	1.60	0.00	0	0.00	1.4	0.01	30.00	1.81	9.70			
			1994	10-Mar	34	6.06	6.9	0.50	31.8	2.29	7.2	0.52	29	2.09	2.60	0.19	14	1.01	2.00	0.01	25.00	0.91	13.57		
			8-Mar	940	0.65	36.5	6.24	46.00	3.32	1.30	0.09	31.00	2.23	0.00	0.00	57.00	4.11	39.00	0.26	0.00	16.90				
			23-Mar	17	1.23	12	0.87	79.3	5.71	18.5	1.33	30	2.16	4.70	0.34	39	2.81	4.00	0.03	30.00	1.09	15.56			
			14-Nov	0	0.00	0	0.00	0.00	0.00	135.7	9.78	10	0.72	129.30	0.00	0	0.00	0.00	0.00	0.00	10.50				
			14-Jan	26	1.87	11	0.79	1.3	0.09	8.2	0.59	65	4.54	6.10	0.00	33	2.38	5.00	0.03	10.00	0.36	10.67			
			14-Nov	0	0.00	0	0.00	0.00	0.00	135.7	9.78	10	0.72	129.30	0.00	0	0.00	0.00	0.00	0.00	10.50				
			23-Feb	49	3.53	26.5	1.91	0.00	0.00	0	0.00	60	4.33	0.00	0.00	104	7.50	0.00	0.00	30.00	1.09	18.35			
			15-Nov	0	0.00	0	0.00	7.00	0.50	0	0.00	0	0.00	0.00	0.00	3	0.22	83.00	0.56	0.00	1.28				
			27-Jan	46	3.32	3.5	0.25	3.2	0.23	0	0.00	40	2.88	0.00	0.00	9	0.65	4.00	0.03	115.00	4.17	11.53			
			1993	8-Dec	96	6.92	0	0.00	51.00	3.68	9.4	0.68	0	0.00	4.30	0.31	5	0.36	3.00	0.02	45.00	1.63	13.60		
			16-Apr	12.00	0.87	80.00	5.77	0.00	0.00	2.40	0.17	25.00	1.30	0.00	0.00	86.00	6.20	0.00	0.00	17.00	0.62	15.42			
			3-Mai	0	0.00	18	1.30	185.00	13.34	0	0.00	20	1.44	0.00	0.00	0	0.00	40.00	0.27	120.00	4.35	20.70	20.70	6.89	

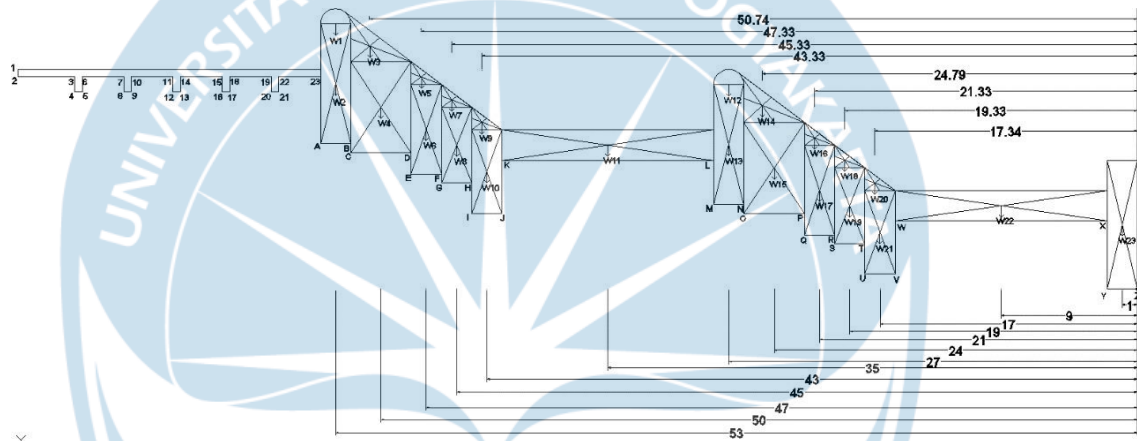
	24-Dec	41	2.96	2.5	0.18	17.00	1.23	103.8	7.48	13	0.94	97.60	0.00	0	0.00	134.00	0.91	35.00	1.27	14.96			
	4-Mai	0	0.00	0	0.00	0.00	0	0.00	93	6.70	0.00	0.00	0	0.00	0.00	0.00	5.00	0.18	6.89				
	24-Dec	41	2.96	2.5	0.18	17.00	1.23	103.8	7.48	13	0.94	97.60	0.00	0	0.00	134.00	0.91	35.00	1.27	14.96			
	19-Dec	0	0.00	44.5	3.21	38.00	2.74	23.3	1.68	0	0.00	16.10	0.00	0.00	98	7.07	0.00	0.00	80.00	2.90	17.59		
	24-Dec	41	2.96	2.5	0.18	17.00	1.23	103.8	7.48	13	0.94	94.50	0.00	0	0.00	134.00	0.91	35.00	1.27	14.96			
	4-Mai	40	2.88	0	0.00	0.00	0.00	0	0.00	12	0.87	0.00	0.00	0	0.00	0.00	0.00	120.00	4.35	8.10			
		1992	11-Jan	115	8.15	43.3	3.12	9.00	0.65	0	0.00	22	1										

Tahun	n	Hujan (Xi)	(Xi-Xrt)	(Xi-Xrt)^2	(Xi-Xrt)^3	(Xi-Xrt)^4
1992	1	20.73	-9.07	82.23	-745.65	6761.55
1993	2	31.32	1.52	2.32	3.53	5.37
1994	3	34.04	4.24	17.99	76.33	323.80
1995	4	21.73	-8.07	65.09	-525.17	4237.05
1996	5	67.77	37.97	1441.87	54750.79	2078997.13
1997	6	27.35	-2.45	5.99	-14.67	35.91
1998	7	36.05	6.25	39.09	244.38	1527.83
1999	8	18.35	-11.45	131.06	-1500.34	17175.86
2000	9	20.70	-9.10	82.77	-753.07	6851.47
2001	10	19.94	-9.86	97.18	-958.00	9443.98
Total		297.9800	0.0000	1965.60	50578.13	2125359.95
X rerata		29.80				

Xmax		67.77
Xmin		18.35
K	$1 + \frac{3,322}{\log(n)}$	4.32
DoF	$k - R - 1$	2.00
α	0,05 = 5%	
Dari tabel Chi kuadrat, diperoleh harga X^2 sebesar 5,991		
Ef	n / k	2.0000
Dx	$\frac{(X \text{ max} - X \text{ min})}{(K - 1)}$	12.3550
X awal	$X \text{ min} - (0,5 Dx)$	12.1725

Nomor	Nilai Batasan			Of	Ef	(Of-Ef) ²	(Of-Ef) ² / Ef
1	12.1725	< X <	24.5275	5	2	9	1.8
2	24.5275	< X <	36.8825	4	2	4	1.0
3	36.8825	< X <	49.2375	0	2	4	0.0
4	49.2375	< X <	61.5925	0	2	4	0.0
5	61.5925	< X <	73.9475	1	2	1	1.0
				10	10		
X²							3.8

Tahun	n	Hujan (Xi)	Urutan Data	P(x)	P(x<)	P'(x)	P'(x<)	D
			Terbesar	(n / m + 1)	(I-P(x))	(n/m-1)	(1-P'(x))	
1992	1	20.73	67.77	0.09091	0.90909	0.11111	0.88889	0.02020
1993	2	31.32	36.05	0.18182	0.81818	0.22222	0.77778	0.04040
1994	3	34.04	34.04	0.27273	0.72727	0.33333	0.66667	0.06061
1995	4	21.73	31.32	0.36364	0.63636	0.44444	0.55556	0.08081
1996	5	67.77	27.35	0.45455	0.54545	0.55556	0.44444	0.10101
1997	6	27.35	21.73	0.54545	0.45455	0.66667	0.33333	0.12121
1998	7	36.05	20.73	0.63636	0.36364	0.77778	0.22222	0.14141
1999	8	18.35	20.70	0.72727	0.27273	0.88889	0.11111	0.16162
2000	9	20.70	19.94	0.81818	0.18182	1.00000	0.00000	0.18182
2001	10	19.94	18.35	0.90909	0.09091	1.11111	-0.11111	0.20202



Tabel 5.1 Perhitungan Uplift

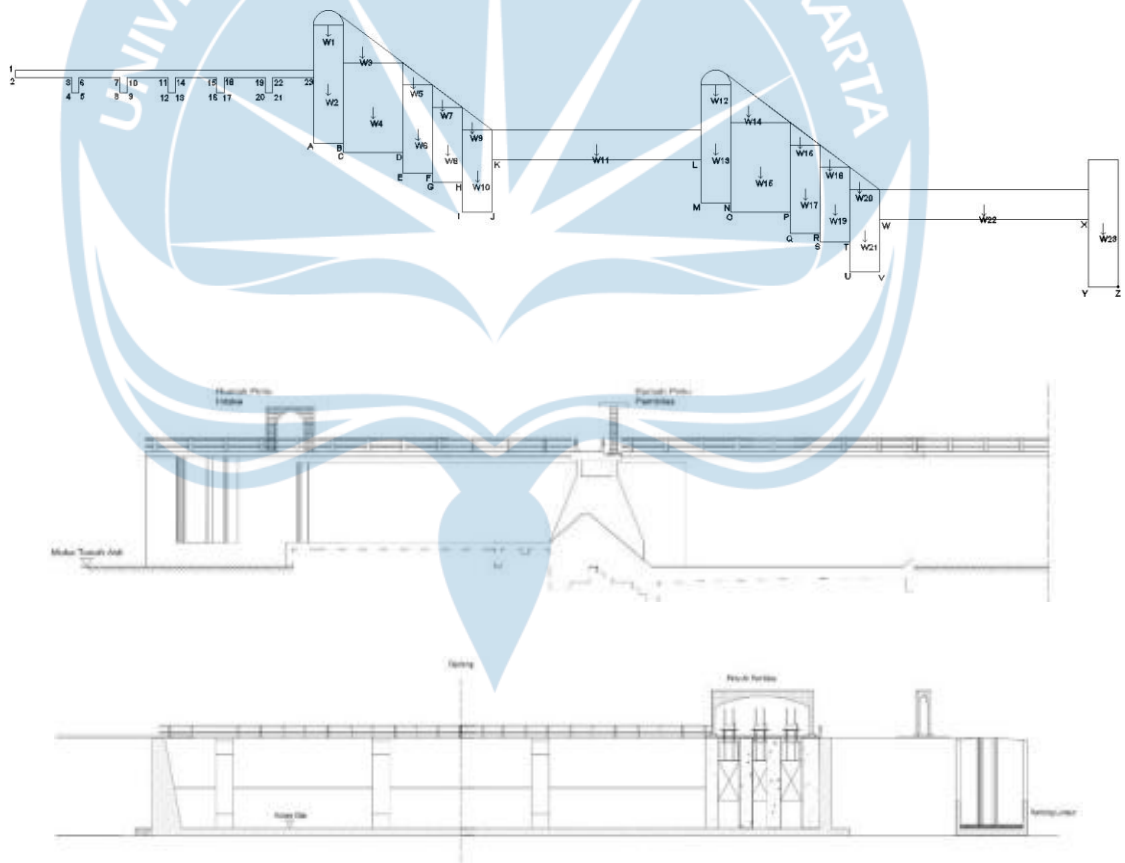
Titik	Koordinat		Jalur	L _y (m)	L _h (m)	L _x (m)	L (m)	H _x (m)	Δh (m)	U _x (m)	Gaya angkat (KN/m)
	x (m)	y (m)									
A	0	0				0,00	16,43	1,55	4,40	1,55	
B	0,5	0	A-B	0	0,5	0,17	16,43	1,55	4,40	1,51	0,76
C	0,5	2	B-C	2	0	2,17	16,43	1,55	4,40	0,97	0,00
D	2	2	C-D	0	1,5	2,67	16,43	1,55	4,40	0,84	1,35
E	2	1,5	D-E	0,5	0	3,17	16,43	1,55	4,40	0,70	0,00
F	2,75	1,5	E-F	0	0,75	3,42	16,43	1,55	4,40	0,64	0,50
G	2,75	2	F-G	0,5	0	3,92	16,43	1,55	4,40	0,50	0,00
H	4,5	2	G-H	0	1,75	4,50	16,43	1,55	4,40	0,35	0,74
I	4,5	1,5	H-I	0,5	0	5,00	16,43	1,55	4,40	0,21	0,00
J	5,25	1,5	I-J	0	0,75	5,25	16,43	1,55	4,40	0,14	0,13
K	5,25	2	J-K	0,5	0	5,75	16,43	1,55	4,40	0,00	0,00

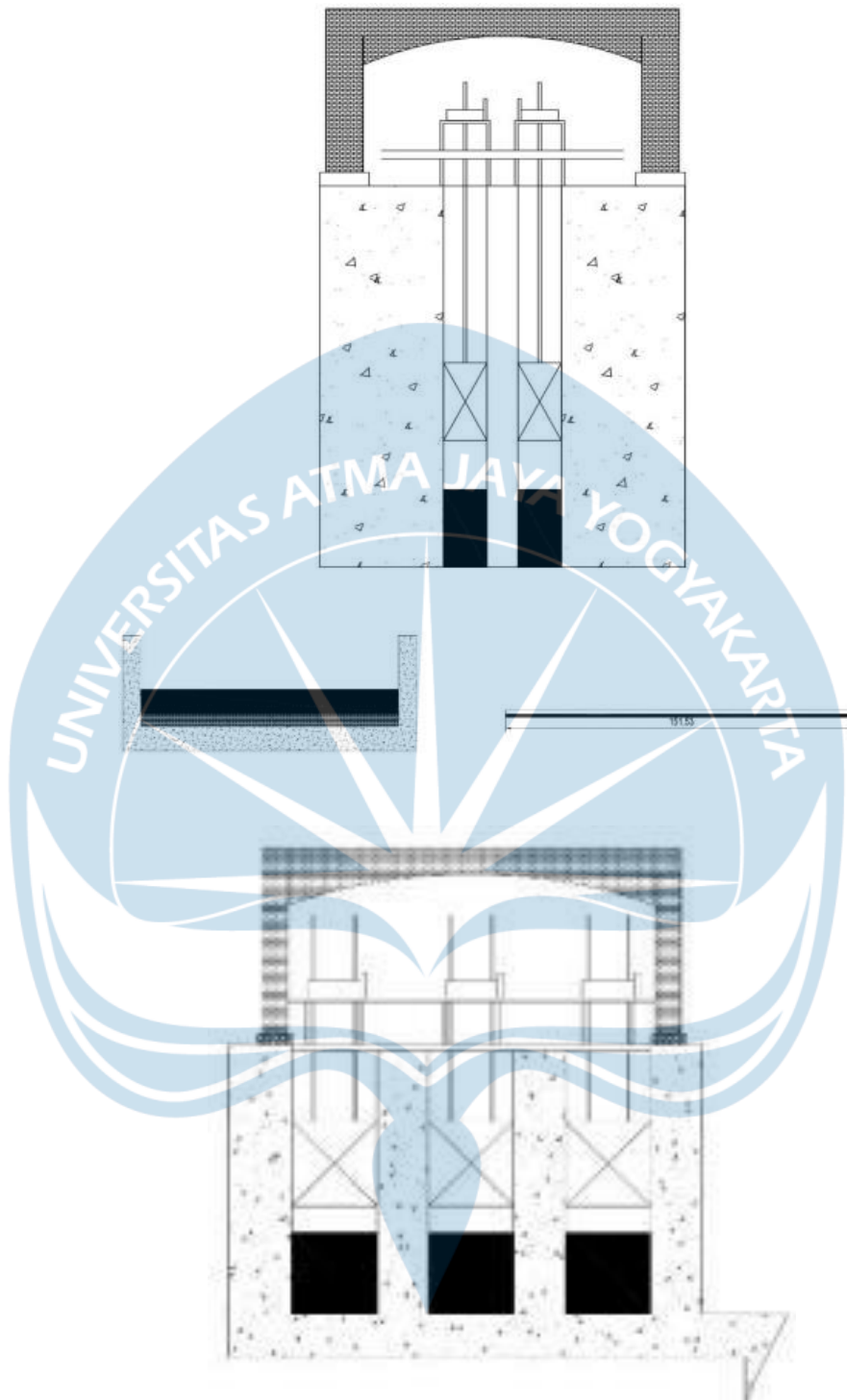
K	5,25	2				5,75	16,43	1,55	4,40	0,01		
			K-L	0,5	2,15						-0,33	-3,22
L	7,4	2				6,97	16,43	1,55	4,40	-0,32		
			L-M	0,5	0						0,00	0,00
M	7,4	1,5				7,47	16,43	1,55	4,40	-0,45		
			M-N	0	1						-0,49	-4,84
N	8,4	1,5				7,80	16,43	1,55	4,40	-0,54		
			N-O	1	0						0,00	0,00
O	8,4	0,5				8,80	16,43	1,55	4,40	-0,81		
			O-P	0	2						-1,79	-17,57
P	10,4	0,5				9,47	16,43	1,55	4,40	-0,98		
			P-Q	0,5	0						0,00	0,00
Q	10,4	0				9,97	16,43	1,55	4,40	-1,12		
			Q-R	0	12,9						-21,86	-214,40
R	23,3	0				14,27	16,43	1,55	4,40	-2,27		
			R-S	2	0						0,00	0,00
S	23,3	-2				16,27	16,43	1,55	4,40	-2,81		
			S-T	0	0,5						-1,41	-13,87
T	23,8	-2				16,43	16,43	1,55	4,40	-2,85		
				8,5	23,8						-22,39	-219,63

Nama Gaya	Luas (m ²)	Tebal (m)	Berat Jenis (KN/m ³)	Gaya (KN)	Lengan (m)	Momen (KN.m)
W1	1	1	24	24,00	0,25	6,00
W2	3,7	1	24	88,80	3,70	328,56
W3	0,38	1	24	9,12	2,38	21,66
W4	0,38	1	24	9,12	4,88	44,46
W5	2,88	1	24	69,12	6,60	456,19
W6	2,9	1	24	69,60	7,90	549,84
W7	0,5	1	24	12,00	7,90	94,80
W8	9,68	1	24	232,32	9,87	2292,30
W9	6,45	1	24	154,80	16,85	2608,38
W10	0	1	24	0,00	0,00	0,00
W11	0	1	24	0,00	14,70	0,00
W12	1,25	1	24	30,00	23,55	706,50
W13	0,09	1	24	2,16	23,65	51,08
W14	0,05	1	24	1,20	23,40	28,08
W15	1,57	1	24	37,68	7,9	297,67
				739,92		7485,53

Gaya	Tinggi (m)	Gaya yang bekerja (KN)	Lengan Momen (m)	Momen terhadap titik X (KNm)	Ket
Ea 1	1,7	3,0823	9,067	27,95	Akibat tanah basah
Ea 2	3,950	78,0125	9,817	765,82	Akibat Air banjir
Ep1	1,516	95,1253	0,505	48,07	Akibat Air banjir
Ep2	2,5	140,9853	0,833	117,49	Akibat tanah basah
Jumlah		317,2054	20,2220	959,3271	

	Gaya yang bekerja	Lengan Momen (m)	Momen ke titik U
A-B	7,49	-23,55	-176,47
C-D	13,29	-22,55	-299,62
E-F	4,92	-21,43	-105,40
G-H	7,27	-19,80	-143,86
I-J	1,31	-18,93	-24,76
K-L	-3,22	-17,48	56,18
M-N	-4,84	-15,90	77,02
O-P	-17,57	-14,40	252,99
Q-R	-214,40	-6,95	1490,09
S-T	-13,87	-0,25	3,47
Jumlah	-219,63		1129,65





LAMPIRAN IV

PERANCANGAN BIAYA DAN WAKTU

BILL OF QUANTITY (BQ)				
PEKERJAAN PEMBANGUNAN GEDUNG GIZI				
UNIVERSITAS JENDERAL SOEDIRMAN PURWOKERTO				
TAHUN 2018				
No	Uraian Pekerjaan	Volume	Harga Satuan Rp.	Jumlah Harga Rp.
A. PEKERJAAN PERSIAPAN :				
1	Pembersihan Lapangan	3367 m ²	10,169.50	34,242,740
2	Bouwplank	119.2 m'	79,455.75	9,471,125
3	Pagar proyek dari seng tingg 1,8 m'	238.4 m'	464,887.50	110,823,180
B. PEKERJAAN FONDASI, STRUKTUR DAN ATAP :				
I PEKERJAAN TANAH				
1	Galian Tanah Struktur	482.2 m ³	59,226.75	28,561,034
2	Urug Kembali	152 m ³	19,742.25	3,000,534
II PEKERJAAN BETON BERTULANG				
A. PONDASI				
	Pekerjaan Pondasi Batu Belah	85.92 m ³	716344.75	61550633.22
	Pekerjaan Pondasi Foot Plat P1			
	Beton f'c=...Mpa	35.46 m ³	715,459	25,371,477
	Besi Tulangan P10 K1	567.4 kg	9,557	5,422,738
	Besi Tulangan P10 K2	189.1 kg	9,557	1,807,579
	Bekisting	36.96 m ²	127,929	4,728,252
	Pekerjaan Pondasi Foot Plat P2			
	Beton f'c=... Mpa	18.24 m ³	715,459	13,052,613
	Besi Tulangan D19	1823 kg	9,929	18,100,888
	Besi Tulangan P10 K1	93.39 kg	9,557	892,451
	Besi Tulangan P10 K2	373.5 kg	9,557	3,563,803
	Bekisting	21 m ²	127,929	2,686,507
	Pekerjaan Pondasi Foot Plat P3			
	Beton f'c=...Mpa	14.08 m ³	715,459	10,072,452
	Besi Tulangan D19	1392 kg	9,929	13,816,458
	Besi Tulangan P10 K2	349.6 kg	9,557	3,341,113
	Bekisting	16.8 m ²	127,929	2,149,206
	Pekerjaan Pondasi Foot Plat P4			
	Beton f'c=...Mpa	6.255 m ³	715,459	4,475,086
	Besi Tulangan D16	2020 kg	9,929	20,052,657
	Besi Tulangan P10 K4	206.9 kg	9,557	1,976,310
	Bekisting	11.52 m ²	127,929	1,473,741

No	Uraian Pekerjaan	Volume	Harga Satuan Rp.	Jumlah Harga Rp.
B. LANTAI 1				
1	Pagar Urug Pondasi	46.7 m ³	96,099	4,485,217
2	Lantai keris 1:3:5 bwh pondasi	9.86 m ³	561,559	5,539,089
3	Beton Kolom Struktur			
	Kolom K1 (50x50)			
	Beton f'c = Mpa	11.3 m ³	715,459	8,075,745
	Besi Tulangan D19	1793 kg	9,929	17,805,517
	Besi Tulangan P10	367 kg	9,557	3,508,812
	Bekisting	30.3 m ²	404,755	12,264,417
	Kolom K2 (50x50)			
	Beton f'c = Mpa	17.8 m ³	715,459	12,735,173
	Besi Tulangan D19	2114 kg	9,929	20,985,074
	Besi Tulangan P10	583 kg	9,557	5,563,543
	Bekisting	14.2 m ²	404,755	5,748,176
	Kolom K3 (40x40)			
	Beton f'c = Mpa	1.86 m ³	715,459	1,327,892
	Besi Tulangan D19	113 kg	9,929	1,121,253
	Besi Tulangan D16	112 kg	9,329	1,045,828
	Besi Tulangan P10	101 kg	9,557	964,597
	Bekisting	18.6 m ²	404,755	7,512,261
	Kolom K4 (20x40)			
	Beton f'c = Mpa	3.12 m ³	669,271	2,088,126
	Besi Tulangan D16	573 kg	9,329	5,342,912
	Besi Tulangan P10	319 kg	9,557	3,051,635
	Bekisting	46.8 m ²	404,755	18,942,555
4	Beton Sloof Struktur			
	Beton f'c =...Mpa	30.1 m ³	715,459	21,506,703
	Besi tulangan D16	3486 kg/m'	9,329	32,513,745
	Besi Tulangan P10	1975 kg	9,557	18,871,033
5	Beton BALOK INDUK			
	Beton f'c =...Mpa	41.4 m ³	715,459	29,631,636
	Besi tulangan D25	8180 kg	9,329	76,524,347
	Besi Tulangan P12	409 kg	9,557	3,912,384
	Besi Tulangan P10	2232 kg	9,557	21,323,690
	Bekisting	347 m ²	423,730	147,165,890
6	Beton Balok Anak			
	Beton f'c =...Mpa	25.5 m ³	669,271	17,054,368
	Besi tulangan D16	7793 kg	9,329	72,772,307
	Besi Tulangan P8	2001 kg	9,557	19,120,353
	Bekisting	24.2 m ²	423,730	10,257,244
7	Beton Plat Kanopi			
	Beton f'c =...Mpa	3.81 m ³	669,271	2,550,927
	Besi tulangan P10	1522 m'	9,557	14,540,253
	Bekisting	40.6 m ²	378,391	15,381,343
8	Beton Plat Lantai			
	Beton f'c =...Mpa	68.1 m ³	715,459	48,688,320
	Besi tulangan P8	4451 kg	9,557	42,533,843
	Bekisting	567 m ²	624,755	354,298,035

No	Uraian Pekerjaan	Volume	Harga Satuan Rp.	Jumlah Harga Rp.
C. LANTAI 2				
1	Beton Kolom Struktur			
	Kolom K1 (50x50)			
	Beton f'c = Mpa	4.2 m3	715,453	3,004,929
	Besi Tulangan D19	539.4 kg	9,929	5,951,705
	Besi Tulangan P10	75.29 kg	9,557	719,538
	Bekesting	33.6 m2	404,755	13,539,783
	Kolom K2 (50x50)			
	Beton f'c = Mpa	14.7 m3	715,453	10,517,250
	Besi Tulangan D19	1573 kg	9,929	15,623,225
	Besi Tulangan P10	263.5 kg	9,557	2,518,381
	Bekesting	117.6 m2	404,755	47,539,241
	Kolom K4 (20x40)			
	Beton f'c = Mpa	2.016 m3	715,453.1681	1442365.683
	Besi Tulangan D16	337.2 kg	9,929	3347833.991
	Besi Tulangan P10	148.7 kg	9,557	1420588.909
	Bekesting	30.24 m2	404,755	12239804.81
2	Beton BALOK INDUK			
	Beton f'c =...Mpa	41.42 m3	715,453	29,631,636
	Besi tulangan D25	8180 kg	9,929	81,224,347
	Besi tulangan P12	409.5 kg	9,557	3,912,984
	Besi Tulangan P10	2232 kg	9,557	21,329,630
	Bekesting	347.3 m2	423,730	147,165,890
3	Beton Balok Anak			
	Beton f'c =...Mpa	25.48 m3	715,453.1681	18231330.52
	Besi tulangan D16	7793 kg	9,929	77,372,307
	Besi Tulangan P8	2001 kg	9,557	19,120,359
	Bekesting	242.1 m2	423,730	102,576,244
4	Beton Plat Lantai			
	Beton f'c =...Mpa	68.05 m3	715,453.1681	48,688,319.99
	Besi tulangan P8	4451 kg	9,557	42,539,849
	Bekesting	567.1 m2	624,755	354,298,035

No	Uraian Pekerjaan	Volume	Harga Satuan Rp.	Jumlah Harga Rp.
D. LANTAI 3				
1	Beton Kolom Struktur			
	Kolom K3 (40x40)			
	Beton f'c = Mpa	12.1 m3	715,453.1681	8,654,194.037
	Besi Tulangan D19	674.4 kg	9,929.04	6,695,667.982
	Besi Tulangan D16	674.4 kg	9,929.04	6,695,667.982
	Besi Tulangan P10	611.1 kg	9,556.525	5,840,198.848
	Bekesting	121 m2	404,755.45	48,959,219.23
	Kolom K4 (20x40)			
	Beton f'c = Mpa	2.016 m3	715,453.1681	1,442,365.683
	Besi Tulangan D16	337.2 kg	9,929.04	3,347,833.991
	Besi Tulangan P10	148.7 kg	9,929.04	1,475,963.711
	Bekesting	30.24 m2	404,755.45	12,239,804.81
2	Beton BALOK INDUK			
	Beton f'c =...Mpa	27.15 m3	715,453.1681	19,421,139.12
	Besi tulangan D25	4645 kg	9,929.04	46,186,23.93
	Besi Tulangan P12	285 kg	9,556.525	2,723,219.719
	Besi Tulangan P10	0 kg	9,556.525	0
	Bekesting	198.4 m2	423,730.45	84,069,177.97
3	Beton Balok Anak			
	Beton f'c =...Mpa	1.344 m3	715,453.1681	961,577.1219
	Besi tulangan D16	390.4 kg	9,929.04	3,876,744.023
	Besi Tulangan P8	101.1 kg	9,556.525	966,256.4201
	Bekesting	16.03 m2	423,730.45	6,790,280.461
7	Beton Plat Lantai			
	Beton f'c =...Mpa	6.009 m3	715,453.1681	4,299,194.141
	Besi tulangan P8	769.5 kg	9,556.525	7,353,313.077
	Bekesting	60.09 m2	624,755.45	37,541,554.99

No	Uraian Pekerjaan	Volume	Harga Satuan Rp.	Jumlah Harga Rp.
III PEKERJAAN ATAP				
1	Keds Keds Baja ringan	1019 m ²	150,855	153,724,631
2	Atap selulos bitumen	1019 m ²	87,257	88,916,309,59
3	Bubungan	88,2 m'	93,217	8,222,906,331
4	saringan talang	21 bh	60656,25	1,273,781,29
5	Pipa Talang PVC 4"	266 m'	54,111	14,374,719,39
6	Listplank	91 m'	60500,5	5,505,545,9

C. PEKERJAAN TANGGA				
I TANGGA TYPE A				
1 Plat dan anak Tangga				
	Beton F'c = Mpa	8,07 m ³	715459,1681	5773420,129
	Besi Tulangan P8	250 kg	3,557	2,393,682
	Besi Tulangan P10	201 kg	3,557	1,816,681
	Besi Tulangan D16	826 kg	3,329	8,201,408
	Bekisting	54,6 m ²	387,529	21,154,847
2 Plat Bordes				
	Beton F'c = Mpa	2,16 m ³	715459,1681	1,542,529,366
	Besi Tulangan P10	195 kg	3,557	1,866,389
	Besi Tulangan D16	423 kg	3,329	4,201,215
	Bekisting	11,3 m ²	387,529	4,611,600
3 Balok Bordes				
	Beton F'c = Mpa	0,31 m ³	715459,1681	220,361,4238
	Besi Tulangan P10	22,3 kg/m'	3,557	218,634
	Besi Tulangan D19	54,6 kg	3,329	542,473
	Bekisting	3,08 m ²	387,529	1,193,591
II TANGGA TYPE B				
1 Plat dan anak Tangga				
	Beton F'c = Mpa	5,52 m ³	715459,1681	3,947,255,764
	Besi Tulangan P8	180 kg	3,557	1,720,718
	Besi Tulangan P10	134 kg	3,557	1,277,440
	Besi Tulangan D16	590 kg	3,329	5,858,148
	Bekisting	39,2 m ²	387,529	15,199,107
2 Plat Bordes				
	Beton F'c = Mpa	1,71 m ³	715459,1681	1,233,435,177
	Besi Tulangan P10	109 kg	3,557	1,042,808
	Besi Tulangan D16	325 kg	3,329	3,231,704
	Bekisting	9,75 m ²	387,529	3,778,412
3 Balok Bordes				
	Beton F'c = Mpa	0,23 m ³	715459,1681	163,124,6903
	Besi Tulangan P10	17,9 kg/m'	3,329	177,293
	Besi Tulangan D19	40,7 kg	3,557	388,927
	Bekisting	2,28 m ²	387,529	883,567

No	Uraian Pekerjaan	Volume	Harga Satuan Rp.	Jumlah Harga Rp.
D. PEKERJAAN FINISHING ARSITEKTUR				
I LANTAI 1				
A. PEK. PAS. KOSEN :				
1 Pekerjaan Jendela				
Jendela J2				
	kusen aluminium	98,2 m'	62000,5	6088449,1
	Kaca T 8 mm	31,95 m ²	165456,25	5,286,327,188
	karet	111,8 m'	59500,5	6,652,155,9
2 Pekerjaan Bouven				
Bouven BV1				
	kusen aluminium	10,4 m'	62000,5	644805,2
	Kaca T 5 mm	1,28 m ²	107706,25	137864
Bouven BV2				
	kusen aluminium	9,4 m'	62000,5	582804,7
	Kaca T 5 mm	1,28 m ²	107706,25	137864
Bouven BV3				
	kusen aluminium	12,8 m'	62000,5	793606,4
	Kaca T 5 mm	1,92 m ²	107706,25	206796
Bouven BV4				
	kusen aluminium	3,3 m'	62000,5	204601,65
	Kaca T 5 mm	1,38 m ²	107706,25	148634,625

No	Uraian Pekerjaan	Volume	Harga Satuan Rp.	Jumlah Harga Rp.
3	Pekerjaan Partisi			
	Partisi PTS 1			
	Partisy double kalsiboard 6 mm + rang	26.1 m2	127430.3	3325930.83
	Partisi PTS 2			
	Partisy double kalsiboard 6 mm + rang	15.68 m2	127430.3	1997463.953
	Partisi PTS 3			
	Kaca T 5 mm	4 m2	107706.25	430825
	daun Pintu HPL Double	2 bh	2233375	4466750
	Partisy double kalsiboard 6 mm + rang	36.32 m2	127430.3	4628268.496
	Engsel Pintu	8 bh	116456.25	931650
	Handle pintu double	2 bh	183187.5	366375
	Partisi PTS 4			
	Kaca T 5 mm	4 m2	107706.25	430825
	daun Pintu HPL Double	2 bh	2233375	4466750
	Partisy double kalsiboard 6 mm + rang	36.32 m2	127430.3	4628268.496
	Engsel Pintu	8 bh	116456.25	931650
	Handle pintu double	2 bh	183187.5	366375
	Partisi PTS 5			
	Kaca T 5 mm	4 m2	107706.25	430825
	daun Pintu HPL Double	2 bh	2233375	4466750
	Partisy double kalsiboard 6 mm + rang	33.92 m2	127430.3	4322435.776
	Engsel Pintu	8 bh	116456.25	931650
	Handle pintu double	2 bh	183187.5	366375
	Partisi PTS 6			
	Kaca T 5 mm	2 m2	107706.25	215412.5
	daun Pintu HPL Double	1 bh	2233375	2233375
	Partisy double kalsiboard 6 mm + rang	16.96 m2	127430.3	2161217.888
	Engsel Pintu	4 bh	116456.25	465825
	Handle pintu double	1 bh	183187.5	183187.5
	Partisi PTS 7			
	Kaca T 5 mm	1.46 m2	107706.25	157251.125
	daun Pintu HPL Double	1 bh	2233375	2233375
	Partisy double kalsiboard 6 mm + rang	5.425 m2	127430.3	691309.3775
	Engsel Pintu	4 bh	116456.25	465825
	Handle pintu double	1 bh	183187.5	183187.5
	Partisi PTS 8			
	Partisy double kalsiboard 6 mm + rang	45.6 m2	127430.3	5810821.68

No	Uraian Pekerjaan	Volume	Harga Satuan Rp.	Jumlah Harga Rp.
	B. PEK. PLAFOND :			
	Plafond kalsiboard rangka hollow	652.4 m2	177,843	116,030,671
	List tepi profil gypsum	425.5 m'	22,564	9,599,747
	C. PEK. PASANG LANTAI TANGGA			
	TANGGA TYPE A			
	Lt. keramik 40/40 cm	47.27 m2	174,705	8,257,678
	TANGGA TYPE A			
	Lt. keramik 40/40 cm	38.76 m2	174,705	6,771,567
	D. PEK. PASANG LANTAI DAN DINDING :			
	Lt. keramik 40/40 cm	595.1 m2	174,705	103,965,577
	Lt. keramik 40/40 cm anti selip	47.33 m2	174,705	8,269,007
	Lt. keramik 20/20 cm anti selip	16.85 m2	177,410	2,989,427
	Urug pasir bawah lantai	65.93 m3	96,099	6,335,538
	Lantai Kerja 1: 3: 5	32.96 m3	561,559	18,511,065
	Dinding keramik 20x25 cm Lavatory	41.74 m2	192,212	8,022,440
	Keramik Border	27.83 m'	258,943	7,205,082
	Plint lantai keramik	182.7 m'	23,595	4,311,477
	E. PEK. PAS. BT. BATA / PLESTERAN :			
	Pas. bt. bata 1: 3	370.8 m2	235,793	87,440,583
	Pas. bt. bata 1:5	107.9 m2	227,867	24,591,369
	Pas. bt. bata 1:2 (40 + 30)	113.9 m2	243,526	27,735,205
	Plesteran 1:5	209.1 m2	45,648	9,544,704
	Plesteran 1:3	530.1 m2	47,451	27,939,833
	F. PEK. CAT-CATAN :			
	Cat Tembok Exterior	398.7 m2	52,940	21,104,631
	Cat Tembok Interior	666.8 m2	15,760	10,506,177
	Cat Plafond	652.4 m2	13,217	8,622,979

No	Uraian Pekerjaan	Volume	Harga Satuan Rp.	Jumlah Harga Rp.
G. INSTALASI PENERANGAN LANTAI 1				
	Lampu RMO TL 2 x 36 W	37 bh	Rp 93,100.00	3,444,700
	Lampu RMO TL 1 x 36 W	4 bh	Rp 53,100.00	212,400
	Down light essential 11 W	29 bh	Rp 41,100.00	1,191,900
	Lampu SL 18 W	8 bh	Rp 31,100.00	248,800
	Lampu baret TL 18 W	2 bh	Rp 31,100.00	62,200
	Stop kontak 3 phasa 1500 VA	18 ttk	Rp 41,100.00	739,800
	Stop kontak 200 W	5 ttk	Rp 33,100.00	165,500
	Saklar tunggal	9 bh	Rp 37,100.00	333,900
	Saklar ganda	11 bh	Rp 45,100.00	496,100
	Saklar hotel	2 bh	Rp 35,100.00	70,200
	Instalasi stop kontak dan titik lampu	103 ttk	Rp 38,100.00	3,924,300
	Grid swicth	2 bh	Rp 38,100.00	76,200
	Rak kabel	46 m'	Rp 38,450.00	1,768,700

H. INSTALASI LANTAI 1				
	Pasang instalasi AC	16 tk	2675000	42800000

I. PEK. SANITASI				
	Closet jongkok	4 bh	324,566	1,298,264
	Saringan air st.st.	4 bh	10656.25	42,625
	Kran air	4 bh	86375	345,500
	Urinoir	2 bh	1,499,315	2,998,630
	Penyekat urinoir	2 bh	1,499,315	2,998,630
	Wastafel + kran lengkap	2 bh	1514995	3,029,990
	Meja beton wastafel lapis keramik + alr	2 bh	6003360	12,006,720
	Kaca cermin	2 bh	159956.25	319,913
	Meja beton lapis keramik lab	68.4 m'	8003360	547,429,824
	Wash bak meja beton lab	14 bh	6503360	91,047,040
	Kran washbak lab	14 bh	303360	4,247,040

No	Uraian Pekerjaan	Volume	Harga Satuan Rp.	Jumlah Harga Rp.
II LANTAI 2				
A PEK. PAS. KOSEN.				
1 Pekerjaan Jendela				
Jendela J3				
	kusen aluminium	72.9 m'	62000.5	4519836.45
	Kaca T 8 mm	29.89 m2	165456.25	4945900.953
	Karet	124.6 m2	59500.5	7413762.3
Jendela J4				
	kusen aluminium	20.4 m'	62000.5	1264810.2
	Kaca T 8 mm	39.15 m2	165456.25	6477612.188
	Kaca T 5 mm	12.15 m2	107706.25	1308630.938
2 Pekerjaan Bouwen				
Bouwen BV1				
	kusen aluminium	10.4 m'	62000.5	644805.2
	Kaca T 5 mm	1.28 m2	107706.25	137864
Bouwen BV2				
	kusen aluminium	9.4 m'	62000.5	582804.7
	Kaca T 5 mm	1.28 m2	107706.25	137864
Bouwen BV3				
	kusen aluminium	12.8 m'	62000.5	793606.4
	Kaca T 5 mm	1.92 m2	107706.25	206796
Bouwen BV4				
	kusen aluminium	3.3 m'	62000.5	204601.65
	Kaca T 5 mm	1.38 m2	107706.25	148634.625

No	Uraian Pekerjaan	Volume	Harga Satuan Rp.	Jumlah Harga Rp.
3 Pekerjaan Partisi				
Partisi PTS 1				
	Partisy double kalsiboard 6 mm + rang	26,1 m ²	127430,3	3325330,83
Partisi PTS 2				
	Partisy double kalsiboard 6 mm + rang	15,7 m ²	127430,3	1997463,953
Partisi PTS 3				
	Kaca T 5 mm	4 m ²	107706,25	430825
	Jsun Pintu HPL Double	2 bh	2233375	4466750
	Partisy double kalsiboard 6 mm + rang	36,3 m ²	127430,3	4628268,436
	Engsel Pintu	8 bh	116456,25	931650
	Handle pintu double	2 bh	183187,5	366375
Partisi PTS 4				
	Kaca T 5 mm	4 m ²	107706,25	430825
	Jsun Pintu HPL Double	2 bh	2233375	4466750
	Partisy double kalsiboard 6 mm + rang	36,3 m ²	127430,3	4628268,436
	Engsel Pintu	8 bh	116456,25	931650
	Handle pintu double	2 bh	183187,5	366375
Partisi PTS 5				
	Kaca T 5 mm	4 m ²	107706,25	430825
	Jsun Pintu HPL Double	2 bh	2233375	4466750
	Partisy double kalsiboard 6 mm + rang	33,3 m ²	127430,3	4232435,776
	Engsel Pintu	8 bh	116456,25	931650
	Handle pintu double	2 bh	183187,5	366375
Partisi PTS 6				
	Kaca T 5 mm	2 m ²	107706,25	215412,5
	Jsun Pintu HPL Double	1 bh	2233375	2233375
	Partisy double kalsiboard 6 mm + rang	17 m ²	127430,3	2161211,888
	Engsel Pintu	4 bh	116456,25	465825
	Handle pintu double	1 bh	183187,5	183187,5
Partisi PTS 7				
	Kaca T 5 mm	1,46 m ²	107706,25	157251,125
	Jsun Pintu HPL Double	1 bh	2233375	2233375
	Partisy double kalsiboard 6 mm + rang	5,43 m ²	127430,3	691309,3175
	Engsel Pintu	4 bh	116456,25	465825
	Handle pintu double	1 bh	183187,5	183187,5
Partisi PTS 8				
	Partisy double kalsiboard 6 mm + rang	22,8 m ²	127430,3	2905410,84
Partisi PTS 9				
	Kaca T 5 mm	1,54 m ²	107706,25	165867,625
	Jsun Pintu HPL Single	1 bh	2233375	2233375
	Partisy double kalsiboard 6 mm + rang	8,31 m ²	127430,3	1058308,642
	Engsel Pintu	4 bh	116456,25	465825
	Handle pintu Single	1 bh	183187,5	183187,5
Partisi PTS 10				
	Kaca T 5 mm	3,03 m ²	107706,25	327352,25
	Jsun Pintu HPL double	1 bh	2233375	2233375
	Partisy double kalsiboard 6 mm + rang	16,8 m ²	127430,3	2138230,434
	Engsel Pintu	4 bh	116456,25	465825
	Handle pintu double	1 bh	183187,5	183187,5
B. PEK. PLAFOND :				
	Plafond kalsiboard rangka hollow	630 m ²	177,843	111975862,5
	List tepi profil gypsum	405 m'	13,345	5642248,15
C. PEK. PASANG LANTAI DAN DINDING :				
	Lt. keramik 40/40 cm	560 m ²	174,705	97.836,380
	Lt. keramik 40/40 cm anti selip	59,3 m ²	174,705	10.354,330
	Lt. keramik 20/20 cm anti selip	16,3 m ²	177,410	2.889,427
	Dinding keramik 20x25 cm Lavatory	41,7 m ²	192,212	8.022,440
	Keramik Border Lavatory	27,8 m ²	258,343	7.205,062
	Plint lantai keramik	172 m'	23,595	4.065,084
D. PEK. PAS. BT. BATA / PLESTERAN :				
	Pas. bt. bata 1:3	396 m ²	235,793	93.414,692
	Pas. bt. bata 1:5	116 m ²	227,867	26.512,570
	Plesteran 1:5	615 m ²	45,648	28.035,012
	Plesteran 1:3	504 m ²	47,451	23.916,033
E. PEK. CAT-CATAN :				
	Cat Tembok Exterior	420 m ²	52,340	22.216,376
	Cat Tembok Interior	707 m ²	15,760	11.140,527
	Cat Plafond	630 m ²	13,217	8.321,640
F. INSTALASI PENERANGAN LANTAI 2				
	Lampu RMO TL 2 x 36 'w	43 bh	93100	4003300
	Lampu RMO TL 1 x 36 'w	2 bh	53100	106200
	Down light essential 11 'w	15 bh	41100	616500
	Lampu SL 18 'w	8 bh	31100	248800
	Lampu baret TL 18 'w	2 bh	31100	62200
	Stop kontak 3 phase 1500 VA	16 ttk	41100	657600
	Stop kontak 200 'w	6 ttk	33100	198600
	Saklar tunggal	7 bh	37100	259700
	Saklar ganda	12 bh	45100	541200
	Saklar hotel	4 bh	35100	140400
	Instalasi stop kontak dan titik lampu	32 ttk	38100	350200
	Grid switch	1 bh	38100	38100
	Rak kabel	46 m'	38450	1768700
G. INSTALASI AC LANTAI 2				
	Pasang instalasi AC	17 tk	2675000	45475000
H. PEK. SANITASI				
	Clozet jongkok	4 bh	324,566	1.298,264
	Saringan air st.et.	4 bh	10656,25	42.625
	Kran air	4 bh	86,375	345,500
	Urinoir	2 bh	1.439,315	2.878,630
	Penyekat urinoir	2 bh	1.439,315	2.878,630
	Wastafel + kran lengkap	2 bh	1.514,395	3.028,790
	Meja beton wastafel lapis keramik + air	2 bh	6.003,360	12.006,720
	Kaca cermin	2 bh	159956,25	319.913

No	Uraian Pekerjaan	Volume	Harga Satuan Rp.	Jumlah Harga Rp.
III LANTAI 3				
A PEK. PAS. KOSEN :				
1 Pekerjaan Jendela				
Jendela J4				
	kusen aluminium	20.4 m'	62000.5	1264810.2
	Kaca T 8 mm	39.15 m2	165456.25	6477612.188
	Kaca T 5 mm	12.15 m2	107706.25	1308630.938
2 Pekerjaan Bouwen				
Bouwen BV1				
	kusen aluminium	10.4 m'	62000.5	644805.2
	Kaca T 5 mm	1.28 m2	107706.25	137864
Bouwen BV2				
	kusen aluminium	9.4 m'	62000.5	582804.7
	Kaca T 5 mm	1.28 m2	107706.25	137864
Bouwen BV3				
	kusen aluminium	12.8 m'	62000.5	793606.4
	Kaca T 5 mm	1.92 m2	107706.25	206796
Bouwen BV4				
	kusen aluminium	3.3 m'	62000.5	204601.65
	Kaca T 5 mm	1.38 m2	107706.25	148634.625

No	Uraian Pekerjaan	Volume	Harga Satuan Rp.	Jumlah Harga Rp.
3 Pekerjaan Partisi				
Partisi PTS 1				
	Partizy double kalsiboard 6 mm + rang	26.1 m2	127430.3	3325330.83
Partisi PTS 2				
	Partizy double kalsiboard 6 mm + rang	15.7 m2	127430.3	1997463.353
Partisi PTS 3				
	Kaca T 5 mm	4 m2	107706.25	430825
	daun Pintu HPL Double	2 bh	2233375	4466750
	Partizy double kalsiboard 6 mm + rang	36.3 m2	127430.3	4628266.436
	Enqzel Pintu	8 bh	116456.25	931650
	Handle pintu double	2 bh	183187.5	366375
Partisi PTS 4				
	Kaca T 5 mm	4 m2	107706.25	430825
	daun Pintu HPL Double	2 bh	2233375	4466750
	Partizy double kalsiboard 6 mm + rang	36.3 m2	127430.3	4628266.436
	Enqzel Pintu	8 bh	116456.25	931650
	Handle pintu double	2 bh	183187.5	366375
Partisi PTS 5				
	Kaca T 5 mm	4 m2	107706.25	430825
	daun Pintu HPL Double	2 bh	2233375	4466750
	Partizy double kalsiboard 6 mm + rang	33.3 m2	127430.3	4222435.776
	Enqzel Pintu	8 bh	116456.25	931650
	Handle pintu double	2 bh	183187.5	366375
Partisi PTS 6				
	Kaca T 5 mm	2 m2	107706.25	215412.5
	daun Pintu HPL Double	1 bh	2233375	2233375
	Partizy double kalsiboard 6 mm + rang	17 m2	127430.3	2161217.888
	Enqzel Pintu	4 bh	116456.25	465825
	Handle pintu double	1 bh	183187.5	183187.5
Partisi PTS 7				
	Kaca T 5 mm	1.46 m2	107706.25	157251.125
	daun Pintu HPL Double	1 bh	2233375	2233375
	Partizy double kalsiboard 6 mm + rang	5.43 m2	127430.3	691309.3775
	Enqzel Pintu	4 bh	116456.25	465825
	Handle pintu double	1 bh	183187.5	183187.5
Partisi PTS 8				
	Partizy double kalsiboard 6 mm + rang	22.8 m2	127430.3	2905410.84
Partisi PTS 9				
	Kaca T 5 mm	1.54 m2	107706.25	165867.625
	daun Pintu HPL Single	1 bh	2233375	2233375
	Partizy double kalsiboard 6 mm + rang	8.31 m2	127430.3	1058308.642
	Enqzel Pintu	4 bh	116456.25	465825
	Handle pintu Single	1 bh	183187.5	183187.5
Partisi PTS 10				
	Kaca T 5 mm	3.08 m2	107706.25	331735.25
	daun Pintu HPL double	1 bh	2233375	2233375
	Partizy double kalsiboard 6 mm + rang	16.8 m2	127430.3	2138280.434
	Enqzel Pintu	4 bh	116456.25	465825
	Handle pintu double	1 bh	183187.5	183187.5

No	Uraian Pekerjaan	Volume	Harga Satuan Rp.	Jumlah Harga Rp.
B PEK PLAFOND :				
1	Plafond kalsiboard rangka hollow	367 m ²	177,843	171,935,017
2	Liet tepi profil aluminium	517 m'	13,945	7,208,397
C PEK PASANG LANTAI DAN DINDING :				
	Lt. keramik 40/40 cm	560 m ²	174,705	37,896,380
	Lt. keramik 40/40 cm anti selip	53,3 m ²	174,705	10,354,330
	Lt. keramik 20/20 cm anti selip	16,3 m ²	177,410	2,883,427
	Dinding keramik 20x25 cm Lavatory	41,7 m ²	192,212	8,022,440
	Keramik Border Lavatory	27,8 m'	258,943	7,205,082
	Plint lantai keramik	172 m'	23,265	4,003,217
D. PEK PAS. BT. BATA / PLESTERAN :				
	Pas. bt. bata 1:3	424 m ²	235,793	39,303,126
	Pas. bt. bata 1:5	116 m ²	227,867	26,512,570
	Plesteran 1:5	633 m ²	61,132	38,693,383
	Plesteran 1:3	518 m ²	54,163	28,050,595
E. PEK CAT-CATAN :				
	Cat Tembok Exterior	420 m ²	52,940	22,216,376
	Cat Tembok Interior	707 m ²	15,760	11,140,527
	Cat Plafond	367 m ²	13,217	12,777,587
F INSTALASI PENERANGAN LANTAI 3				
	Lampu RMO TL 2 x 36 w	50 bh	33100	4,655,000
	Lampu RMO TL 1 x 36 w	4 bh	53100	212,400
	Down light essential 11 w	15 bh	41100	616,500
	Lampu SL 18 w	8 bh	31100	248,800
	Stop kontak 3 phase 1500 VA	13 ttk	41100	534,300
	Stop kontak 200 w	14 bh	33100	463,400
	Saklar tunggal	11 bh	37,100	408,100
	Saklar ganda	13 bh	45,100	586,300
	Saklar hotel	2 bh	35100	70,200
	Instalasi stop kontak dan titik lampu	104 ttk	38100	3,362,400
	Grid switch	1 bh	38100	38,100
	Rak kabel	46 m'	38450	1,768,700
G INSTALASI AC LANTAI 3				
	Pasang instalasi AC	17 tk	2675000	45475000
H PEK SANITASI				
	Closet jongkok	4 bh	324,566	324,566
	Saringan air st.st.	4 bh	10,656	10,656
	Kran air	4 bh	86,375	86,375
	Urinoir	2 bh	1,493,315	1,493,315
	Penyekat urinoir	2 bh	1,493,315	1,493,315
	Wastafel + kran lengkap	2 bh	1,514,395	1,514,395
	Meja beton wastafel lapis keramik + akr	2 bh	6,003,360	6,003,360
	Kaca cermin	2 bh	153,356	153,356

**DAFTAR HARGA SATUAN BAHAN DAN UPAH
TAHUN 2017**

NO.	URAIAN	SATUAN	EE	KETERANGAN	
1	2	3	EE	5	
UPAH					
1	Pekerja	Oh	Rp	56,200.00	
2	Tenaga gali tanah/pondasi	Oh	Rp	56,200.00	
3	Tukang batu	Oh	Rp	65,000.00	
4	Tukang kayu	Oh	Rp	67,500.00	
5	Tukang cat	Oh	Rp	65,000.00	
6	Tukang besi	Oh	Rp	65,000.00	
7	Tukang politur	Oh	Rp	65,000.00	
8	Tukang Listrik	Oh	Rp	65,000.00	
9	Tukang Las Konstruksi	Oh	Rp	65,000.00	
10	Tukang Las biasa	Oh	Rp	65,000.00	
11	Tukang Pipa ledeng	Oh	Rp	65,000.00	
12	Tukang Vibrator	Oh	Rp	65,000.00	
13	Tukang Erection	Oh	Rp	70,000.00	
14	Operator crane	Oh	Rp	70,000.00	
15	Pembantu operator crane	Oh	Rp	65,000.00	
16	Kepala tukang batu	Oh	Rp	70,000.00	
17	Kepala tukang kayu	Oh	Rp	70,000.00	
18	Kepala tukang cat	Oh	Rp	70,000.00	
19	Kepala tukang besi	Oh	Rp	70,000.00	
20	Kepala tukang politur	Oh	Rp	70,000.00	
21	Mandor	Oh	Rp	72,500.00	
BAHAN					
1	Air	m3	Rp	30,000.00	Belum termasuk pajak dan
2	Aluminium foil	roll	Rp	80,300.00	retribusi bahan galian C
3	Aspal curah	kg	Rp	12,348.60	
4	Aspal drum AC 60/70	kg	Rp	13,927.10	
5	Asbes gelombang kecil				
	3000x1050x4 mm	lbr	Rp	75,000.00	
	2400x1050x4 mm	lbr	Rp	62,000.00	
	2100x1050x4 mm	lbr	Rp	55,000.00	
	1800x1050x4 mm	lbr	Rp	48,000.00	
6	Asbes gelombang besar				
	3000x1020x5 mm	lbr	Rp	115,000.00	
	2250x920x5 mm	lbr	Rp	90,000.00	
	1500x920x5 mm	lbr	Rp	60,000.00	
	3000x920x6 mm	lbr	Rp	100,000.00	
	2250x920x6 mm	lbr	Rp	90,000.00	
	1500x920x6 mm	lbr	Rp	56,000.00	
7	Asbes plat				
	1000x1000x3 mm	lbr	Rp	18,000.00	
	1000x2000x3 mm	lbr	Rp	37,000.00	
	500x2000x3 mm	lbr	Rp	20,000.00	
	250x2000x4 mm	lbr	Rp	20,000.00	
	1200x2400x4 mm	lbr	Rp	52,000.00	
	1000x1000x4 mm	lbr	Rp	20,000.00	
	1200x2400x5 mm	lbr	Rp	65,000.00	
	1200x2400x6 mm	lbr	Rp	85,000.00	
8	Asbes nok				
	Gelombang kecil	bj	Rp	35,000.00	
	Gelombang besar	bj	Rp	80,000.00	
9	Batu bata apple 4	bj	Rp	750.00	
10	Batu bata apple 5	bj	Rp	700.00	

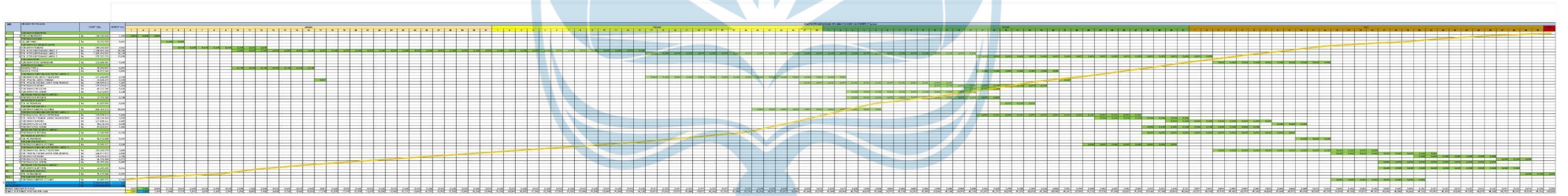
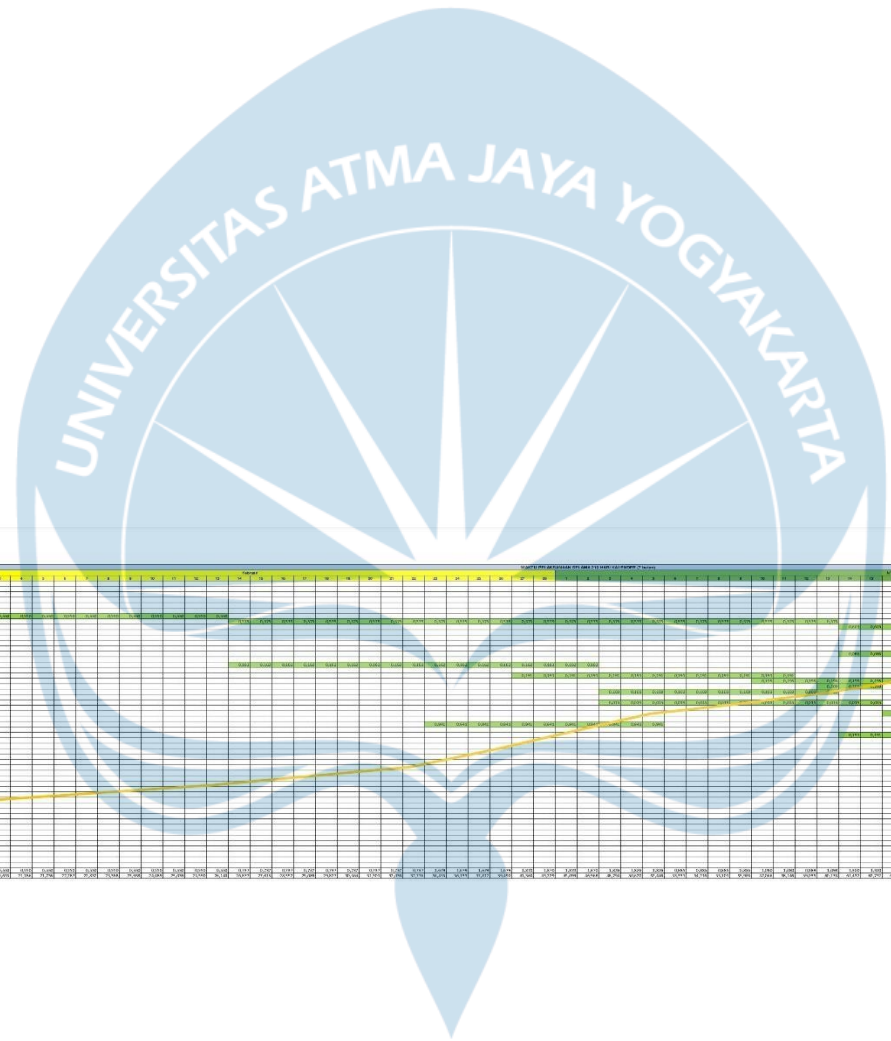
NO.	URAIAN	SATUAN	EE	KETERANGAN
1	2	3	4	5
11	Batu bata berongga expose	bj	Rp 1,600.00	
12	Batu belah hitam			
	batu belah 15/20	m ³	Rp 250,900.00	
	batu belah 10/15	m ³	Rp 262,200.00	
	batu belah 5/7	m ³	Rp -	
	batu belah 4/6	m ³	Rp -	
	batu krikak 3/4 (MS)	m ³	Rp -	
	batu krikak 2/3 (MS)	m ³	Rp -	
13	Batu belah putih	m ³	Rp 162,200.00	
14	Batu granit	kg	Rp 2,500.00	
15	Baja dan Besi			
	Baja IWF	kg	Rp 7,500.00	
	Besi profil Siku	kg	Rp 8,500.00	
	Besi beton	kg	Rp 7,500.00	
	Besi square tube	m	Rp 24,000.00	
	Profil aluminium	m ¹	Rp 104,500.00	
	Aluminium strip	m ¹	Rp 48,500.00	
	Skrup fixer	bh	Rp 3,850.00	
	sealant	tube	Rp 27,500.00	
	Profil kaca	m	Rp 8,250.00	
	Besi hollow 40.40.2	m	Rp 19,250.00	
16	Batako pejal	bj	Rp 2,500.00	
17	Bambu			
	Bambu apus	btg	Rp 12,000.00	
	Bambu wulung	btg	Rp 12,000.00	
	Bambu petung	btg	Rp 60,000.00	
18	Bus beton			
	diameter 15 mm x 1 m	bj	Rp 50,000.00	
	diameter 20 mm x 1 m	bj	Rp 60,000.00	
	diameter 25 mm x 1 m	bj	Rp 65,000.00	
	diameter 30 mm x 1 m	bj	Rp 70,000.00	
	diameter 40 mm x 1 m	bj	Rp 75,000.00	
	diameter 60 mm x 0,5 m	bj	Rp 50,000.00	
	diameter 80 mm x 0,5 m	bj	Rp 70,000.00	
	diameter 100 mm x 0,5 m	bj	Rp 75,000.00	
19	Cat			
	cat kayu	kg	Rp 65,000.00	Emco
	cat meni	kg	Rp 28,000.00	
	cat besi	kg	Rp 28,000.00	
	cat tembok interior (Decolith)	kg	Rp 20,000.00	Decolith
	cat tembok exterior (Dulux)	kg	Rp 100,000.00	
	cat tembok exterior (Mowilex)	kg	Rp 100,000.00	
21	Dempul tembok/ plamir	kg	Rp 12,500.00	
22	Dempul kayu	kg	Rp 27,500.00	
23	Dinabot dia 12 mm (10-15 cm)	bh	Rp 5,000.00	
24	Engsel pintu	bh	Rp 35,000.00	
25	Engsel jendela	bh	Rp 25,000.00	
26	eternit 100 x 100 (polos)	lbr	Rp 18,000.00	
27	Fiberglass	lbr	Rp 100,000.00	
28	Filler	kg	Rp 40,000.00	
29	Formika 120 x 240 cm	lbr	Rp 75,350.00	
30	Gebalan rumput	m ²	Rp 10,000.00	
29	Grendel			
	Grendel pintu	bh	Rp 15,000.00	
	Grendel jendela	bh	Rp 10,000.00	
30	Genteng			
	genteng beton besar	bj	Rp 7,700.00	
	genteng beton kecil	bj	Rp 5,000.00	

NO.	URAIAN	SATUAN	EE	KETERANGAN
1	2	3	EE	5
	genteng murando glassur	bj	Rp 5,400.00	
	genteng murando natural	bj	Rp 4,400.00	
	genteng tanah paris	bj	Rp 1,800.00	
	genteng tanah kodok	bj	Rp 2,000.00	
	genteng kaca 3 mm	bj	Rp 12,000.00	
	genteng kaca kodok	bj	Rp 20,000.00	
	Bubungan genteng beton	bj	Rp 17,600.00	
	Bubungan genteng tanah	bj	Rp 4,500.00	
	Bubungan murando	bj	Rp 7,500.00	
31	Geotekstil	m2	Rp 27,500.00	
32	Gypsum Board	lbr	Rp 71,500.00	
33	Handel pintu	bh	Rp 10,000.00	
35	Handel jendela	bh	Rp 5,500.00	
36	Hak angin	bh	Rp 17,600.00	
37	H.B 20	bh	Rp 5,500.00	
38	H.B 15	bh	Rp 6,000.00	
39	H.B 10	bh	Rp 6,600.00	
40	lujuk	kg	Rp 6,000.00	
41	Kaca			
	kaca bening 3 mm	m2	Rp 60,500.00	
	kaca bening 5 mm	m2	Rp 90,000.00	
	Kaca buram 3 mm	m2	Rp 68,750.00	
	kaca buram 5 mm	m2	Rp 120,000.00	
	kaca reyband 5 mm	m2	Rp 148,000.00	
	Glassblok	bh	Rp 22,500.00	
42	Karpet lebar 90 cm	m'	Rp 16,000.00	
43	kayu bakar	m3	Rp 2,200,000.00	
44	kayu begasteng	m3	Rp 1,500,000.00	dpt untuk begasteng
45	Kayu dolken	m3	Rp 2,800,000.00	
46	Kayu dolken, 4 mtran	btg	Rp 50,000.00	
47	Kayu jati			Kelas I
	papan	m3	Rp 30,000,000.00	
	balok	m3	Rp 25,500,000.00	
	reng	m'	Rp 4,600.00	
48	Kayu kamper			
	papan	m3	Rp 10,000,000.00	
	balok	m3	Rp 9,500,000.00	
	reng	m'	Rp 2,400.00	
49	Kayu Bangkirei			
	papan	m3	Rp 11,000,000.00	
	balok	m3	Rp 10,250,000.00	
	reng	m'	Rp 2,900.00	
50	Kayu kruing			
	papan	m3	Rp 7,750,000.00	
	balok	m3	Rp 6,250,000.00	
	reng	m'	Rp 2,000.00	
51	Kayu meranti			
	papan	m3	Rp 6,250,000.00	
	balok	m3	Rp 5,750,000.00	
	reng	m'	Rp 1,750.00	
52	Kayu glugu	m3	Rp 4,000,000.00	Kelas I
53	Kayu lapis tripleks 3 mm	lbr	Rp 50,000.00	
54	Kayu lapis tripleks 4 mm	lbr	Rp 62,000.00	
55	Kayu lapis tripleks 6 mm	lbr	Rp 76,000.00	
56	Kayu lapis tripleks 9 mm	lbr	Rp 120,000.00	
57	Kayu lapis tripleks 12 mm	lbr	Rp 148,000.00	
58	Kayu lapis teakwood 4 mm	lbr	Rp 170,000.00	
59	Kapur pasang	m3	Rp 125,000.00	

NO.	URAIAN	SATUAN	EE	KETERANGAN
1	2	3		5
60	Kapur sirih	m3	Rp 220,000.00	
61	Kawat ayakan	m2	Rp 19,000.00	
62	Kawat Las	kg	Rp 34,500.00	
63	Kawat nyamuk aluminium	m2	Rp 27,000.00	
64	Kawat beton / bendrat	kg	Rp 15,000.00	
65	Kawat bronjong	kg	Rp 17,000.00	
66	Kawat duri	kg	Rp 13,000.00	
67	Kawat jaring galvanis, pj. 240 cm	unit	Rp 285,000.00	
68	Split beton	m3	Rp 295,000.00	
69	Split beton	kg	Rp 2.46	
70	Krokos/kroco 2-4 cm	m3	Rp 247,300.00	
71	Kunci tanam besar	bh	Rp 125,000.00	SES
72	Kunci tanam kecil	bh	Rp 85,000.00	PIONEER
73	Kloset duduk lengkap	bh	Rp 1,300,000.00	
74	Kloset jongkok	bh	Rp 145,500.00	
75	Lem kaca karbon	kg	Rp 58,500.00	
76	Lem kayu	kg	Rp 13,500.00	
77	Lis Pro fil kayu	m	Rp 5,500.00	
78	Melamin	kg	Rp 100,000.00	
79	Minyak cat/ Thinner	ltr	Rp 15,500.00	
80	Minyak tanah	ltr	Rp 12,000.00	
81	Minyak bekisting	ltr	Rp 13,200.00	
82	Oil gardan	ltr	Rp 45,200.00	
83	Oil mesin	ltr	Rp 38,500.00	
84	Pasir pasang			
	pasir pasang	m3	Rp 298,000.00	
	pasir pasang	kg	Rp 214.49	
	pasir beton	m3	Rp 298,000.00	
	pasir beton	kg	Rp 214.49	
85	Pasir urug	m3	Rp 162,400.00	
86	Paku besar, sedang	kg	Rp 15,000.00	
87	Paku kecil	kg	Rp 17,600.00	
88	Paku payung	kg	Rp 23,100.00	
89	Paku skrup	kg	Rp 27,500.00	
90	Panel beton pracetak uk. 240x40x5 cm	lbr	Rp 121,000.00	
91	Kolom beton pracetak	buah	Rp 275,000.00	
92	Pipa			
	galvanis diameter 0,5"	btg	Rp 79,000.00	
	galvanis diameter 0,75"	btg	Rp 97,000.00	
	galvanis diameter 1"	btg	Rp 115,000.00	
	galvanis diameter 1,5"	btg	Rp 192,500.00	
	galvanis diameter 3"	btg	Rp 752,000.00	
	galvanis diameter 4"	btg	Rp 1,155,000.00	
	PVC 4 m diameter 0,5" AW	btg	Rp 20,000.00	
	PVC 4 m diameter 0,75" AW	btg	Rp 27,000.00	
	PVC 4 m diameter 1" AW	btg	Rp 35,000.00	
	PVC 4 m diameter 1,5" D	btg	Rp 40,000.00	
	PVC 4 m diameter 1,5" AW	btg	Rp 60,000.00	
	PVC 4 m diameter 2" D	btg	Rp 49,000.00	
	PVC 4 m diameter 2" AW	btg	Rp 74,000.00	
	PVC 4 m diameter 2,5" D	btg	Rp 63,500.00	
	PVC 4 m diameter 2,5" AW	btg	Rp 105,500.00	
	PVC 4 m diameter 3" D	btg	Rp 79,000.00	
	PVC 4 m diameter 3" AW	btg	Rp 141,000.00	
	PVC 4 m diameter 4" D	btg	Rp 120,000.00	
	PVC 4 m diameter 4" AW	btg	Rp 229,000.00	
93	Paving (abu - abu) tebal 6 cm	m2	Rp 60,000.00	
94	Paving (warna) tebal 8 cm	m2	Rp 90,000.00	

NO.	URAIAN	SATUAN	EE	KETERANGAN
1	2	3	4	5
95	Paving beton press tebal 8 cm	m2	Rp 88,000.00	
96	Plastik gelombang	bh	Rp 69,500.00	3M
97	Plamuur kayu	kg	Rp 27,000.00	
98	Plywood 900x2100x4 mm	lbr	Rp 100,000.00	
99	Plywood 1200x2400x4 mm	lbr	Rp 140,000.00	
100	Plywood phenol film 12 mm	lbr	Rp 275,000.00	
101	Politur	ltr	Rp 50,000.00	
102	PVC Waterstop 150 mm	m'	Rp 195,800.00	
103	PVC Waterstop 200 mm	m'	Rp 294,800.00	
104	PVC Waterstop 230 - 320 mm	m'	Rp 951,400.00	
105	Residu	ltr	Rp 13,924.90	
106	Rooster terawang	bh	Rp 5,500.00	
107	Semen (PC)			
	Semen nusantara Tiga roda	zak	Rp 35,000.00	
	Semen putih	zak	Rp 85,000.00	
	Semen warna	kg	Rp 12,000.00	
	Sika grout 215	kg	Rp 6,600.00	
	Screening	kg	Rp 5,500.00	
108	Semen merah	m3	Rp 350,000.00	
109	Seng plat			
	seng BJLS 20 lebar 45 cm	lbr	Rp 15,000.00	
	seng BJLS 20 lebar 55 cm	lbr	Rp 17,000.00	
	seng BJLS 20 lebar 60 cm	lbr	Rp 19,000.00	
	seng BJLS 20 lebar 70 cm	lbr	Rp 22,000.00	
	seng BJLS 20 lebar 80 cm	lbr	Rp 23,500.00	
	seng BJLS 20 lebar 90 cm	lbr	Rp 25,500.00	
	seng BJLS 25 lebar 90 cm	lbr	Rp 35,000.00	
110	Seng gelombang			
	BJLS 30 90x190 cm	lbr	Rp 69,000.00	
	BJLS 25 90x190 cm	lbr	Rp 58,000.00	
	BJLS 20 90x240 cm	lbr	Rp 60,000.00	
	BJLS 20 90x300 cm	lbr	Rp 73,000.00	
111	Solar	ltr	Rp 9,620.00	
112	Soda api	kg	Rp 22,000.00	
113	Sirak	kg	Rp 118,000.00	
114	Sirtu	m3	Rp 175,100.00	
115	Spiritus	ltr	Rp 9,000.00	
116	Spacer	buah	Rp 4,750.00	
117	Storox-100	kg	Rp 29,000.00	
118	Tanah urugan	m3	Rp 65,000.00	
119	Tanah liat	m3	Rp 120,000.00	
120	Tesak oil	ltr	Rp 20,000.00	
121	Teer	ltr	Rp 13,000.00	
122	Terpentin	ltr	Rp 15,000.00	
123	Tegel			
	marmer 40x40 cm	m2	Rp 200,000.00	
	keramik 20x20 cm	m2	Rp 48,400.00	
	keramik 20x25 cm	m2	Rp 48,400.00	
	keramik 30x30 cm	m2	Rp 44,000.00	
	keramik 30x30 cm anti slip	m2	Rp 50,000.00	
	keramik 40x40 cm	m2	Rp 51,000.00	
	porcelain 11x11 cm	m2	Rp 55,000.00	
	teraso 30x30 cm	m2	Rp -	
	kembang 20x20 cm	m2	Rp -	
	kembang 30x30 cm	m2	Rp -	
	warna 20x20 cm	m2	Rp 65,000.00	
	warna 30x30 cm	m2	Rp 60,000.00	
	warna 40x40 cm	m2	Rp 55,000.00	

NO.	URAIAN	SATUAN	EE	KETERANGAN
1	2	3	4	5
	abu - abu 20x20 cm	m2	Rp 52,500.00	
	abu - abu 30x30 cm	m2	Rp 47,500.00	
	abu - abu 40x40 cm	m2	Rp 44,000.00	
124	Thinner melamin	ltr	Rp 30,000.00	
125	Unioir	bh	Rp 625,000.00	
126	vet	kg	Rp 25,000.00	
127	Washtafel	bh	Rp 285,000.00	
128	Wiremesh	kg	Rp 10,000.00	
129	Bak mandi ips porselin/ keramik	bh	Rp 350,000.00	
130	Bak mandi teraso uk. 50x50x50 cm	bh	Rp 200,000.00	
131	Nako	daun	Rp 16,000.00	
132	Kalsi plank/wood plank (200x4000x8 mm)	lbr	Rp 60,000.00	
133	Sewa crane	uh	Rp 1,500,000.00	
134	Sewa Pipe Support	uh/set	Rp 30,000.00	



DAFTAR PUSTAKA

- Amir, Aristo. 2017. Tugas Besar Geometrik Jalan Raya. Makassar.
- Departement Pekerjaan Umum. 1986. *Kriteria Perencanaan 02*. Galang Persada: Bandung.
- Departement Pekerjaan Umum. 1986. *Kriteria Perencanaan 04*. Galang Persada: Bandung.
- Departement Pekerjaan Umum. 1986. *Kriteria Perencanaan 06*. Galang Persada: Bandung.
- Departement Pekerjaan Umum. 1990. *Tata Cara Perencanaan Umum Bendung*. Yayasan Badan Penerbit Pekerjaan Umum: Jakarta.
- Kementrian Pekerjaan Umum dan Perumahan Rakyat. 2017. Modul 3 Dasar- Dasar Perancangan Geometrik Ruas Jalan. Bandung.
- Launardo, Andreas. 2018. Tugas Akhir Desain Geometrik Jalan (Studi Kasus Jalan Raya Singkawang- Bengkayang, Kalimantan Barat). Yogyakarta.
- Lulie, Yohanes. 2017. Perancangan Geometrik Jalan SPL1732. Yogyakarta.
- Mawardi dan Memed. 2002. *Desain Hidraulik Bendung Tetap untuk Irigasi Teknis*. Alfabeta: Bandung.
- Soandrijanie, L. 2017. Perancangan Geometrik Jalan Raya. Yogyakarta.
- Soewarno. 1995. *Analisis Metode Statistik untuk Analisa Data*.
- Sukirman, Silvia. 1999. Dasar- Dasar Perencanaan Geometrik Jalan. Nova: Bandung.