

**TUGAS WAJIB
STRUKTUR BAJA**

Disusun Oleh :

**MUHAMMAD FADIL ICHSAN
14 811 0081**



**PROGRAM STUDI TEKNIK SIPIL
FAKULTAS TEKNIK
UNIVERSITAS MEDAN AREA
MEDAN
2019**

7/4/16
08

JURUSAN TEKNIK SIPIL
FAKULTAS TEKNIK
UNIVERSITAS MEDAN AREA

TUGAS BAJA

Diberikan kepada :

Nama : MUHAMMAD FADIL UHSAN

NPM : K. 04.0081

Diketahui :

- Bentang L = m
- Tinggi H = m
- Jarak Gading-gading Kap l = 500 m
- Jenis Atap =
- Mutu Baja =

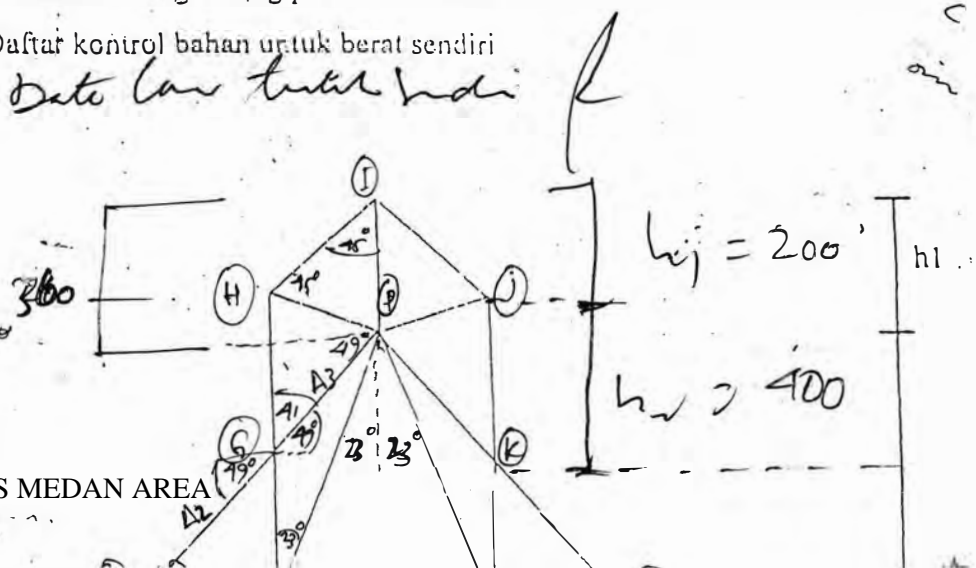
Ditanya :

8737

- Dimensionering gording dalam 3 variasi
- Daftar gaya-gaya batang
- Dimensionering batang profil dan detail
- Daftar kontrol bahan untuk berat sendiri

• Data lain untuk sendiri

A).





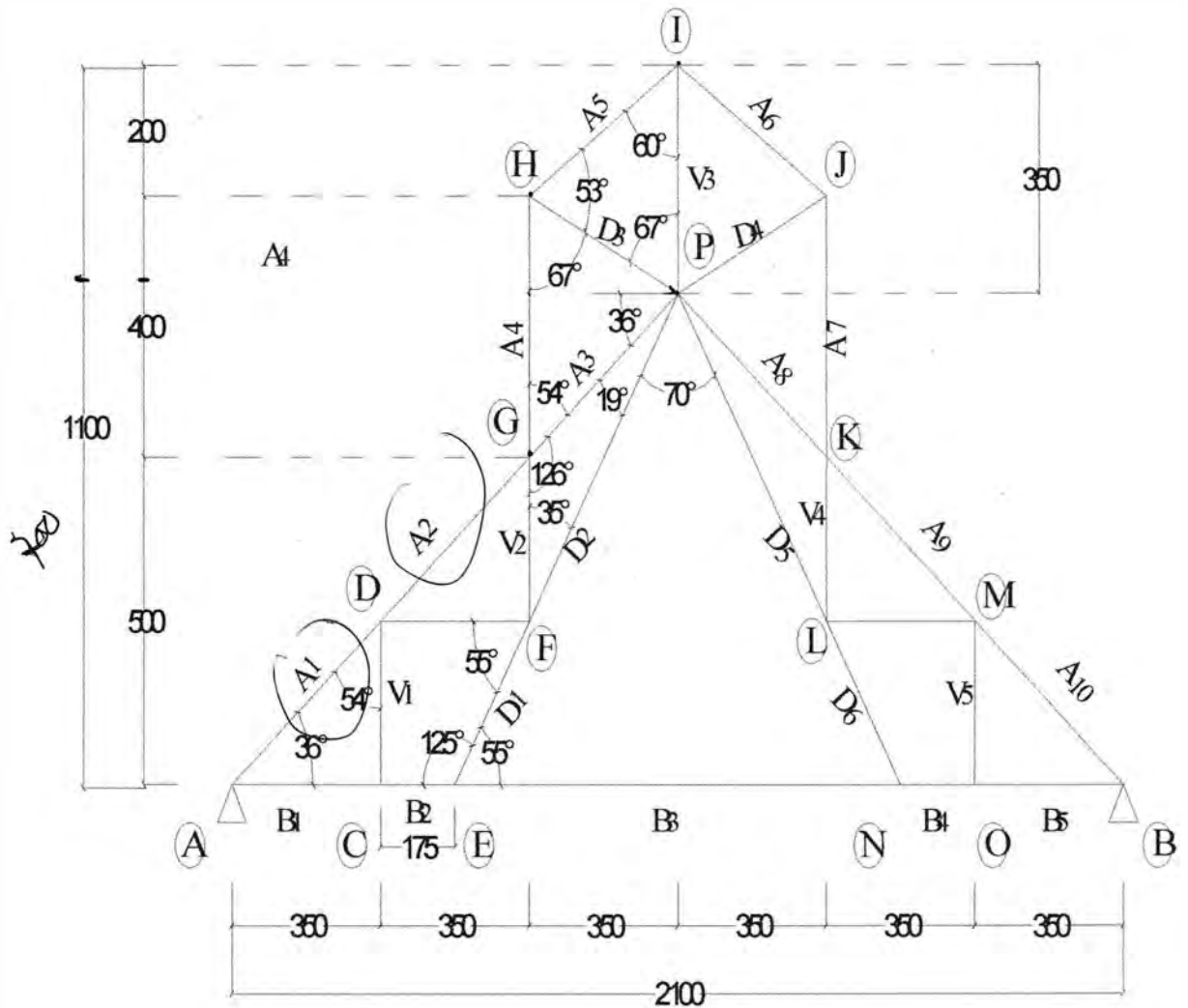
UNIVERSITAS MEDAN AREA
KERTAS ASISTENSI TUGAS WAJIB BAJA

Nama : MUHAMMAD FADIL ICHSAN

NPM : 148110081

NO	TANGGAL/HARI	PARAF	KETERANGAN
1	05/06.7	f	Agenda/pemb.
2			
3	10/06 - 17	f	Agenda/pemb.
4	10/06		
5			
6	13/06 - 12	f	Agenda/pemb.
7	13/06		
8			
9	05/07 - 12	f	Agenda/pemb.
10	05/07		
11			
12	11/07 - 17	f	Agenda/pemb.
13	11/07		
14			
15	17/07	f	Agenda/pemb.
16	17/07		
17			
18			
19			
20			

TUGAS WAJIB KONSTRUKSI BAJA



A. DIKETAHUI

- | | |
|----------------------------|------------------------------------|
| 1. Bentang (L) | = 21,00 m |
| 2. Tinggi (H) | = 11,00 m |
| - h1 | = 7,00 m |
| - h2 | = 4,00 m |
| 3. jarak gading-gading kap | = 5,00 m |
| 4. jenis atap | = seng |
| 5. mutu baja | = ST 37 (1600 kg/cm ²) |



$$\sin 36^\circ = 0,588$$

$$\cos 36^\circ = 0,809$$

$$\sin 35^\circ = 0,574$$

$$\cos 35^\circ = 0,819$$

$$\sin 55^\circ = 0,819$$

$$\cos 55^\circ = 0,574$$

$$\sin 23^\circ = 0,391$$

$$\cos 23^\circ = 0,921$$

$$\sin 54^\circ = 0,809$$

$$\cos 54^\circ = 0,588$$

$$\sin 67^\circ = 0,921$$

$$\cos 67^\circ = 0,809$$

$$\sin 53^\circ = 0,799$$

$$\cos 53^\circ = 0,602$$

$$\sin 60^\circ = 0,866$$

$$\cos 60^\circ = 0,5$$

$$\sin 19^\circ = 0,326$$

$$\cos 19^\circ = 0,946$$

$$\sin 59^\circ = 0,857$$

$$\cos 59^\circ = 0,515$$

B. DITANYA

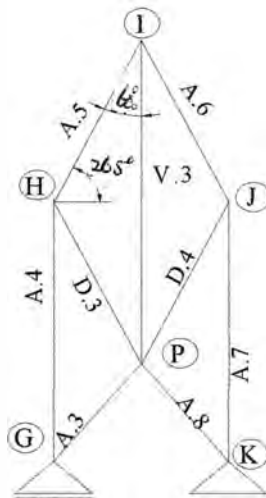
1. Dimensionering gording
2. Daftar gaya-gaya batang
3. Dimensionering batang profil dan detail
4. Daftar control bahan untuk berat sendiri



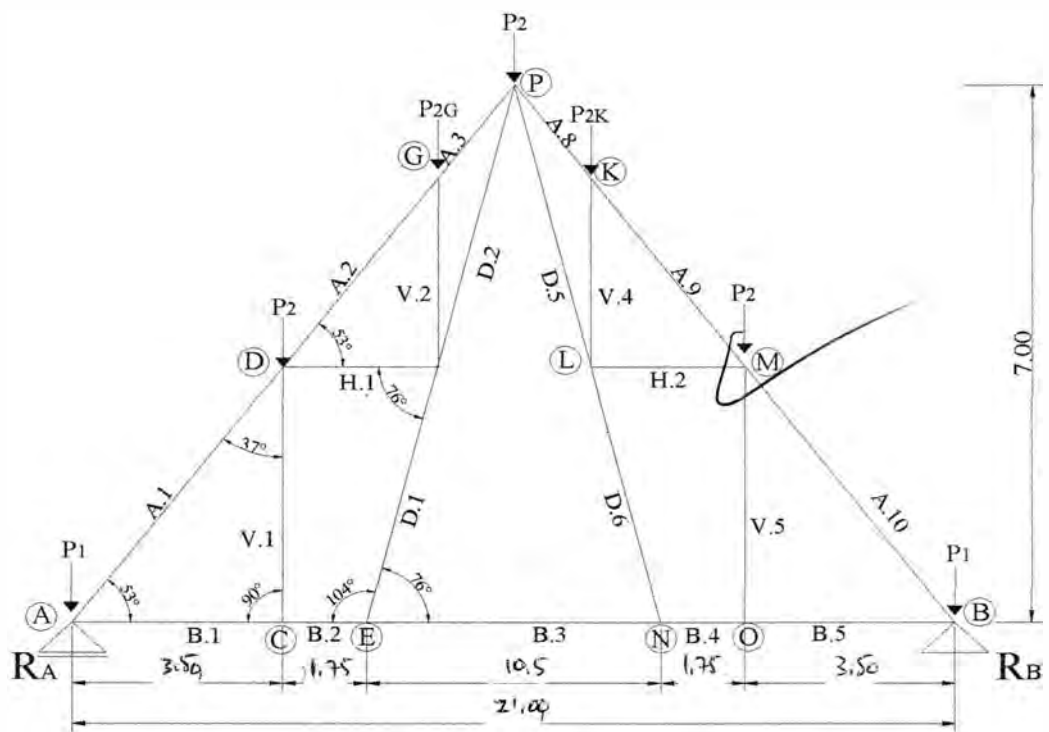
II. DAFTAR GAYA-GAYA BATANG

Untuk menghitung gaya-gaya batang pada konstruksi kuda-kuda ini, konstruksi harus dihitung terpisah yaitu :

Konstruksi A

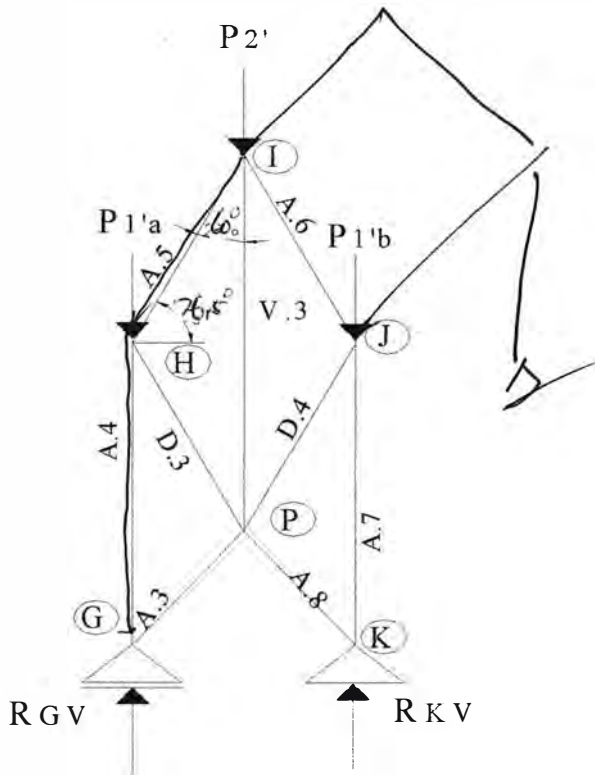


Konstruksi B



1. PERHITUNGAN BEBAN

Konstruksi A



No,	Panjang (m)
A3	4,30
A4	4,00
A5	4,03
A6	4,03
A7	4,00
A8	4,30
D3	3,81
D4	3,81
V3	3,50
JLH	31,75

$$7 + 4,03 = 11,03$$

$$\frac{2}{16,06}$$

Panjang Ikatan angin tap dan dinding

Besi diameter 8 mm = $4 \times 8 = 32$ m

a. Beban Mati

Penutup Atap	$= (2,82 \text{ m} + 1 \text{ m} \times 5,00 \text{ m}) \times 10,00 \text{ kg/m}^2$	= 191,00 kg
Pengikat Atap	= (Taksir)	= 0,20 kg
Ikatan Angin	$= (32,00 \text{ m} \times 4,74 \text{ kg/m}^1)$	= 151,68 kg
Ventilasi	$= (8 \text{ m} \times 3,25 \text{ m} \times 5 \text{ kg/m}^1)$	= 130,00 kg
Gording	$= (5,00 \text{ m} \times 4,76 \text{ kg/m}^1 \times 5 \text{ bh})$	= 119,00 kg
Pengikat Gording	= (Taksir)	= 0,20 kg
Rangka Atap	$= 77,16 \text{ m} \times 5,95 \text{ kg/m}^1$	= 459,10 kg
TOTAL BEBAN MATI (P')		= 1131,18 kg

Ket

Gording menggunakan baja profil kanal kait 125x50x20 dengan $t = 2,3$ mm

Rangka atap menggunakan baja I profil normal 80x42x8

$P' = 1131,18 \sim 1131,00$ kg

$$P2' = 251 \text{ kg}$$

$$P1'a = 440 \text{ kg}$$

$$P1'b = 440 \text{ kg}$$

b. Beban Hidup

$$P2' = 100 \text{ kg}$$

$$P1'a = 100 \text{ kg}$$

$$P1'b = 100 \text{ kg}$$

c. Beban Angin

- Pada bidang angin/Angin Datang/Tiup

$$\alpha \leq 65^\circ$$

$$Wda = (C \times \alpha - 0,4) \times L \times W$$

$$Wda = (0,02 \times 53 - 0,40) \times 2,82 \times 30$$

$$Wda = \mathbf{88,99 \text{ kg/m}}$$

$$\alpha = 65^\circ - 90^\circ$$

$$Wdb = C \times L \times W$$

$$Wdb = 0,90 \times 4,5 \times 30$$

$$Wdb = \mathbf{121,5 \text{ kg/m}}$$

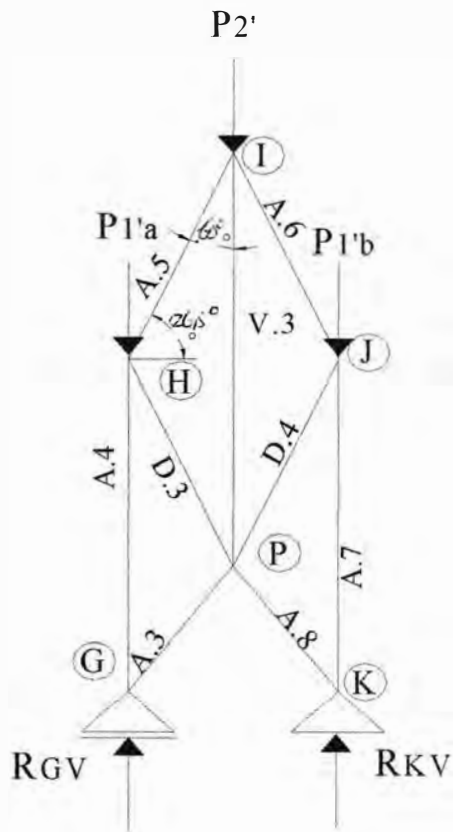
- Pada bidang tidak ada angin/Angin Pergi/Hisap

$$Wp = C \times L \times W$$

$$Wp = -0,40 \times 2,82 \times 30$$

$$\underline{Wp} = \mathbf{-33,84 \text{ kg/m}}$$

2. PERHITUNGAN GAYA BATANG BEBAN MATI



A. PERHITUNGAN REAKSI

$$\Sigma M_K = 0$$

$$R_G \cdot 7 - P_1'a \cdot 7 - P_2' \cdot 3,5 - P_1'b \cdot 0 = 0$$

$$R_G = \frac{(440) \cdot (7) - (251) \cdot (3,5) - (440) \cdot (0)}{7}$$

$$R_G = 565,5 \text{ kg}$$

$$\Sigma M_k = 0$$

$$R_G + R_K = P_1'a + P_2' + P_1'b - R_G$$

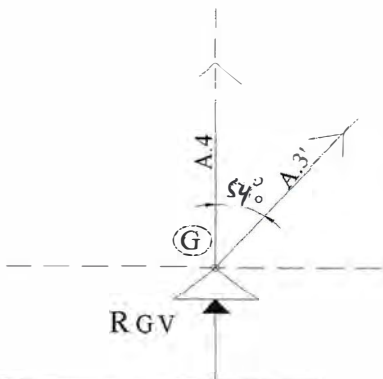
$$R_K$$

$$R_K = 440 + 251 + 440 - 565,5$$

$$R_K = 565,5 \text{ kg}$$

B. GAYA BATANG

TITIK BUHUL-G



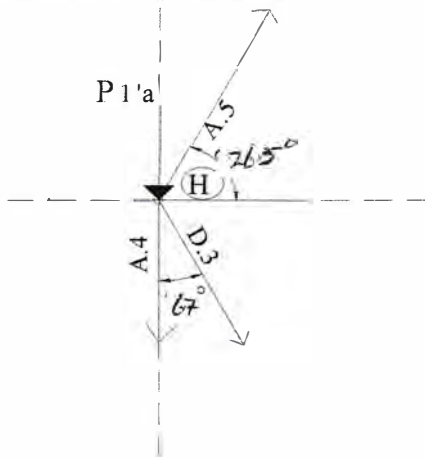
$$\Sigma V = 0$$

$$RGV + A4 + A3 \sin 54^\circ = 0$$

$$565,5 + A4 + (-0,476) = 0$$

A4	= -565,02 kg <i>Tekanan</i>
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TITIK BUHUL-H



$$\Sigma V = 0$$

$$P1'a + A4 + A5 \sin 26,5^\circ + D3 \sin 67^\circ = 0$$

$$440 + (-565,02) - 0,446 A5 + 0,921 D3 = 0$$

$$0,446 A5 + 0,921 D3 - 125,02 = 0 \dots \dots \dots 1$$

$$\Sigma H = 0$$

$$A5 \cos 26,5^\circ + D3 \cos 67^\circ = 0$$

$$0,894 A5 + 0,391 D3 = 0 \dots \dots \dots 2$$

Substitusikan Persamaan 1 dan 2

$$\left. \begin{aligned} -0,446 A5 + 0,921 D3 - 125,02 &= 0 \\ \times 0,894 \end{aligned} \right\}$$

$$\left. \begin{aligned} 0,894 A5 + 0,391 D3 &= 0 \\ \times 0,446 \end{aligned} \right\}$$

$$0,823 D3 - 111,77 = 0$$

$$0,174 D3$$

$$0,997 D3 - 111,77$$

$$D3 = \underline{111,77}$$

$$0,997$$

D3	= 112,11 kg (Tarik)
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$\sin 67^\circ = 0.921$
$\cos 67^\circ = 0.391$

$\sin 26,5^\circ = 0.446$
$\cos 26,5^\circ = 0.894$

Persamaan -2

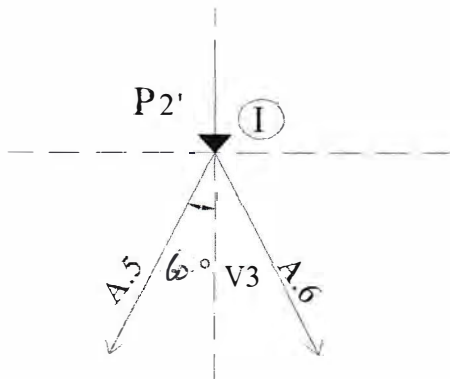
$$-0,446 A5 + 0,921 D3 - 125,02 = 0$$

$$-0,446 A5 + 0,921 (112,11) - 125,02 = 0$$

$$A5 = \frac{21,767}{0,446}$$

A5	= 48,80 kg (Tarik)
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TITIK BUHUL-I



$$\Sigma H = 0$$

$$A5 \cos 60^\circ + A6 \cos 60^\circ = 0$$

$$A5 = A6$$

A6	= 48,80 kg (Tarik)
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$$\Sigma V = 0$$

$$V3 + P2' + A5 \sin 60^\circ + A6 \sin 60^\circ = 0$$

$$V3 + 251 + (48,80 \times 0,866) + (48,80 \times 0,866) = 0$$

$$V3 + 335,52 = 0$$

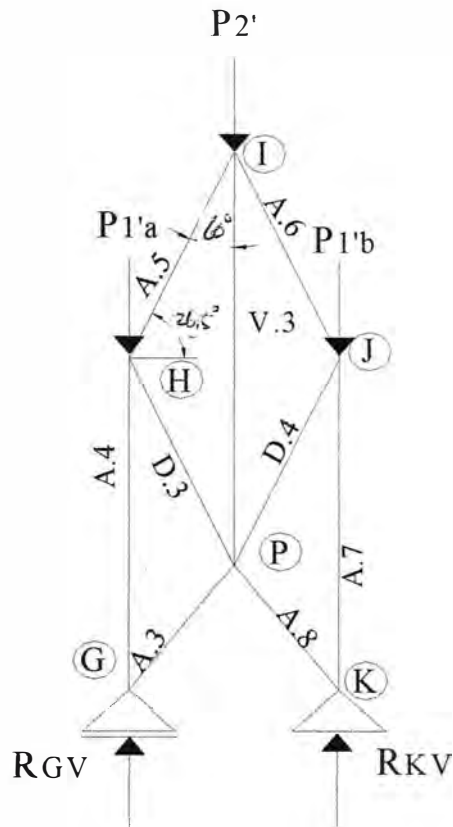
V3	= - 335,52 kg (Tekan)
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TABEL GAYA BATANG

PERHITUNGAN GAYA BATANG (BEBAN MATI)		
No Batang	Batang Tarik (+)	Batang Tekan (-)
A3'	-	0,588
A4	-	565,02
A5	48,80	-
A6	48,80	-
A7	-	565,02
A8	-	0,588
D3	112,11	-
D4	112,11	-

V3	-	335,52
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3. PERHITUNGAN GAYA BATANG BEBAN HIDUP



C. PERHITUNGAN REAKSI

$$\Sigma M_K = 0$$

$$R_G \cdot 7 - P'_{1a} \cdot 7 - P'_2 \cdot 3,5 - P'_{1b} \cdot 0 = 0$$

$$R_G = \frac{(100) \cdot (7) - (100) \cdot (3,5) - (100) \cdot (0)}{7}$$

7

$$R_G = 150 \text{ kg}$$

$$\Sigma M_k = 0$$

$$R_G + R_K = P'_{1a} + P'_2 + P'_{1b} - R_G$$

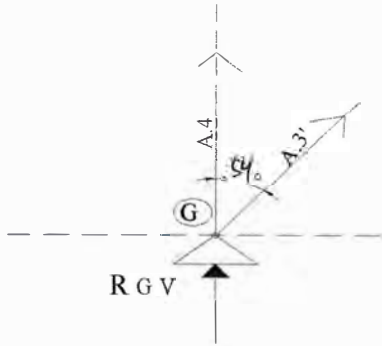
$$R_K$$

$$R_K = 100 + 100 + 100 - 50$$

$$R_K = 150 \text{ kg}$$

D. GAYA BATANG

TITIK BUHUL-G



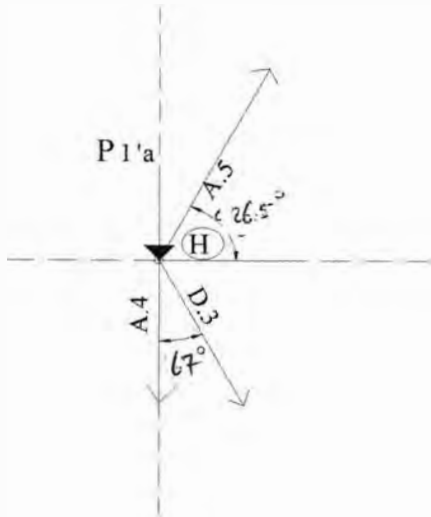
$$\Sigma V = 0$$

$$RGV + A4 + A3 \sin 54^\circ = 0$$

$$150,00 + A4 + (-0,476) = 0$$

A4	= -149,52 (Tekan)
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TITIK BUHUL-H



$$\Sigma V = 0$$

$$P1'a + A4 + A5 \sin 26,5^\circ + D3 \sin 67^\circ = 0$$

$$100 + -149,52 - 0,446 A5 + 0,921 D3 = 0$$

$$0,446 A5 + 0,921 D3 - 50 = 0 \dots \dots \dots 1$$

$$\Sigma H = 0$$

$$A5 \cos 26,5^\circ + D3 \cos 67^\circ = 0$$

$$0,894 A5 + 0,391 D3 = 0 \dots \dots \dots 2$$

Substitusikan Persamaan 1 dan 2

$$-0,446 A5 + 0,921 D3 - 50 = 0 \quad \} \times 0,894$$

$$0,894 A5 + 0,391 D3 = 0 \quad \} \times 0,446$$

$$0,823 D3 - 44,7 = 0$$

$$0,174 D3$$

$$0,997 D3 - 44,7$$

$$D3 = \frac{44,70}{0,997}$$

$$D3 = 44,83$$

D3	= 44,83 kg (Tarik)
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$\sin 67^\circ = 0.921$
$\cos 67^\circ = 0.391$

$\sin 26,5^\circ = 0.446$
$\cos 26,5^\circ = 0.894$

Persamaan -2

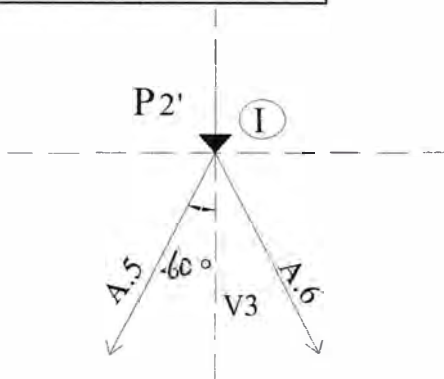
$$-0,446 A5 + 0,921 D3 - 50 = 0$$

$$-0,446 A5 + 0,921 (44,83) - 50 = 0$$

$$A5 = \frac{8,712}{0,446}$$

A5	≅ 19,53 kg (Tarik)
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TITIK BUHUL-I



$$\Sigma H = 0$$

$$A5 \cos 60^\circ + A6 \cos 60^\circ = 0$$

$$A5 = A6$$

A6	= 19,53 kg (Tarik)
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$$\Sigma V = 0$$

$$V3 + P2' + A5 \sin 60^\circ + A5 \sin 60^\circ = 0$$

$$V3 + 100 + (19,53 \times 0,5) + (19,53 \times 0,5) = 0$$

$$V3 + 119,53 = 0$$

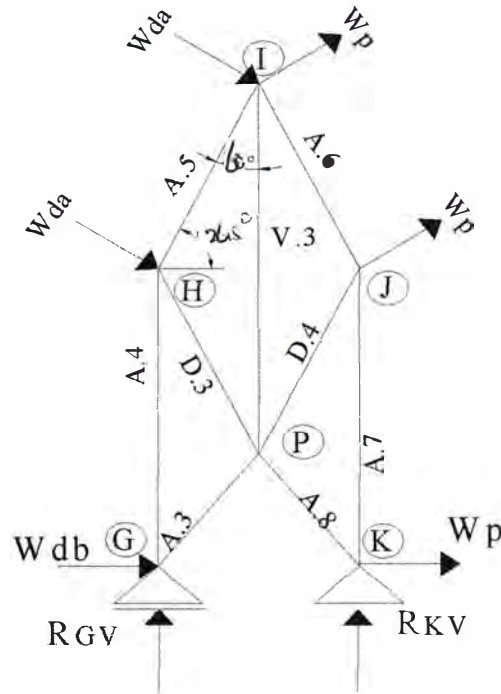
V3	= - 119,53 kg (Tekan)
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TABEL GAYA BATANG

PERHITUNGAN GAYA BATANG (BEBAN HIDUP)		
No Batang	Batang Tarik (+)	Batang Tekan (-)
4.		
5.		
6.	A3'	0,588
7.	A4	149,52
8.	A5	19,53
9.	A6	19,53
10.	A7	149,52
11.	A8	0,588
12.	D3	44,83
13.	D4	44,83
14.	V3	119,53

PERHITUNGAN GAYA BATANG BEBAN ANGIN DATANG

$W_{da} = 88,99 \text{ kg}$ $\cos 60^\circ = 0.5$ $W_{da} \cos 60^\circ = 44,49$
$W_{da} = 88,99 \text{ kg}$ $\cos 26,5^\circ = 0.894$ $W_{da} \cos 26,5^\circ = 79,56$
$W_{db} = 121,5 \text{ kg}$
$W_p = 33,84 \text{ kg}$ $\cos 60^\circ = 0.5$ $W_p \cos 60^\circ = 16,92$



E. PERHITUNGAN REAKSI

$$\Sigma MK = 0$$

$$R_{GV} \cdot 7 - W_{da} \cos 26,5^\circ \cdot (7) - W_{da} \cos 26,5^\circ \cdot (3,5) + W_p \cos 60^\circ \cdot (3,5) + W_p \cdot 0 = 0$$

$$R_{GV} = \frac{79,56 \cdot (7) - 79,56 \cdot (3,5) + 16,92 \cdot (3,5) + 0}{7} = 0$$

$$= \frac{556,92 - 278,46 + 59,22 + 0}{7} = 0$$

$$R_{GV} = \frac{337,68}{7} = 48,24 \text{ kg}$$

$$\Sigma M_k = 0$$

$$R_{KV} \cdot 7 + W_{da} \cos 26,5^\circ \cdot (3,5) + W_p \cos 60^\circ \cdot (3,5) + W_{da} \cdot 0 = 0$$

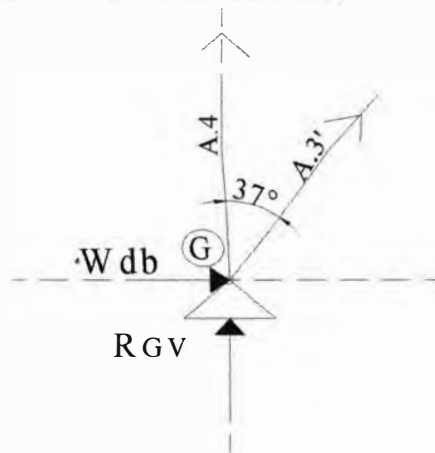
$$R_{KV} = \frac{278,46 + 59,22 + 0}{7} = 0$$

$$R_{KV} = \frac{337,68}{7} = 48,24 \text{ kg}$$

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A. GAYABATANG

TITIK BUHUL-G



$$\Sigma H = 0$$

$$Wdb + A3 \sin 54^\circ = 0$$

$$121,5 + 0,809 A3 = 0$$

$$A3 = - \frac{121,5}{0,809}$$

$$\mathbf{A3 = -150,18 \text{ kg (Tekan)}}$$

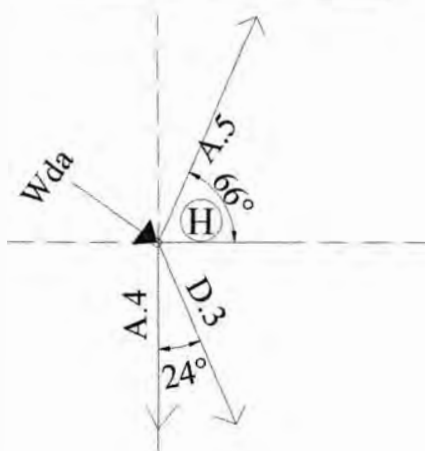
$$\Sigma V = 0$$

$$RGV + A3 \cos 54^\circ + A4 = 0$$

$$48,24 + (-150,18) 0,809 + A4 = 0$$

$$\mathbf{A4 = 73,26 \text{ kg (Tarik)}}$$

TITIK BUHUL-H



$$\Sigma V = 0$$

$$Wda \sin 26,5^\circ + A4 - A5 \sin 26,5^\circ + D3 \sin 67^\circ = 0$$

$$88,99 \cdot 0,446 + (73,26) - 0,446 A5 + 0,391 D3 = 0$$

$$-0,446 A5 + 0,391 D3 + 112,95 = 0 \dots \dots \dots 1$$

$$\Sigma H = 0$$

$$A5 \cos 26,5^\circ + D3 \cos 67^\circ + Wda \cos 26,5^\circ = 0$$

$$0,894 A5 + 0,391 D3 + 79,56 = 0 \dots \dots \dots 2$$

Substitusikan Persamaan 1 dan 2

$$-0,446 A5 + 0,391 D3 + 112,95 = 0 \quad \} \times 0,894$$

$$0,894 A5 + 0,391 D3 + 79,56 = 0 \quad \} \times 0,446$$

$$0,349 D3 + 100,98 = 0$$

$$\mathbf{0,349 D3 + 35,48 = 0}$$

$$0,698 D3 + 136,46 = 0$$

$$D3 = - \frac{136,46}{0,698}$$

$$\mathbf{D3 = -195,50 \text{ kg (Tekan)}}$$

Persamaan -2

$$0,894 A5 + 0,391 D3 + 79,56 = 0$$

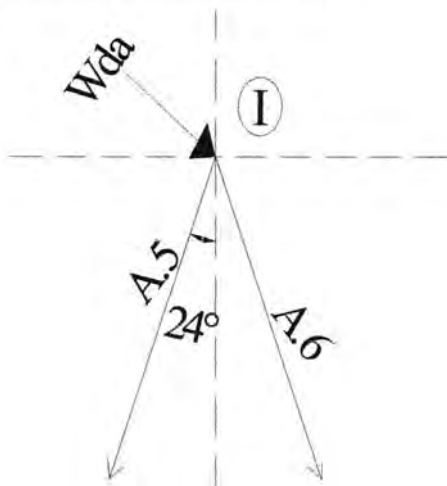
$$0,894 A5 + 0,391 (-195,50) + 79,56 = 0$$

$$A5 = \frac{-3,12}{0,894}$$

$$0,894$$

A5	= - 3,49 kg (Tekan)
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TITIK BUHUL-I



$$\Sigma H = 0$$

$$A5 \cos 60^\circ - A6 \cos 60^\circ - Wda \cos 26,5^\circ = 0$$

$$-3,49 \cdot 0,5 - 0,5 A6 - 79,56 = 0$$

$$A6 = \frac{-81,30}{0,5}$$

$$0,5$$

A6	= - 165,61 kg (Tekan)
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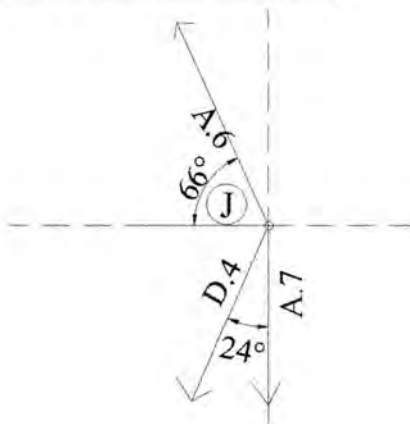
$$\Sigma V = 0$$

$$V3 + Wda \sin 26,5^\circ = 0$$

$$V3 + 39,69 = 0$$

V3	= - 39,69 kg (Tekan)
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TITIK BUHUL-J



$$\Sigma H = 0$$

$$A6 \sin 26,5^\circ - D4 \sin 67^\circ = 0$$

$$165,61 \cdot (0,446) - 0,921 D4 = 0$$

$$D4 = \frac{73,86}{0,921}$$

$$0,921$$

D4	= 80,19 kg (Tarik)
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$$\Sigma V = 0$$

$$A6 \cos 26,5^\circ - D4 \cos 67^\circ + A7 \cos 67^\circ = 0$$

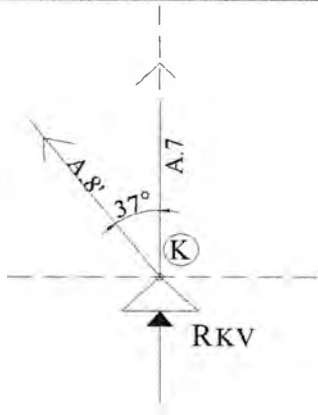
$$- 165,61 \cdot (0,894) - 80,19 \cdot (0,391) + 0,391 A7 = 0$$

$$- 148,05 - 31,35 + 0,391 A7 = 0$$

$$A7 = \frac{179,4}{0,391}$$

$$A7 = 458,82 \text{ kg (Tarik)}$$

TITIK BUHUL -K



$$\Sigma H = 0$$

$$W_{db} + A8 \sin 54^\circ = 0$$

$$121,5 + 0,809 A8 = 0$$

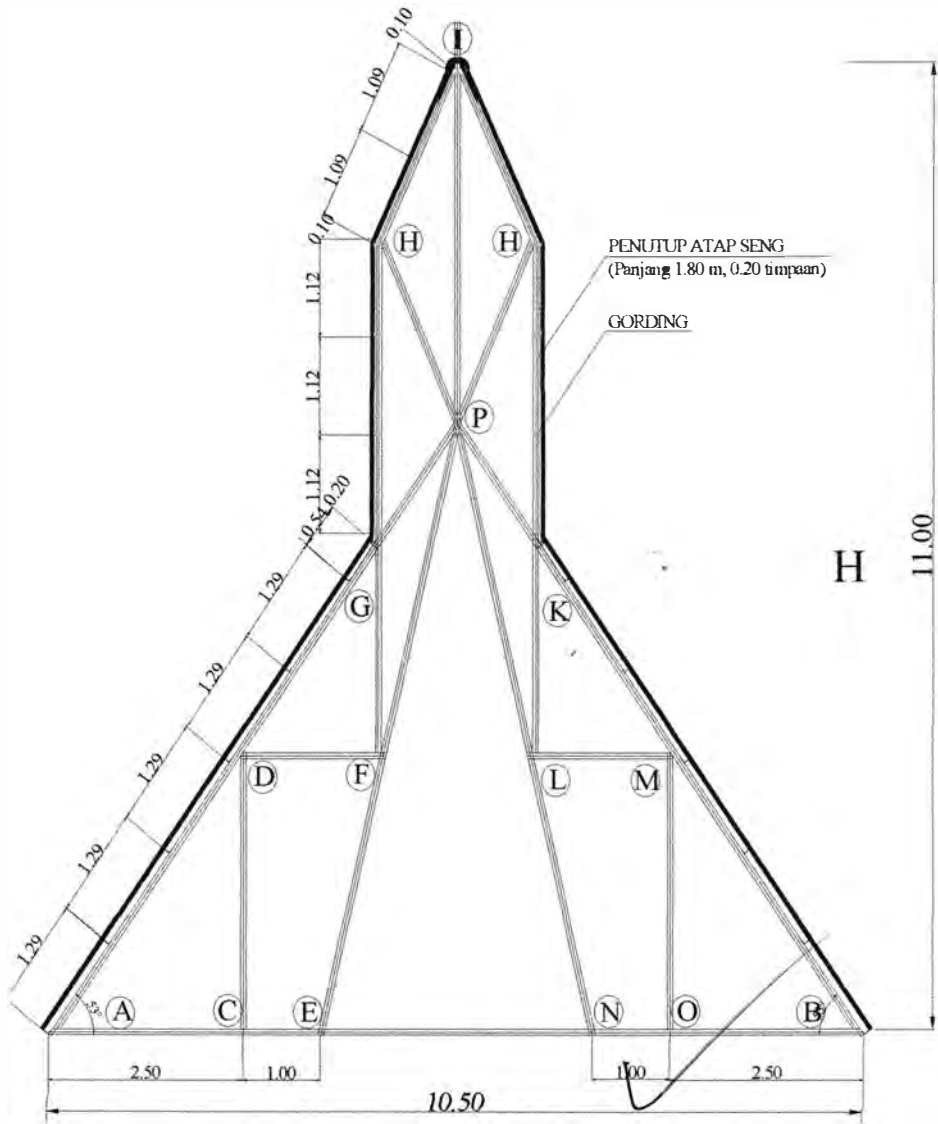
$$A8 = - \frac{121,5}{0,809}$$

$$A8 = -150,18 \text{ kg (Tekan)}$$

TABEL GAYA BATANG

PERHITUNGAN GAYA BATANG (ANGIN DATANG)		
No Batang	Batang Tari (+)	Batang Tekan (-)
A3'	-	150,18
A4	73,26	-
A5	-	3,49
A6	-	165,61
A7	458,82	-
A8	-	150,18
D3	-	195,50
D4	80,19	-
V3	-	39,69

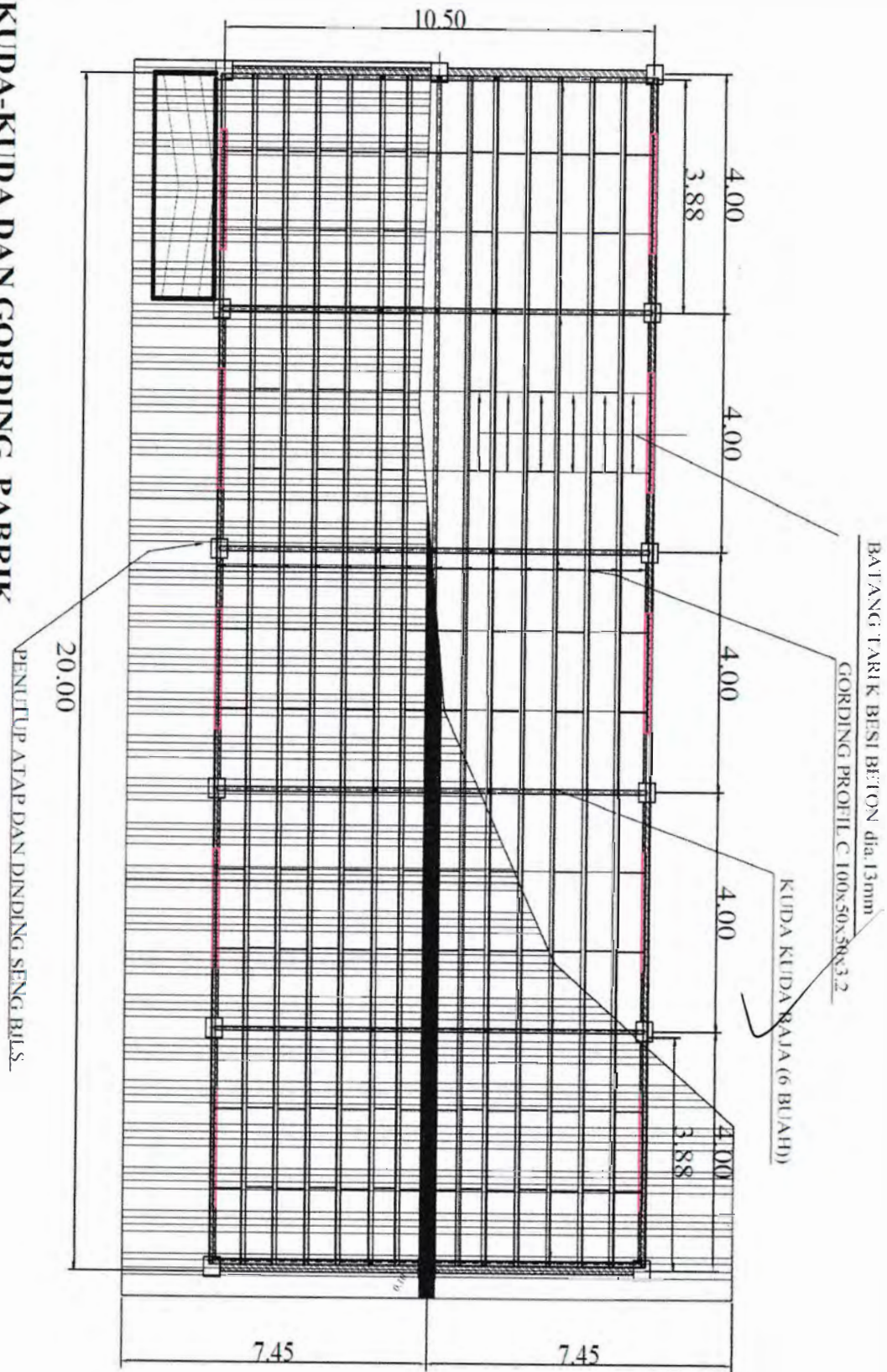
GAMBAR PERENCANAAN GORDING

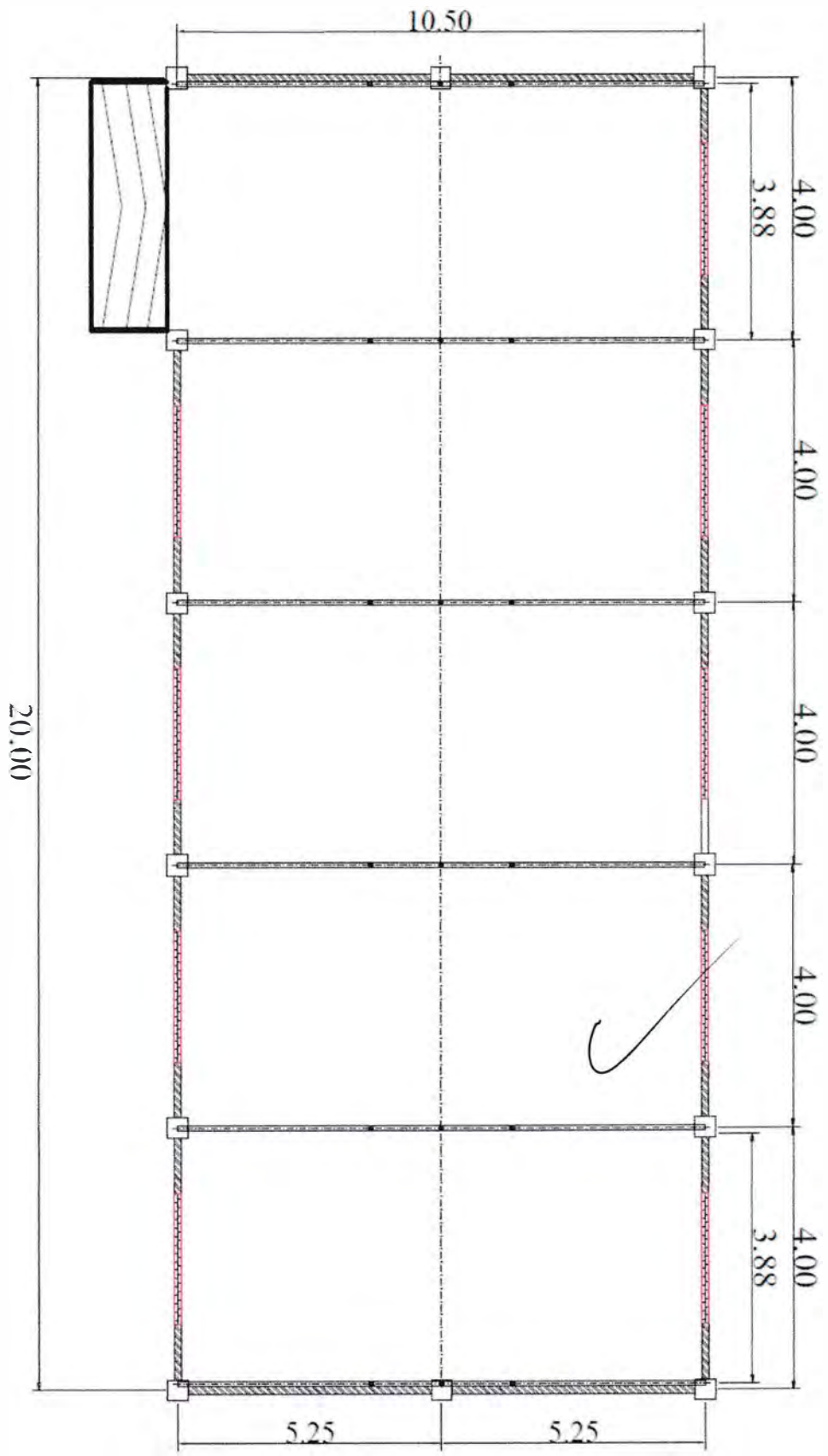


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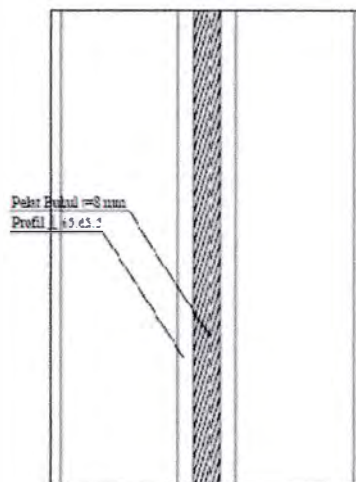
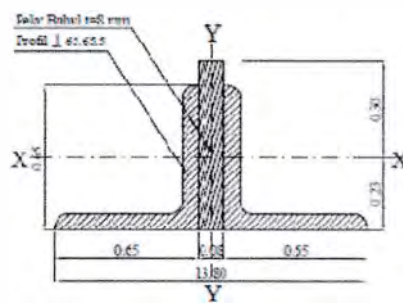
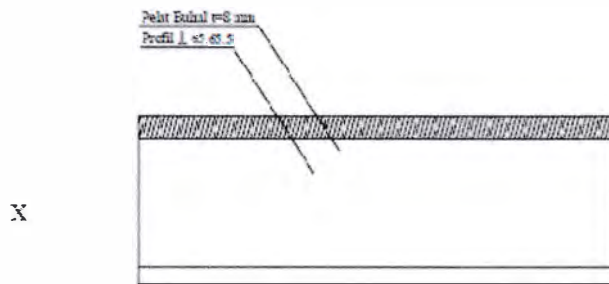
10/06 - 17

KUDA-KUDA DAN GORDING PABRIK

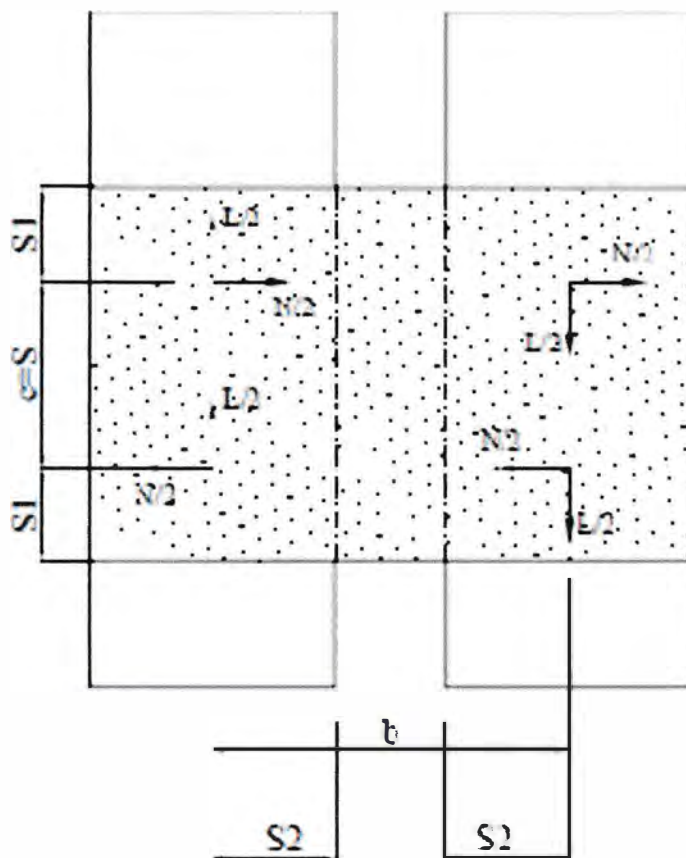
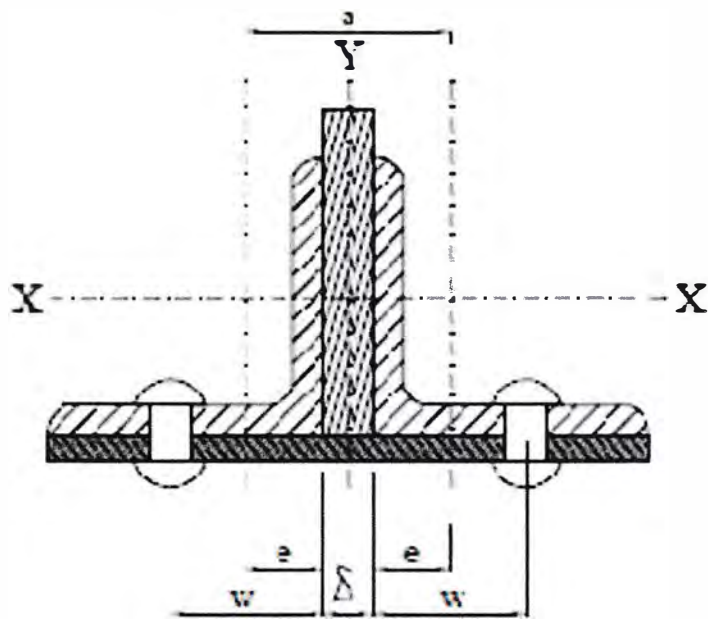




DENAH KUDA-KUDA PABRIK



PROFIL BAJA BATANG TARIK

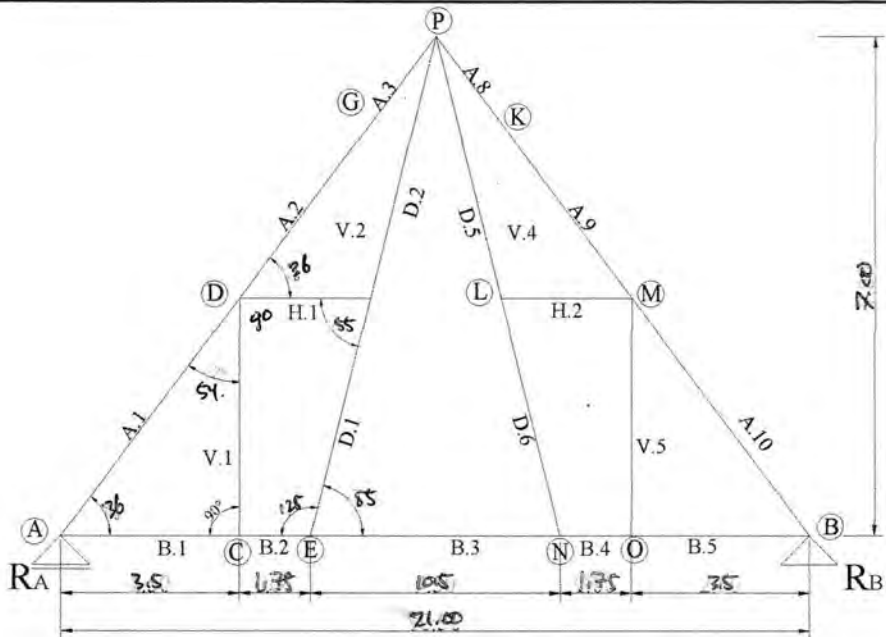


TUGAS WAJIB KONSTRUKSI BAJA

Konstruksi-B

Nilai Sudut Rangka

Sin 36 = 0.588
Cos 36 = 0.809
Sin 54 = 0.809
Cos 54 = 0.588
Sin 35 = 0.574
Cos 35 = 0.819
Sin 55 = 0.819
Cos 55 = 0.574
Sin 60 = 0.866
Cos 60 = 0.500
Sin 26.5 = 0.446
Cos 26.5 = 0.894



1. PERHITUNGAN BEBAN

a. Beban Mati

Penutup Atap	= 25.80 m x 5.00 m x 10.00 kg/m ²	= 1,290.00 kg
Pengikat Atap	= (Taksir)	= 0.20 kg
Ikatan Angin	= 32.00 m x 4.74 kg/m ²	= 151.68 kg
Gording	= 17.00 bh x 5.00 m x 4.76 kg/m ²	= 404.60 kg
Pengikat Gording	= (Taksir)	= 0.20 kg
Rangka Atap	= 75.10 m x 5.95 kg/m ²	= 446.85 kg +

a. Beban Mati = 2,293.53 kg

Beban mati tersebut di jadikan beban titik pada titik buhul rangka, harga dari beban titik (P) tersebut :

P1 (Posisi Tumpuan)	= 2.00 bh x 130.00 kg	= 260.00 kg
P1 (Posisi Buhul)	= 5.00 bh x 256.00 kg	= 1,280.00 kg
(lihat gambar di bawah)		= 1,540.00 kg

b. Beban Hidup

P1 = 100.00 kg
P2 = 100.00 kg

c. Beban Angin

- Pada Bidang Angin/Angin Datang/Angin Tiup

$$\alpha \leq 65^\circ =$$

$$W_{da} = (0.02 \times 53 - 0.40) \times 2.82 \times 30 = 55.84 \text{ kg}$$

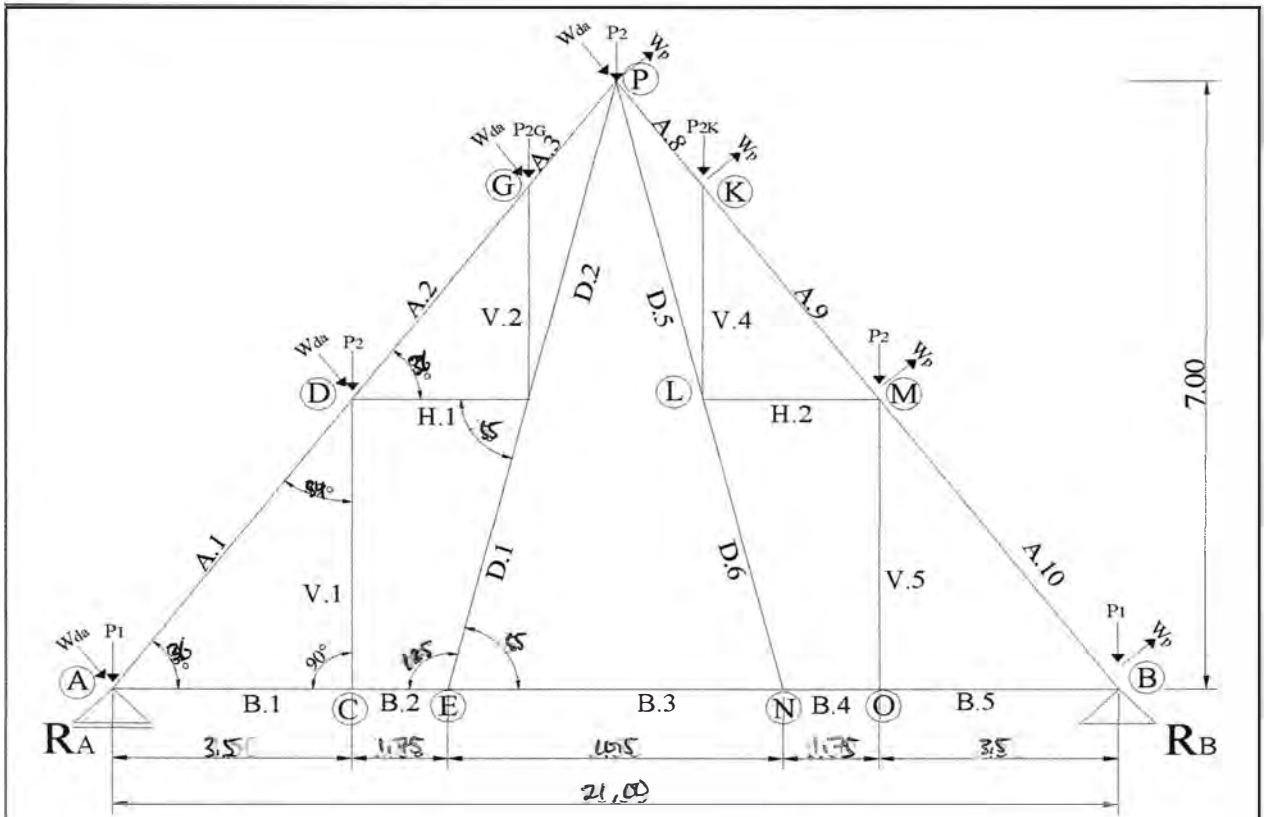
- Pada Bidang Tidak Ada Angin/Angin Pergi/Angin Hisap

$$W_p = -0.40 \times 2.82 \times 30 = -33.84 \text{ kg}$$

Panjang Profil

No.	Panjang (m)
A1.	4.30
A2.	4.30
A3.	4.30
A8.	4.30
A9.	4.30
A10.	4.30
B1.	3.50
B2.	1.75
B3.	10.50
B4.	1.75
B5.	3.50
D1.	3.05
D2.	6.10
D5.	6.10
D6.	3.05
V1.	2.50
V2.	2.50
V4.	2.50
V5.	2.50
75.10 m	

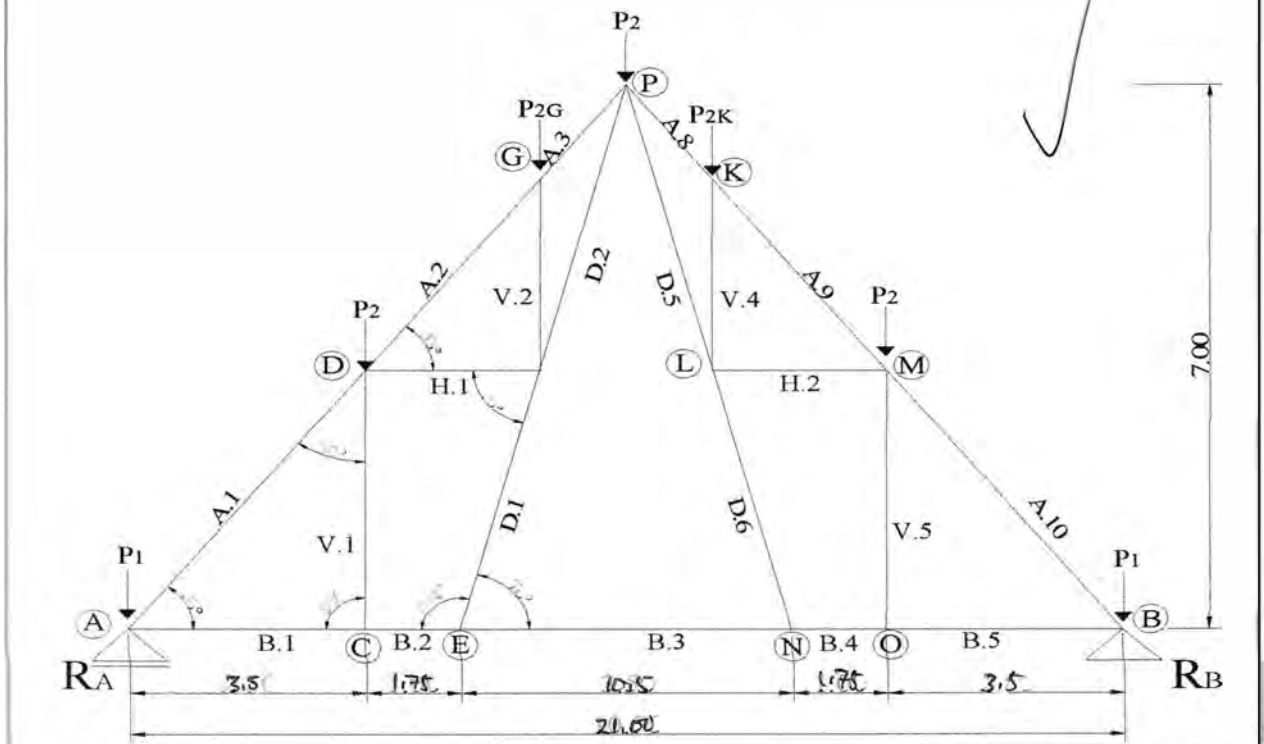
TUGAS WAJIB KONSTRUKSI BAJA



Gambar-1 Gaya-Gaya yang Bekerja Pada Rangka Batang

2. PERHITUNGAN GAYA BATANG AKIBAT BEBAN MATI

$$\begin{aligned}
 R_{GV} &= 565.50 \text{ kg} & P_2 &= 256.00 \text{ kg} & P_{2G} &= 821.50 \text{ kg} \\
 R_{KV} &= 565.50 \text{ kg} & P_1 &= 130.00 \text{ kg} & P_{2K} &= 695.50 \text{ kg}
 \end{aligned}$$



TUGAS WAJIB KONSTRUKSI BAJA

2.1 Perhitungan Gaya Reaksi

$$\Sigma M_B = 0$$

$$R_{VA} \times 21.00 - P_1 \times 21.00 - P_2 \times 17.50 - P_{2G} \times 14.00 - P_2 \times 10.50 - P_{2K} \times 7.00 - P_2 \times 3.50 - P_1 \times 0.00 = 0.00$$

$$R_{VA} \times 21.00 - 130.00 \times 21.00 - 256.00 \times 17.50 - 821.50 \times 14.00 - 256.00 \times 10.50 - 821.50 \times 7.00 - 256.00 \times 3.50 - 130.00 \times 0.00 = 0.00$$

$$21.00 R_{VA} = 2,730.00 + 4,480.00 + 2,688.00 + 5,750.50 + 896.00 + 0.00$$

$$R_{VA} = \frac{+ 28,045.50}{21.00}$$

$$R_{VA} = 1,335.50 \text{ kg}$$

$$\Sigma M_A = 0$$

$$-R_{VB} \times 21.00 + 130.00 \times 21.00 + 256.00 \times 17.50 + 821.50 \times 14.00 + 256.00 \times 10.50 + 821.50 \times 7.00 + 256.00 \times 3.50 + 130.00 \times 0.00 = 0.00$$

$$21.00 R_{VB} = 2,730.00 + 4,480.00 + 2,688.00 + 5,750.50 + 896.00 + 0.00$$

$$R_{VB} = \frac{+ 28,045.50}{21.00}$$

$$R_{VB} = 1,335.50 \text{ kg}$$

Kontrol

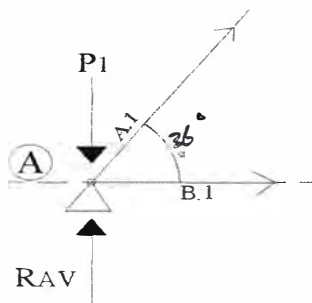
$$\Sigma V = 0$$

$$R_{VA} + R_{VB} - P_1 - P_2 - P_{2G} - P_2 - P_{2K} - P_2 - P_1 = 0.00$$

$$2,671.00 \text{ kg} - 2,671.00 \text{ kg} = 0.00$$

2.2 Gaya Bantang

2.2.1 Titik Buhul-A



$$\Sigma V = 0$$

$$R_{VA} + A_1 \sin 36^\circ - P_1 = 0$$

$$1,335.50 \text{ kg} + 0.588 A_1 - 130.00 = 0.00$$

$$A_1 = \frac{-1,205.50}{0.588}$$

$$A_1 = -2,050.17 \text{ kg (Tekan)}$$

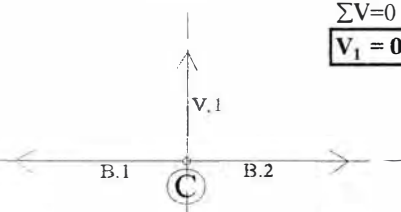
$$\Sigma H = 0$$

$$A_1 \cos 36^\circ + B_1 = 0$$

$$+ 0.809 A_1 + B_1 = 0$$

$$B_1 = +1,658.59 \text{ kg (Tarik)}$$

2.2.2 Titik Buhul-C



$$\Sigma V = 0$$

$$V_1 = 0$$

$$\Sigma H = 0$$

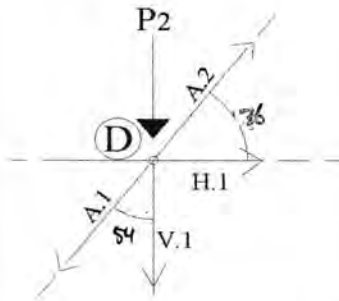
$$B_1 - B_2 = 0$$

$$1,658.59 - B_2 = 0$$

$$B_2 = +1,658.59 \text{ kg (Tarik)}$$

TUGAS WAJIB KONSTRUKSI BAJA

2.2.3 Titik Buhul-D



$$\Sigma V=0$$

$$P_2 + V_1 + A_1 \cos 54^\circ - A_2 \sin 54^\circ = 0$$

$$256 + 0 + 2,050.17 \cdot 0.588 - A_2 \cdot 0.809 = 0$$

$$A_2 = \frac{-949.50}{0.809}$$

$$A_2 = -1,173.67 \text{ kg (Tekan)}$$

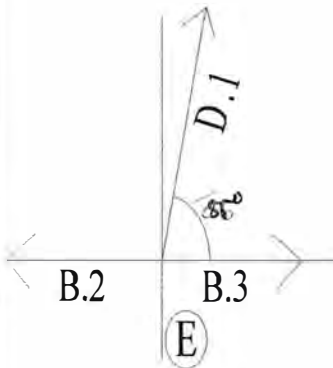
$$\Sigma H=0$$

$$A_1 \sin 54^\circ - A_2 \cos 36^\circ - H_1 = 0$$

$$2,050.17 \cdot 0.809 - (-1173.67 \cdot 0.809) = 0$$

$$H_1 = -709.09 \text{ kg (Tarik)}$$

2.2.4 Titik Buhul-E



$$\Sigma V=0$$

$$D_1 \sin 55^\circ = 0$$

$$0.819 D_1 = 0$$

(persamaan-1)

$$D_1 = 0.00$$

$$\Sigma H=0$$

$$B_2 - B_3 - D_1 \cos 55^\circ = 0$$

$$-0.574 D_1 - B_3 + 0.574 = 0$$

(persamaan-2)

Substitusikan persamaan 1 dan 2

$$0.819 D_1 = 0 \quad \times 0.574$$

$$-0.574 D_1 - B_3 + 1658.59 = 0 \quad \times 0.819 \quad +$$

$$0.470 D_1 = 0$$

$$-0.470 D_1 - 0.819 B_3 + 1358.38 = 0 +$$

$$-0.819 B_3 + 1358.38$$

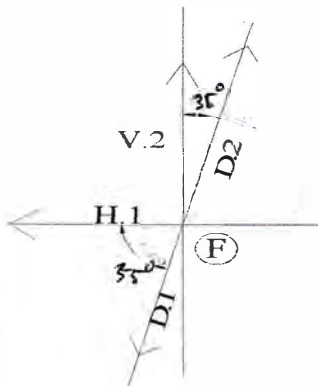
$$B_3 = \frac{1,358.38}{0.819}$$

$$B_3 = 1,658.59$$

$$B_3 = +1,658.59 \text{ kg (Tarik)}$$

TUGAS WAJIB KONSTRUKSI BAJA

2.2.5 Titik Buhul-F



$$\begin{aligned} \Sigma V &= 0 \\ V_2 + D_2 \cos 35^\circ - D_1 \sin 55^\circ &= 0 \\ V_2 + 0.819 D_2 - 0.819 D_1 &= 0 \quad (\text{persamaan-1}) \end{aligned}$$

$$\begin{aligned} \Sigma H &= 0 \\ H_1 + D_1 \cos 55^\circ - D_2 \sin 35^\circ &= 0 \\ -709 + 0.574 D_1 - 0.574 D_2 &= 0 \end{aligned}$$

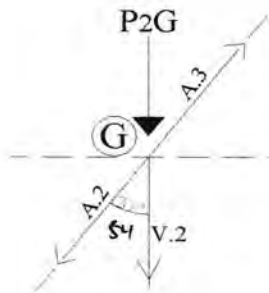
$$D_2 = \frac{-709.09}{0.574}$$

Persamaan-1

$$V_2 = -0.819 \cdot -1235.34$$

$$V_2 = -1,011.75 \text{ kg (Tekan)}$$

2.2.6 Titik Buhul-G

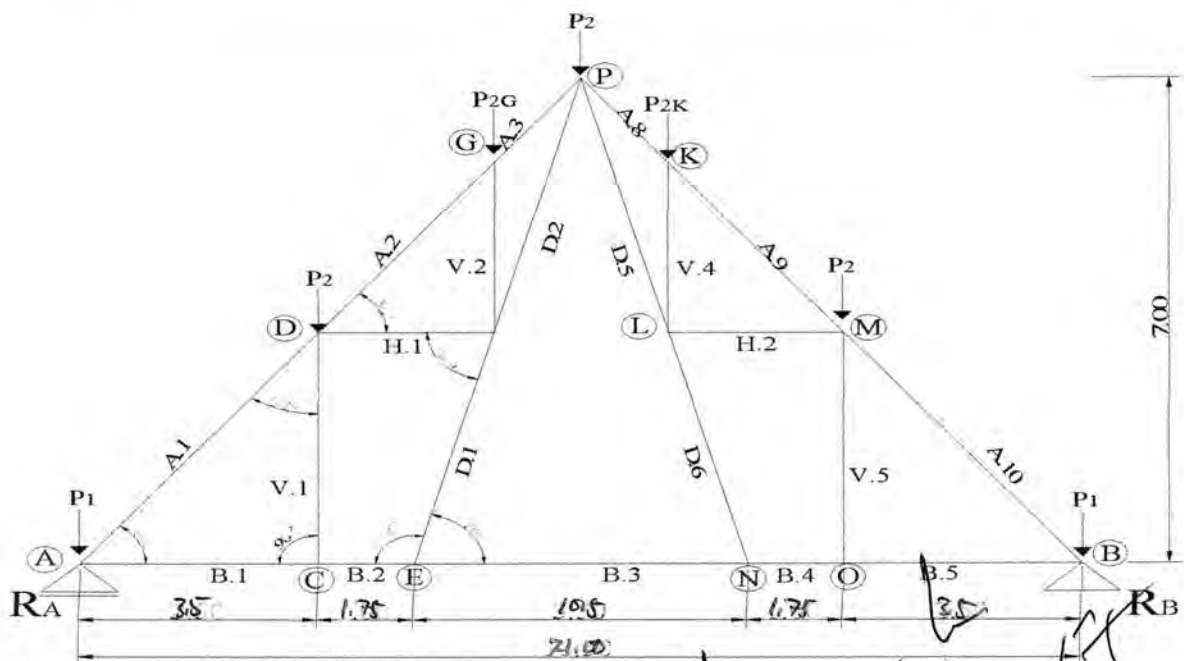


$$\begin{aligned} \Sigma H &= 0 \\ A_2 \sin 54^\circ - A_3 \sin 54^\circ - P_2G &= 0 \\ -1,173.67 \cdot 0.809 - 0.809 A_3 - 821.50 &= 0 \\ A_3 &= \frac{-1,771.00}{0.809} \end{aligned}$$

$$A_3 = -2,189.12 \text{ kg (Tekan)}$$

3. PERHITUNGAN GAYA BATANG AKIBAT BEBAN HIDUP

$$\begin{aligned} P_2 &= 100.00 \text{ kg} \\ P_1 &= 100.00 \text{ kg} \end{aligned}$$



TUGAS WAJIB KONSTRUKSI BAJA

3.1 Perhitungan Gaya Reaksi

$$\Sigma M_B = 0$$

$$R_{VA} \times 21.00 - P_1 \times 21.00 - P_2 \times 17.50 - P_{2G} \times 14.00 - P_2 \times 10.50 - P_{2K} \times 7.00 - P_2 \times 3.50 - P_1 \times 0.00 = 0.00$$

$$R_{VA} \times 21.00 - 100.00 \times 21.00 - 100.00 \times 17.50 - 100.00 \times 14.00 - 100.00 \times 10.50 - 100.00 \times 7.00 - 100.00 \times 3.50 - 100.00 \times 0.00 = 0.00$$

$$21.00 R_{VA} = 2,100.00 + 700.00 + 350.00 + 0.00$$

$$R_{VA} = \frac{+7,350.00}{21.00}$$

$$R_{VA} = 350.00 \text{ kg}$$

$$\Sigma M_A = 0$$

$$-R_{VB} \times 21.00 + 100.00 \times 21.00 + 100.00 \times 17.50 + 100.00 \times 14.00 + 100.00 \times 10.50 + 100.00 \times 7.00 + 100.00 \times 3.50 + 100.00 \times 0.00 = 0.00$$

$$21.00 R_{VB} = 2,100.00 + 700.00 + 350.00 + 0.00$$

$$R_{VB} = \frac{+7,350.00}{21.00}$$

$$R_{VB} = 350.00 \text{ kg}$$

Kontrol

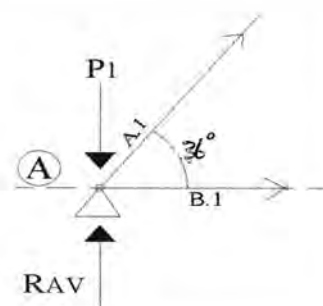
$$\Sigma V = 0$$

$$R_{VA} + R_{VB} - P_1 - P_2 - P_{2G} - P_2 - P_{2K} - P_2 - P_1 = 0.00$$

$$700.00 \text{ kg} - 700.00 \text{ kg} = 0.00$$

3.2 Gaya Bantang

3.2.1 Titik Buhul-A



$$\Sigma V = 0$$

$$R_{VA} + A_1 \sin 36^\circ - P_1 = 0$$

$$350.00 \text{ kg} + 0.588 A_1 - 100.00 = 0.00$$

$$A_1 = \frac{-250.00}{0.588}$$

$$A_1 = -425.17 \text{ kg (Tekan)}$$

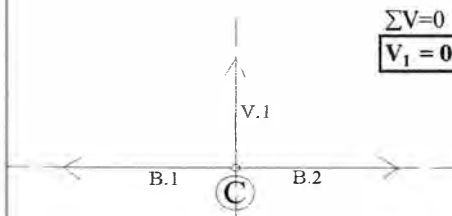
$$\Sigma H = 0$$

$$A_1 \cos 36^\circ + B_1 = 0$$

$$+0.809 A_1 + B_1 = 0$$

$$B_1 = +343.96 \text{ kg (Tarik)}$$

3.2.2 Titik Buhul-C



$$\Sigma V = 0$$

$$V_1 = 0$$

$$\Sigma H = 0$$

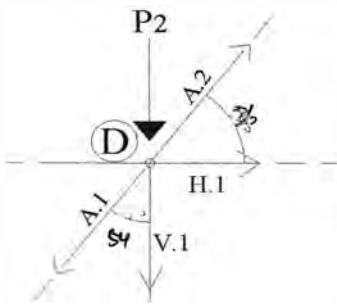
$$B_1 - B_2 = 0$$

$$343.96 - B_2 = 0$$

$$B_2 = +343.96 \text{ kg (Tarik)}$$

TUGAS WAJIB KONSTRUKSI BAJA

3.2.3 Titik Buhul-D



$$\Sigma V=0$$

$$P_2 + V_1 + A_1 \cos 54^\circ - A_2 \sin 54^\circ = 0$$

$$100 + 0 + 425.17 \cdot 0.588 - A_2 \cdot 0.809 = 0$$

$$A_2 = \frac{-150.00}{0.809}$$

$$A_2 = -185.41 \text{ kg (Tekan)}$$

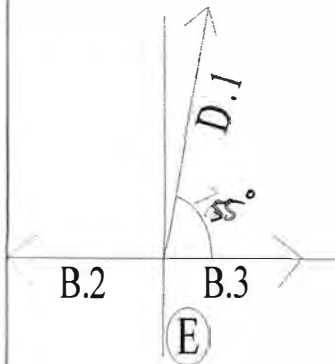
$$\Sigma H=0$$

$$A_1 \sin 54^\circ - A_2 \cos 36^\circ - H_1 = 0$$

$$425.17 \cdot 0.809 - (-185.41) \cdot 0.809 = 0$$

$$H_1 = +193.96 \text{ kg (Tarik)}$$

3.2.4 Titik Buhul-E



$$\Sigma V=0$$

$$D_1 \sin 55^\circ = 0$$

$$0.819 D_1 = 0$$

(persamaan-1)

$$D_1 = 0.00$$

$$\Sigma H=0$$

$$B_2 - B_3 - D_1 \cos 55^\circ = 0$$

$$-0.574 D_1 - B_3 + 0.574 = 0 \quad (\text{persamaan-2})$$

Substitusikan persamaan 1 dan 2

$$0.819 D_1 = 0 \quad \times 0.574$$

$$-0.574 D_1 - B_3 + 343.96 = 0 \quad \times 0.819 \quad +$$

$$0.470 D_1 = 0$$

$$-0.470 D_1 - 0.819 B_3 + 281.71 = 0 \quad +$$

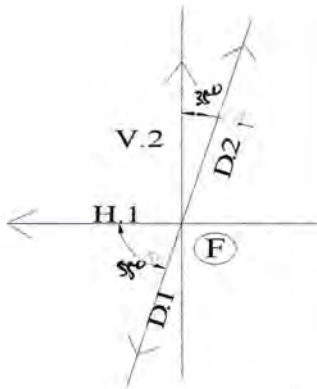
$$-0.819 B_3 + 281.71$$

$$B_3 = \frac{281.71}{0.819}$$

$$B_3 = +343.96 \text{ kg (Tarik)}$$

TUGAS WAJIB KONSTRUKSI BAJA

3.2.5 Titik Buhul-F



$$\Sigma V=0$$

$$\begin{aligned} V_2 + D_2 \cos 35^\circ - D_1 \sin 55^\circ &= 0 \\ V_2 + 0.819 D_2 - 0.819 D_1 &= 0 \quad (\text{persamaan-1}) \end{aligned}$$

$$\Sigma H=0$$

$$\begin{aligned} H_1 + D_1 \cos 55^\circ - D_2 \sin 35^\circ &= 0 \\ 194 + 0.574 D_1 - 0.574 D_2 &= 0 \\ D_2 &= \frac{193.96}{0.574} \end{aligned}$$

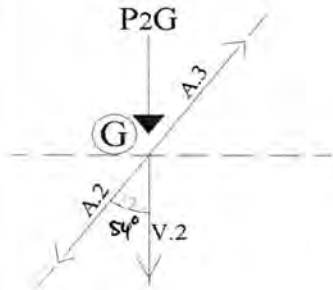
$$D_2 = + 337.91 \text{ kg (Tarik)}$$

$$\text{Persamaan-1}$$

$$V_2 = -0.819 \cdot 337.91$$

$$V_2 = - 276.75 \text{ kg (Tekan)}$$

3.2.6 Titik Buhul-G



$$\Sigma H=0$$

$$\begin{aligned} A_2 \sin 54^\circ - A_3 \sin 54^\circ - P_2G &= 0 \\ -185.41 \cdot 0.809 - 0.809 A_3 - 100.00 &= 0 \\ A_3 &= \frac{-250.00}{0.809} \end{aligned}$$

$$A_3 = - 309.02 \text{ kg (Tekan)}$$

TUGAS WAJIB KONSTRUKSI BAJA

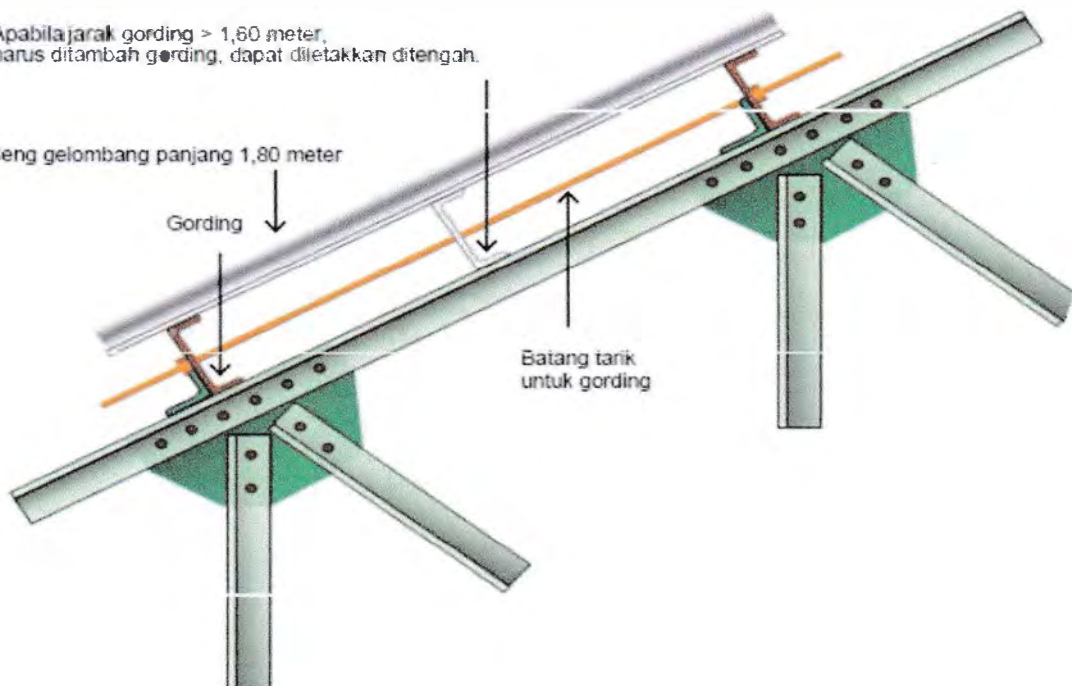
PERHITUNGAN GAYA BATANG AKIBAT BEBAN TETAP

No. Batang	BEBAN MATI		BEBAN HIDUP		BEBAN TETAP	
	Batang Tarik (+)	Batang Tekan (-)	Batang Tarik (+)	Batang Tekan (-)	Batang Tarik (+)	Batang Tekan (-)
A ₁	-	- 2,050.17	-	- 425.17	-	- 2,475.34
A ₂	-	- 1,173.67	-	- 185.41	-	- 1,359.09
A ₃	-	- 2,189.12	-	- 309.02	-	- 2,498.15
A ₄	-	- 551.50	-	- 150.00	-	- 701.50
A ₅	-	- 136.43	-	- 67.20	-	- 203.63
A ₆	-	- 136.43	-	- 67.20	-	- 203.63
A ₇	-	- 551.50	-	- 150.00	-	- 701.50
A ₈	-	- 2,189.12	-	- 309.02	-	- 2,498.15
A ₉	-	- 1,173.67	-	- 185.41	-	- 1,359.09
A ₁₀	-	- 2,050.17	-	- 425.17	-	- 2,475.34
B ₁	+ 1,658.59	-	+ 343.96	-	+ 2,002.55	-
B ₂	+ 1,658.59	-	+ 343.96	-	+ 2,002.55	-
B ₃	+ 1,658.59	-	+ 343.96	-	+ 2,002.55	-
B ₄	+ 1,658.59	-	+ 343.96	-	+ 2,002.55	-
B ₅	+ 1,658.59	-	+ 343.96	-	+ 2,002.55	-
D ₁	-	-	-	-	-	-
D ₂	-+ 1,235.34	-	+ 337.91	-	-+ 897.43	-
D ₃	-	- 136.43	-	-	-	- 136.43
D ₄	-	- 136.43	-	-	-	- 136.43
D ₅	-+ 1,235.34	-	+ 337.91	-	-+ 897.43	-
D ₆	-	-	-	-	-	-
V ₁	-	-	-	-	-	-
V ₂	-	1,011.75	-	- 276.75	-	735.00
V ₃	-	- 46.12	-	- 22.71	-	- 68.83
V ₄	-	1,011.75	-	- 276.75	-	735.00
V ₅	-	-	-	-	-	-
H ₁	-+ 709.09	-	+ 193.96	-	-+ 515.13	-
H ₂	-+ 709.09	-	+ 193.96	-	-+ 515.13	-

TUGAS WAJIB KONSTRUKSI BAJA

Apabila jarak gording > 1,60 meter,
harus ditambah gording, dapat diletakkan ditengah.

Seng gelombang panjang 1,80 meter



I. DIMENSI GORDING DALAM 3 (TIGA) VARIASI

Jarak Gording Dalam Perencanaan Ini Harus Disesuaikan Dengan Ukuran Penutup Atap, Dalam Perencanaan ini penutup atap yang digunakan :

SENG BJLS, DENGAN PANJANG, $L = 1.80 \text{ M}$

Dengan Demikian, Dengan Jarak Overlap BJLS = $0.20 \text{ m} \times 2$ (Atas Dan Bawah), Sehingga Panjang Efektif Seng BJLS $180 - 40 = 1.40 \text{ M}$

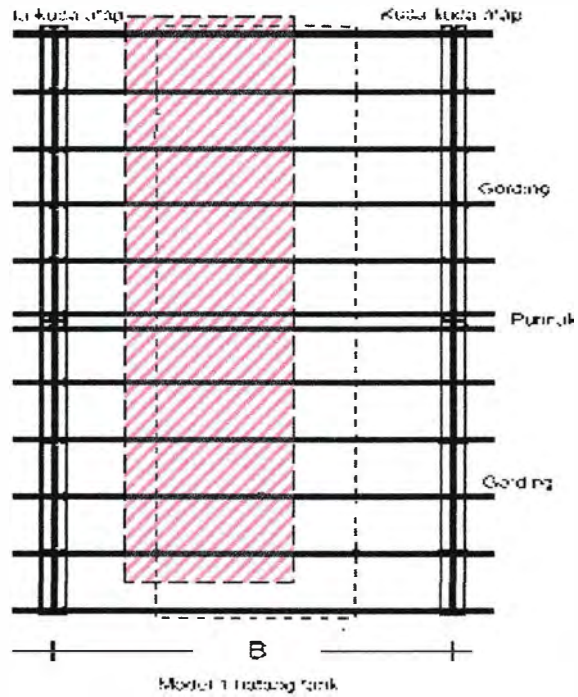
JARAK GORDING $\leq 1.40 \text{ M}$

Perencanaan Gording Ini Dicoba Dengan 3 (Tiga) Variasi Yaitu :

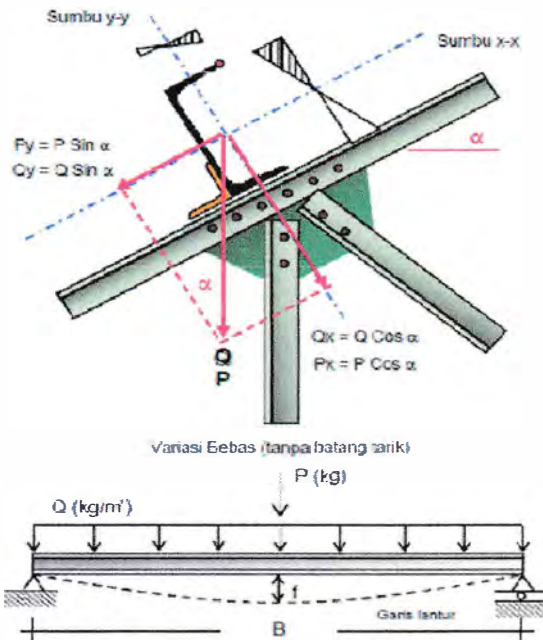
1. VARIASI-A TANPA BATANG TARIK
2. VARIASI-B DENGAN SATU BATANG TARIK (TUNGGAL)
3. VARIASI-C DENGAN DUA BATANG TARIK (GANDA)

TUGAS WAJIB KONSTRUKSI BAJA

1. VARIASI-A TANPA BATANG TARIK



D



TUGAS WAJIB KONSTRUKSI BAJA

1. VARIASI-A TANPA BATANG TARIK

A. PERHITUNGAN BEBAN

a. Beban Mati

- Penutup Atap Seng Bergelombang = $1.29 \times 10.00 = 12.90 \text{ kg/m}$
 - Asumsi Berat Gording = 18.00 kg/m
- Jumlah $Q_{DL} = 30.90 \text{ kg/m}$

b. Beban Hidup

- Beban Terpusat Ditengah Batang
- Jumlah $P_{LL} = 100 \text{ kg}$

c. Beban Angin

- Pada Bidang Angin, $\alpha = 65^\circ - 90^\circ \rightarrow c = 0.90$, $\alpha \leq 65^\circ \rightarrow c = 0.02 \times \alpha - 0.40$
(Angin Datang)
- Pada Bidang Tidak Ada Angin, $\rightarrow c = -0.40$
(Angin Pergi)
- Beban Angin Yang Diambil = $0.90 \times 1.29 \times 50.00 = 58.05 \text{ kg/m}$

B. TEGANGAN IZIN

- Mutu Baja = St.37
- Pembebanan Tetap = $1600.00 \text{ kg/cm}^2 (\sigma t)$
- Pembebanan Sementara = $1.30 \times 1600.00 = 2080.00 \text{ kg/cm}^2 (\sigma s)$

C. LENDUTAN MAKSIMUM YANG DIIZINKAN

- Batas Lendutan Maksimum Arah Vertikal Untuk DL Dan LL

$$f = \frac{1}{250} \times B = \frac{1}{250} \times 5 = 0.02 \text{ M} = 2.00 \text{ CM}$$

D. PERHITUNGAN MOMEN UNTUK MASING-MASING BEBAN

a. Beban Mati (Q_{DL})

$$M_{YQ} = \frac{1}{8} \times Q_{DL} \times \cos 49^\circ \times B^2 = \frac{1}{8} \times 30.90 \times 0.656 \times 25 = 63.35 \text{ kg.m}$$

$$M_{XQ} = \frac{1}{8} \times Q_{DL} \times \sin 49^\circ \times B^2 = \frac{1}{8} \times 30.90 \times 0.755 \times 25 = 72.90 \text{ kg.m}$$

b. Beban Hidup (P_{LL})

$$M_{YP} = \frac{1}{4} \times P_{LL} \times \cos 49^\circ \times B = \frac{1}{4} \times 100 \times 0.656 \times 5 = 82.00 \text{ kg.m}$$

$$M_{XP} = \frac{1}{4} \times P_{LL} \times \sin 49^\circ \times B = \frac{1}{4} \times 100 \times 0.755 \times 5 = 94.38 \text{ kg.m}$$

TUGAS WAJIB KONSTRUKSI BAJA

c. Beban Angin (W_{LL})

$$M_{Yw} = \quad = 0.00 \text{ kg.m}$$

$$M_{Xw} = \frac{1}{8} \times W_{DL} \times B^2 = \frac{1}{8} \times 58.05 \times 25 = 181.41 \text{ kg.m}$$

E. PERHITUNGAN MOMEN MAKSIMUM DENGAN KOMBINASI BEBAN

a. Pembebanan Tetap ($\sigma_t = 1600 \text{ kg/cm}^2$)

$$M_{YMAKS} = M_{YQ} + M_{YP} = 63.35 + 82.00 = 145.35 \text{ kg.m}$$

$$M_{XMAKS} = M_{XQ} + M_{XP} = 72.90 + 94.38 = 167.28 \text{ kg.m}$$

b. Pembebanan Sementara ($\sigma_s = 2080 \text{ kg/cm}^2$)

$$M_{YMAKS} = M_{YQ} + M_{YP} + M_{Yw} = 63.35 + 82.00 + 0.00 = 145.35 \text{ kg.m}$$

$$M_{XMAKS} = M_{XQ} + M_{XP} + M_{Xw} = 72.90 + 94.38 + 181.41 = 348.69 \text{ kg.m}$$

c. Momen Maksimum Yang Digunakan Untuk Perhitungan

$$M_{XMAKS} = 348.69 \text{ kg.m} = \boxed{34,869 \text{ kg.cm}}$$

F. PERHITUNGAN TAHANAN MOMEN UNTUK MEMPEROLEH DIMENSI PROFIL

$$\sigma_s = \frac{M_{XMAKS}}{\omega}$$

$$2,080 = \frac{34,869}{\omega}$$

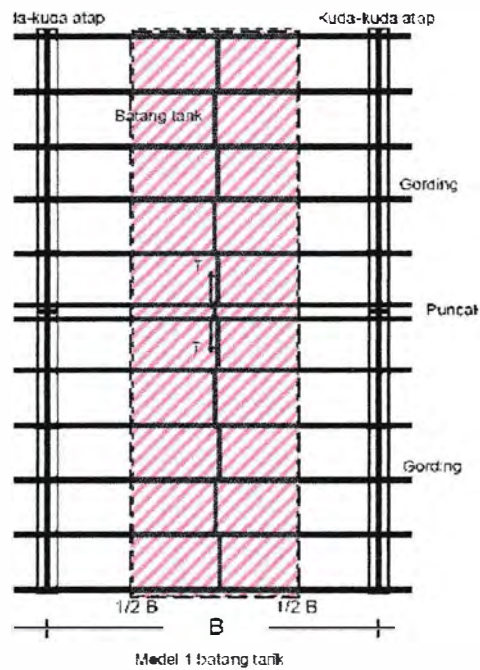
$$\omega = \frac{34,869}{2,080}$$

$$\omega = \boxed{16.76 \text{ cm}^3}$$

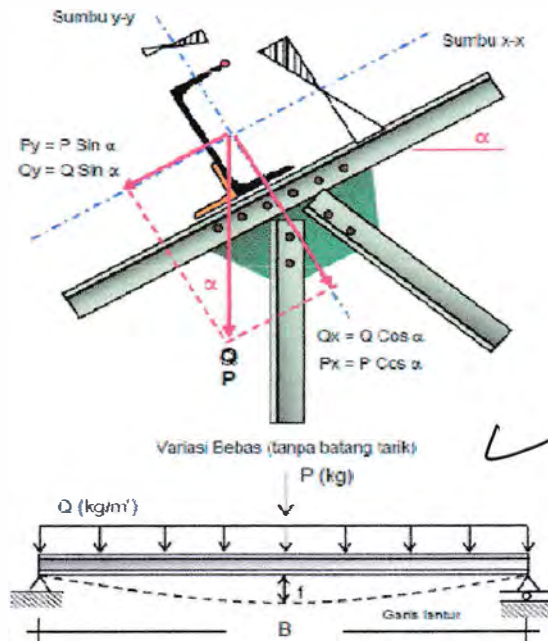


TUGAS WAJIB KONSTRUKSI BAJA

2. VARIASI-B DENGAN SATU BATANG TARIK (TUNGGAL)



D



TUGAS WAJIB KONSTRUKSI BAJA

2. VARIASI-B DENGAN SATU BATANG TARIK (TUNGGAL)

REKAPITULASI PERHITUNGAN ITEM-A S-C ITEM-D VARIASI-A

$$\begin{aligned}Q_{DL} &= 30.90 \text{ kg.m} \\P_{LL} &= 100.00 \text{ kg} \\W_{LL} &= 58.05 \text{ kg.m} \\ \sigma_r &= 1,600 \text{ kg/cm}^2 \\ \sigma_s &= 2,080 \text{ kg/cm}^2 \\ f &= 2.00 \text{ cm} \\ 1/2 B &= 2.50 \text{ m}\end{aligned}$$

E. PERHITUNGAN MOMEN MAKSIMUM DENGAN KOMBINASI BEBAN

a. Beban Mati (Q_{DL})

$$M_{YQ} = \frac{1}{8} \times Q_{DL} \times \cos 49^\circ \times B^2 = \frac{1}{8} \times 30.90 \times 0.656 \times 6.3 = 15.84 \text{ kg.m}$$

$$M_{XQ} = \frac{1}{8} \times Q_{DL} \times \sin 49^\circ \times B^2 = \frac{1}{8} \times 30.90 \times 0.755 \times 6.3 = 18.23 \text{ kg.m}$$

b. Beban Hidup (P_{LL})

$$M_{YP} = \frac{1}{4} \times P_{LL} \times \cos 49^\circ \times B = \frac{1}{4} \times 100 \times 0.656 \times 2.5 = 41.00 \text{ kg.m}$$

$$M_{XP} = \frac{1}{4} \times P_{LL} \times \sin 49^\circ \times B = \frac{1}{4} \times 100 \times 0.755 \times 2.5 = 47.19 \text{ kg.m}$$

d. Beban Angin (W_{LL})

$$M_{YW} = \quad \quad \quad = 0.00 \text{ kg.m}$$

$$M_{XW} = \frac{1}{8} \times W_{DL} \times B^2 = \frac{1}{8} \times 58.05 \times 6.3 = 45.71 \text{ kg.m}$$

E. PERHITUNGAN MOMEN MAKSIMUM DENGAN KOMBINASI BEBAN

c. Momen Maksimum Yang Digunakan Untuk Perhitungan

$$M_{XMAKS} = 111.13 \text{ kg.m} = \boxed{111 \text{ kg.cm}}$$

F. PERHITUNGAN TAHANAN MOMEN UNTUK MEMPEROLEH DIMENSI PROFIL

$$\sigma_s = \frac{M_{XMAKS}}{\omega}$$

$$2,080 = \frac{111}{\omega}$$

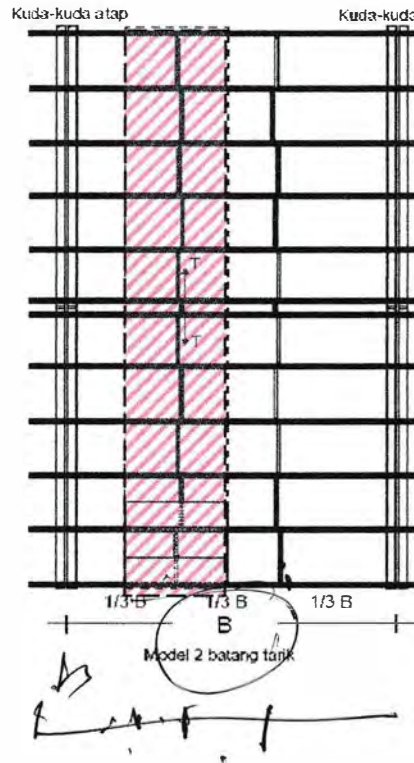
$$\omega = \frac{111}{2,080}$$

$$\omega = \boxed{0.05 \text{ cm}^3}$$

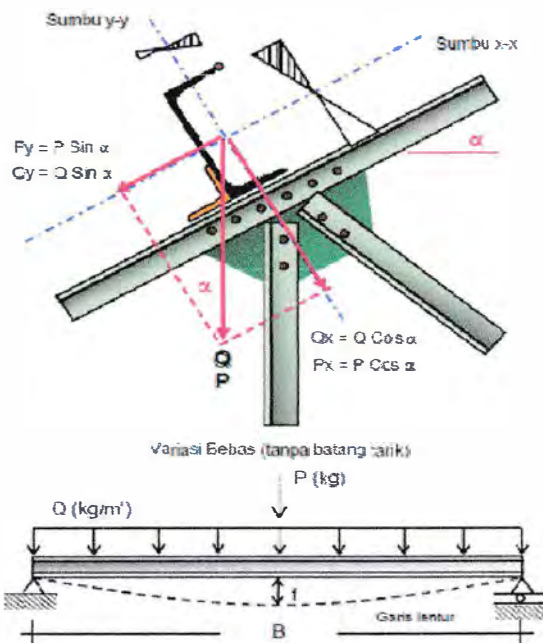


TUGAS WAJIB KONSTRUKSI BAJA

3. VARIASI-C DENGAN DUA BATANG TARIK (GANDA)



D



TUGAS WAJIB KONSTRUKSI BAJA

4. PEMILIHAN PROFIL GORDING

A. Dari Hasil Perhitungan Diperoleh :

1. VARIASI-A TANPA BATANG TARIK

Diperoleh Tahanan Momen = 16.76 cm³

2. VARIASI-B DENGAN SATU BATANG TARIK (TUNGGAL)

Diperoleh Tahanan Momen = 0.05 cm³

3. VARIASI-C DENGAN DUA BATANG TARIK (GANDA)

Diperoleh Tahanan Momen = 0.03 cm³

☉ Yang Diambil Harus $\geq 0,03 \text{ cm}^3$ dan $\leq 17,23 \text{ cm}^3$

B. Dari Hasil Di Atas Profil Yang Digunakan Untuk Gording

a. Profil Baja I-Steel, Ukuran Yang Mendekati Data Di Atas Dan Terdapat Di Pasar Adalah

I -100.50 , $\omega = 34 \text{ cm}^3$

b. Profil Baja Channel , Ukuran Yang Mendekati Data Di Atas Dan Terdapat Di Pasar Adalah

[100x50 , $\omega = 37.60 \text{ cm}^3$

c. Profil Baja Light Channel , Ukuran Yang Mendekati Data Di Atas Dan Terdapat Di Pasar Adalah

C100x50x3.2 , $\omega = 21.30 \text{ cm}^3$

Dari Data Yang Diatas Yang Mendekati Dengan Data Perhitungan Adalah

C100x50x3.2 , $\omega = 21.30 \text{ cm}^3$

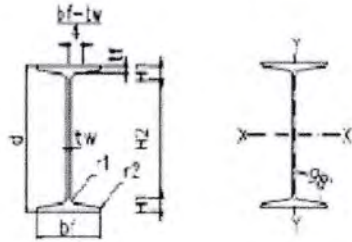
$W_x = 21.30$

$W_y = 7.81$

$I_x = 107$

$I_y = 24.50$

$\omega = 16.76 \text{ cm}^3$
 $E 100 \times 50$
 $\omega = 3$



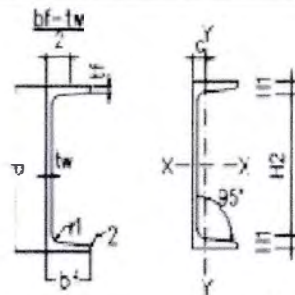
Note

*) Material: JIS G 3101 - SS 400

Fy = 2500 kg/cm² f tf ≤ 15 mm
 Fy = 2400 kg/cm² f 16 mm < tf ≤ 40 mm
 Fy = 2200 kg/cm² f tf > 40 mm

Sectional Dimensions										Sectional Properties								Compact Section Criteria		rT (cm)	d/At (cm)	Lc (cm)	L _u (cm)
d	x	tf	tw	tf	r1	r2	H1	H2	Sec. of Area	Unit Weight	Geometrical Moment of Inertia (cm ⁴)		Radius of Gyration of Area (cm)		Modulus of Section (cm ³)		bf/2tf	d/tw					
mm	mm	mm	mm	mm	mm	mm	mm	mm	cm ²	kg/m	Ix	Iy	ix	iy	Sx	Sy							
I	80	x	42	3.9	5.9	3.9	23	10.8	58.7	7.57	5.94	78	6	3.21	0.91	19	3	3.56	20.51	1.12	3.23	53.5	174.3
I	100	x	50	4.5	6.8	4.5	27	12.3	75.4	10.60	8.32	171	12	4.02	1.07	34	5	3.68	22.22	1.22	2.94	63.7	191.3
		x	75	5.0	8.0	7.0	35	15.5	66.9	15.43	12.90	281	47	4.14	1.70	56	13	4.69	20.00	2.05	1.57	95.6	337.6
I	120	x	58	5.1	7.7	5.1	31	14.0	92.0	14.20	11.15	328	22	4.31	1.23	55	7	3.77	23.53	1.55	2.59	73.9	209.4
I	125	x	75	5.5	9.5	9.0	45	19.8	85.5	20.45	16.05	538	53	5.13	1.68	86	15	3.95	22.73	2.03	1.75	95.6	320.7
I	140	x	66	5.7	8.6	5.7	34	15.7	108.7	18.30	14.37	573	35	5.50	1.59	82	11	3.84	24.53	1.74	2.47	84.1	228.1

Standard Sectional Dimension of Single Channel Steel and its Sectional Area, Unit Weight and Sectional Characteristic



Note :

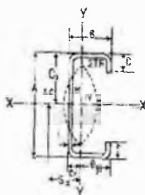
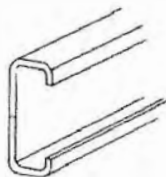
*) Material : JIS G 3101 - SS 400

Fy = 2500 kg/cm² if tf ≤ 16 mm
 Fy = 2400 kg/cm² if 16 mm < tf ≤ 40 mm
 Fy = 2200 kg/cm² if tf > 40 mm

Sectional Dimension								Sectional Properties								Compact Section Criteria		rT	d/Af	Lc	Lu		
d	x	b _f	t _w	t _f	r1	r2	H1	H2	Center of Grav. C	Sec. of Area	Unit Weight	Geometrical Moment of Inertia (cm ⁴)		Radius of Gyration of Area (cm)		Modulus of Section (cm ³)		tf/2tf	d/tw			*)	*)
mm	mm	mm	mm	mm	mm	mm	mm	mm	cm	cm ²	kg/m	I _x	I _y	i _x	i _y	S _x	S _y			(cm)	U/cm	(cm)	(cm)
[30	x	38	5.0	7.0	7.0	3.5	14.9	20.3	1.37	7.10	5.57	26.40	9.10	1.93	1.13	10.56	3.74	2.71	10.00	1.21	1.88	48.4	292.3
[65	x	42	5.5	7.5	7.5	4.0	15.0	33.1	1.42	9.03	7.09	57.50	14.10	2.52	1.25	17.69	5.07	2.80	11.82	1.36	2.06	53.5	272.6
[75	x	40	5.0	7.0	8.0	4.0	15.9	43.3	1.28	3.82	6.92	75.30	12.20	2.92	1.18	20.08	4.49	2.86	15.00	1.32	2.68	51.0	213.0
[80	x	45	6.0	8.0	8.0	4.0	17.0	45.9	1.45	11.00	3.63	106.00	19.40	3.10	1.53	26.50	6.36	2.81	13.53	1.48	2.22	57.4	253.2
[100	x	50	5.0	7.5	8.0	4.0	15.8	66.4	1.54	11.92	9.35	188.00	26.00	3.97	1.48	37.60	7.51	3.53	20.00	1.67	2.67	63.7	211.0
		50	6.0	8.5	8.5	4.5	13.2	63.6	1.55	13.50	10.60	206.00	29.30	3.91	1.47	41.20	8.49	2.94	16.67	1.66	2.35	63.7	232.1

SECTION PROPERTIES

LIGHT LIP CHANNELS



SIZE	SIZE								SECTION AREA				WEIGHT	
	A		B		C		I							
	mm	in	mm	in	mm	in	mm	in	cm ²	in ²	kg/m	kg/ft	lb/ft	
200x75x20x3.2	200	7.874	75	2.953	20	0.787	3.2	0.126	11.81	1.831	9.27	2.824	5.229	
150x75x20x4.5	150	5.906	75	2.953	20	0.787	4.5	0.177	13.97	2.165	11.0	3.351	7.392	
150x65x20x3.2	150	5.906	65	2.559	20	0.787	3.2	0.126	9.567	1.483	7.51	2.288	5.047	
150x50x20x4.5	150	5.906	50	1.969	20	0.787	4.5	0.177	11.72	1.817	9.20	2.802	6.182	
150x50x20x3.2	150	5.906	50	1.969	20	0.787	3.2	0.126	8.607	0.207	6.76	2.059	4.543	
150x50x20x2.3	150	5.906	50	1.969	20	0.787	2.3	0.150	6.322	0.980	4.96	1.511	3.333	
125x50x20x4.5	125	4.921	50	1.969	20	0.787	4.5	0.177	10.59	1.641	8.32	2.534	5.591	
125x50x20x4.0	125	4.921	50	1.969	20	0.787	4.0	0.157	9.548	1.480	7.50	2.285	5.040	
125x50x20x3.2	125	4.921	50	1.969	20	0.787	3.2	0.126	7.807	1.210	6.13	1.867	4.119	
125x50x20x2.3	125	4.921	50	1.969	20	0.787	2.3	0.150	5.747	0.891	4.51	1.374	3.031	
100x50x20x4.5	100	3.937	50	1.969	20	0.787	4.5	0.177	9.469	1.468	7.43	2.263	4.993	
100x50x20x4.0	100	3.937	50	1.969	20	0.787	4.0	0.157	8.548	1.325	6.71	2.044	4.509	
100x50x20x3.2	100	3.937	50	1.969	20	0.787	3.2	0.126	7.007	1.086	5.50	1.675	3.696	
100x50x20x2.5	100	3.937	50	1.969	20	0.787	2.5	0.102	5.796	0.898	4.55	1.386	3.057	
100x50x20x2.3	100	3.937	50	1.969	20	0.787	2.3	0.091	5.172	0.802	4.06	1.227	2.728	
100x50x20x1.6	100	3.937	50	1.969	20	0.787	1.6	0.053	3.672	0.569	2.88	0.877	1.935	

CENTER OF GRAVITY				MOMENT OF INERTIA				RADIUS OF GYRATION				SECTION MODULUS			
Cx		Cy		Ix		Iy		ix		iy		Zx		Zy	
cm	in	cm	in	cm ⁴	in ⁴	cm ⁴	in ⁴	cm	in	cm	in	cm ³	in ³	cm ³	in ³
0	0	2.27	0.894	721	17.32	87.5	2.102	7.77	3.059	2.71	1.067	72.1	4.400	16.8	1.025
0	0	2.50	0.984	489	11.75	99.2	2.383	5.92	2.331	2.66	1.047	65.2	3.979	19.8	1.208
0	0	2.11	0.131	332	7.976	53.8	1.293	5.89	2.319	2.37	0.933	44.3	2.703	12.2	0.744
0	0	1.54	0.604	368	8.841	35.7	0.858	5.60	2.205	1.75	0.689	49.0	2.990	10.5	0.641
0	0	1.54	0.604	280	6.727	28.3	0.680	5.71	2.248	1.81	0.713	37.4	2.282	8.19	0.031
0	0	1.55	0.610	210	5.045	21.9	0.525	5.77	2.272	1.86	0.722	28.0	1.709	6.33	0.513
0	0	1.68	0.661	238	5.718	33.5	0.805	4.74	1.866	1.78	0.701	38.0	2.319	10.1	0.616
0	0	1.68	0.661	217	5.213	33.1	0.795	4.77	1.878	1.81	0.713	34.7	2.117	9.38	0.572
0	0	1.63	0.661	181	4.349	26.6	0.639	4.82	1.898	1.85	0.728	29.0	1.770	8.02	0.489
0	0	1.69	0.665	137	3.291	20.6	0.495	4.88	1.921	1.89	0.783	21.5	1.336	6.22	0.20
0	0	1.86	0.732	139	3.339	30.9	0.742	3.82	1.504	1.81	0.713	27.7	1.690	9.82	0.599
0	0	1.86	0.732	127	3.051	28.7	0.690	3.85	1.516	1.83	0.720	25.4	1.550	9.13	0.557
0	0	1.86	0.732	107	2.571	24.5	0.589	3.90	1.535	1.87	0.736	21.3	1.300	7.81	0.477
0	0	1.86	0.732	85.7	2.155	21.0	0.509	3.93	1.547	1.90	0.748	17.9	1.092	6.68	0.408
0	0	1.86	0.732	80.7	1.935	19.0	0.456	3.95	1.555	1.92	0.756	16.1	0.982	6.06	0.370
0	0	1.87	0.736	58.4	1.403	14.0	0.336	3.99	1.571	1.95	0.768	11.7	0.714	4.47	0.273

TUGAS WAJIB KONSTRUKSI BAJA

5. KONTROL TEGANGAN

1. VARIASI-A TANPA BATANG TARIK

$$\sigma_s = \frac{M_{x\text{MAKS}}}{W_x} + \frac{M_{y\text{MAKS}}}{W_y}$$

$$2,080 \geq \frac{348.69}{21.30} + \frac{145.35}{7.81}$$

$$2,080 \geq 16.37 + 18.61$$

$$2,080 \geq 34.98 \quad \text{OK !!}$$

2. VARIASI-B DENGAN SATU BATANG TARIK (TUNGGAL)

$$\sigma_s = \frac{M_{MAKS}}{W_x} + \frac{M_{y\text{MAKS}}}{W_y}$$

$$2,080 \geq \frac{111.13}{21.30} + \frac{56.84}{7.81}$$

$$2,080 \geq 5.22 + 7.28$$

$$2,080 \geq 12.49 \quad \text{OK !!}$$

3. VARIASI-C DENGAN DUA BATANG TARIK (GANDA)

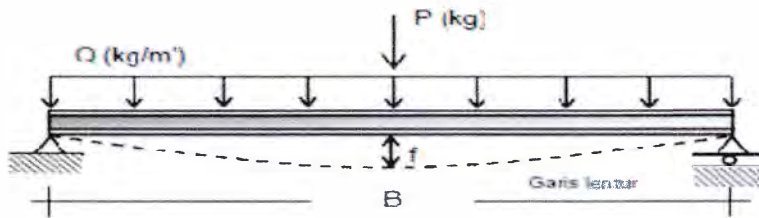
$$\sigma_s = \frac{M_{x\text{MAKS}}}{W_x} + \frac{M_{y\text{MAKS}}}{W_y}$$

$$2,080 \geq \frac{59.78}{21.30} + \frac{34.43}{7.81}$$

$$2,080 \geq 2.81 + 4.41$$

$$2,080 \geq 7.21 \quad \text{OK !!}$$

6. KONTROL LENDUTAN



1. VARIASI-A TANPA BATANG TARIK

DATA

$$\begin{aligned}
 Q_{DL} &= 30.90 \text{ kg.m} & \sin 49^\circ &= 0.755 \\
 P_{LL} &= 100.00 \text{ kg} & \cos 49^\circ &= 0.656 \\
 W_{LL} &= 58.05 \text{ kg.m} & B &= 5.00 \text{ m} \\
 EI &= 2.10\text{E}+06 \\
 I_x &= 107.00 \text{ cm}^4 \\
 I_y &= 24.50 \text{ cm}^4
 \end{aligned}$$

a. Beban Mati (Q_{DL})

$$\begin{aligned}
 f_x &= \frac{4}{384} \times \frac{Q_{DL} \times \sin 49^\circ \times B^4}{EI \times I_x} \\
 &= \frac{4}{384} \times \frac{1.46\text{E}+10}{2.25\text{E}+08} \\
 &= 0.68 \text{ CM}
 \end{aligned}$$

$$\begin{aligned}
 f_y &= \frac{4}{384} \times \frac{Q_{DL} \times \cos 49^\circ \times B^4}{EI \times I_y} \\
 &= \frac{4}{384} \times \frac{1.27\text{E}+10}{5.15\text{E}+07} \\
 &= 2.56 \text{ CM} \quad \swarrow \quad 2.00 \text{ CM} \quad \text{Lendutan Tidak Ok!!}
 \end{aligned}$$

TUGAS WAJIB KONSTRUKSI BAJA

2. VARIASI-B DENGAN SATU BATANG TARIK (TUNGGAL)

DATA

$$\begin{aligned} Q_{DL} &= 30.90 \text{ kg.m} & \sin 49^\circ &= 0.755 \\ P_{LL} &= 100.00 \text{ kg} & \cos 49^\circ &= 0.656 \\ W_{LL} &= 58.05 \text{ kg.m} & 1/2B &= 2.50 \text{ m} \\ EI &= 2.10E+06 \\ I_x &= 107.00 \text{ cm}^4 \\ I_y &= 24.50 \text{ cm}^4 \end{aligned}$$

a. Beban Mati (Q_{DL})

$$\begin{aligned} f_x &= \frac{4}{384} \times \frac{Q_{DL} \times \sin 49^\circ \times 1/2B^4}{EI \times I_x} & f_y &= \frac{4}{384} \times \frac{Q_{DL} \times \cos 49^\circ \times 1/2B^4}{EI \times I_y} \\ &= \frac{4}{384} \times \frac{9.11E+08}{2.25E+08} & &= \frac{4}{384} \times \frac{7.92E+08}{5.15E+07} \\ &= 0.04 \text{ CM} & &= 0.16 \text{ CM} \end{aligned}$$

b. Beban Hidup (P_{LL})

$$\begin{aligned} f_x &= \frac{1}{48} \times \frac{P_{LL} \times \sin 49^\circ \times 1/2B^4}{EI \times I_x} & f_y &= \frac{1}{48} \times \frac{P_{LL} \times \cos 49^\circ \times 1/2B^4}{EI \times I_y} \\ &= \frac{1}{48} \times \frac{2.95E+09}{2.25E+08} & &= \frac{1}{48} \times \frac{2.56E+09}{5.15E+07} \\ &= 0.27 \text{ CM} & &= 1.04 \text{ CM} \end{aligned}$$

c. Beban Angin (W_{LL})

$$\begin{aligned} f_x &= \frac{4}{384} \times \frac{W_{LL} \times \sin 49^\circ \times 1/2B^4}{EI \times I_x} & f_y &= 0.00 \text{ CM} \\ &= \frac{4}{384} \times \frac{1.71E+09}{2.25E+08} \\ &= 0.08 \text{ CM} \end{aligned}$$

d. Kombinasi Lendutan Yang Digunakan

$$\begin{aligned} f_x &= 0.04 \text{ CM} + 0.27 \text{ CM} = 0.32 \text{ CM} \\ f_y &= 0.16 \text{ CM} + 1.04 \text{ CM} = 1.20 \text{ CM} \end{aligned}$$

Maka Lendutan Maksimum

$$\begin{aligned} f_{maks} &= \sqrt{f_x^2 + f_y^2} \\ &= \sqrt{0.10 \text{ CM} + 1.44 \text{ CM}} \\ &= 1.24 \text{ CM} \leq 2.00 \text{ CM} \quad \text{Lendutan Ok!!} \end{aligned}$$

TUGAS WAJIB KONSTRUKSI BAJA

3. VARIASI-C DENGAN DUA BATANG TARIK (GANDA)

DATA

$$\begin{aligned} Q_{DL} &= 30.90 \text{ kg.m} & \sin 49^\circ &= 0.755 \\ P_{LL} &= 100.00 \text{ kg} & \cos 49^\circ &= 0.656 \\ W_{LL} &= 58.05 \text{ kg.m} & 1/3B &= 1.67 \text{ m} \\ EI &= 2.10E+06 \\ I_x &= 107.00 \text{ cm}^4 \\ I_y &= 24.50 \text{ cm}^4 \end{aligned}$$

a. Beban Mati (Q_{DL})

$$\begin{aligned} f_x &= \frac{4}{384} \times \frac{Q_{DL} \times \sin 49^\circ \times 1/3B^4}{EI \times I_x} & f_y &= \frac{4}{384} \times \frac{Q_{DL} \times \cos 49^\circ \times 1/3B^4}{EI \times I_y} \\ &= \frac{4}{384} \times \frac{1.81E+08}{2.25E+08} & &= \frac{4}{384} \times \frac{1.58E+08}{5.15E+07} \\ &= 0.01 \text{ CM} & &= 0.03 \text{ CM} \end{aligned}$$

b. Beban Hidup (P_{LL})

$$\begin{aligned} f_x &= \frac{1}{48} \times \frac{P_{LL} \times \sin 49^\circ \times 1/3B^4}{EI \times I_x} & f_y &= \frac{1}{48} \times \frac{P_{LL} \times \cos 49^\circ \times 1/3B^4}{EI \times I_y} \\ &= \frac{1}{48} \times \frac{5.87E+08}{2.25E+08} & &= \frac{1}{48} \times \frac{5.10E+08}{5.15E+07} \\ &= 0.05 \text{ CM} & &= 0.21 \text{ CM} \end{aligned}$$

c. Beban Angin (W_{LL})

$$\begin{aligned} f_x &= \frac{4}{384} \times \frac{W_{LL} \times \sin 49^\circ \times 1/3B^4}{EI \times I_x} & f_y &= 0.00 \text{ CM} \\ &= \frac{4}{384} \times \frac{3.41E+08}{2.25E+08} \\ &= 0.02 \text{ CM} \end{aligned}$$

d. Kombinasi Lendutan Yang Digunakan

$$f_x = 0.01 \text{ CM} + 0.05 \text{ CM} = 0.06 \text{ CM}$$

$$f_y = 0.03 \text{ CM} + 0.21 \text{ CM} = 0.24 \text{ CM}$$

Maka Lendutan Maksimum

$$\begin{aligned} f_{\text{maks}} &= \sqrt{f_x^2 + f_y^2} \\ &= \sqrt{0.06 \text{ CM}^2 + 0.24 \text{ CM}^2} \\ &= 0.25 \text{ CM} \leq 2.00 \text{ CM} \quad \text{Lendutan Ok!!} \end{aligned}$$

TUGAS WAJIB KONSTRUKSI BAJA

7. DIMENSI DAN VARIASI GORDING

Dari Perhitungan Di Atas Diperoleh Data

Profil Baja Yang Digunakan = Channel 100x50x20x3.2 mm

Kontrol Tegangan =

Variasi - A = (Tegangan Masuk)

Variasi - B = (Tegangan Masuk)

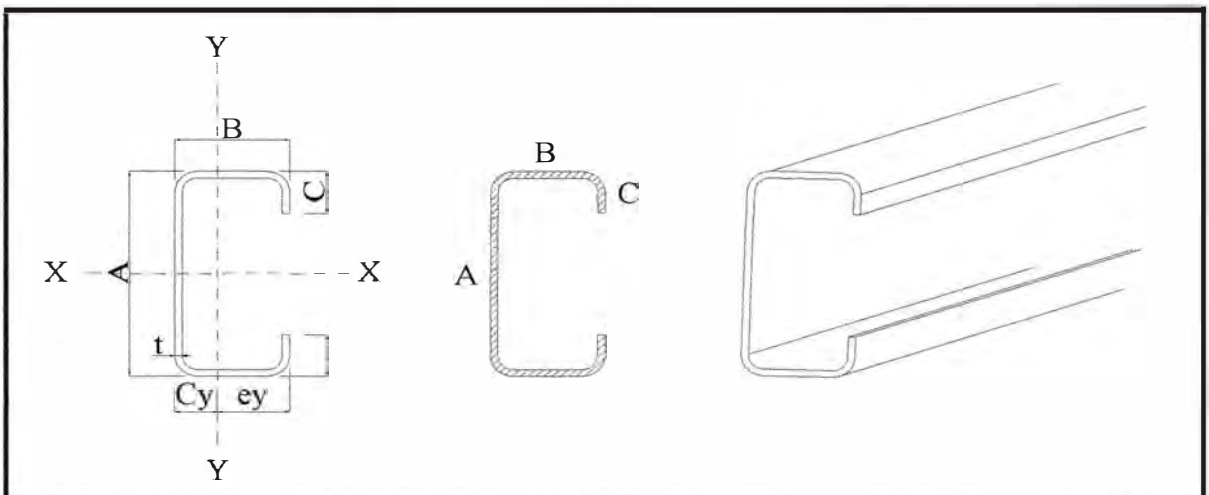
Variasi - C = (Tegangan Masuk)

Kontrol Lendutan =

Variasi - A = (Lendutan Tidak Masuk)

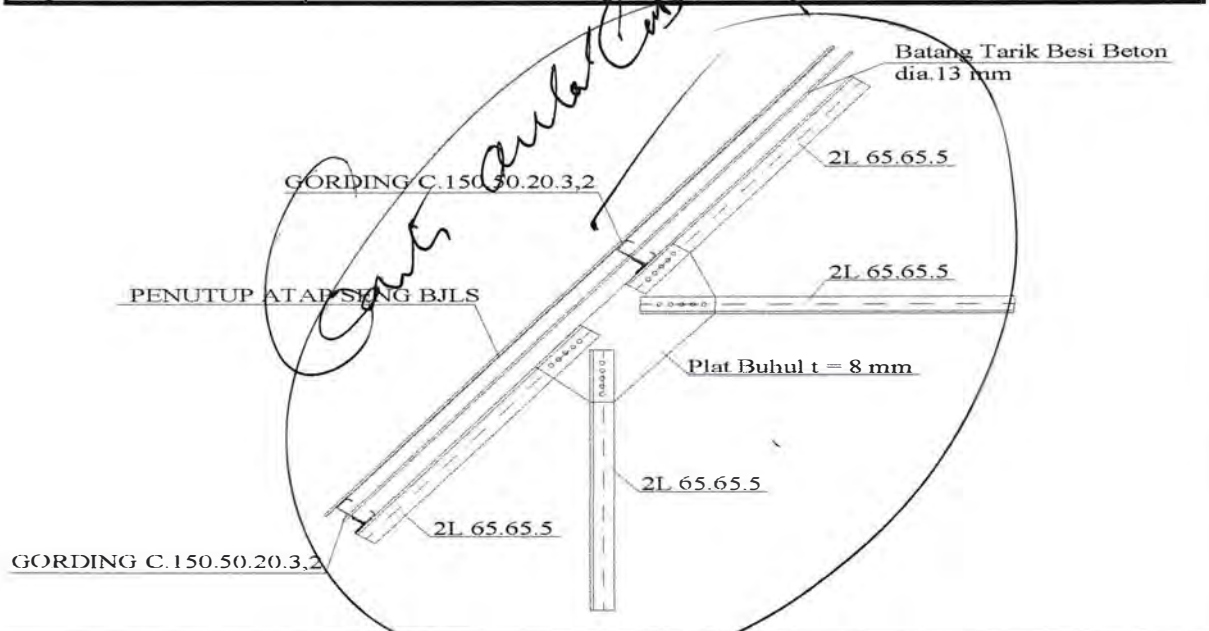
Variasi - B = (Lendutan Masuk)

Variasi - C = (Lendutan Masuk)



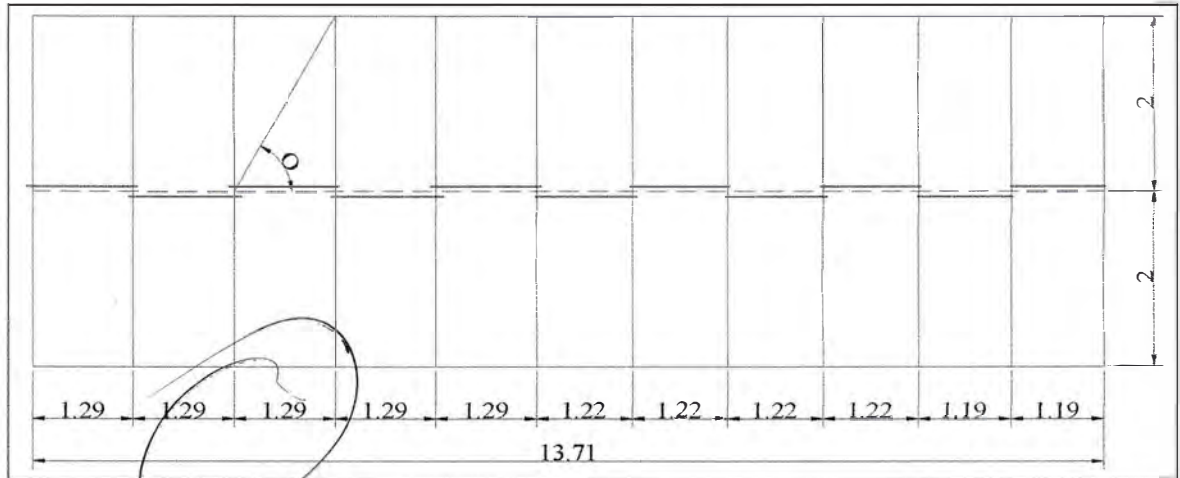
A = 100 mm	$I_x = 107 \text{ cm}^4$
B = 50 mm	$I_y = 24.50 \text{ cm}^4$
C = 20 mm	$W_x = 21.30 \text{ cm}^3$
t = 20 mm	$W_y = 7.81 \text{ cm}^3$
q = 5.50 kg/m	F = 7.807 cm ²

**VARIASI YANG DIGUNAKAN
VARIASI-B**



TUGAS WAJIB KONSTRUKSI BAJA

7. DIMENSI BATANG TARIK



A. BEBAN YANG BEKERJA

- Penutup Atap Seng Bergelombang	=	1.29	x	1.67	x	10.00	x	0.755	=	16.26	kg
- Gording	=	1.67	x	5.00	x	0.755	=	6.30	kg		
- Beban Hidup	=			100	x	0.755	=	75.50	kg		
									=	98.07	kg

B. RENCANA DIMENSI

$$\sigma_s \geq \frac{P / \cos \theta}{1/4 \pi d^2}$$

$$1,600 \geq \frac{1,079 / \cos 52.316}{0.25 \cdot 3.14 \cdot d^2}$$

$$d^2 \geq \frac{1,765.57}{1,256.00}$$

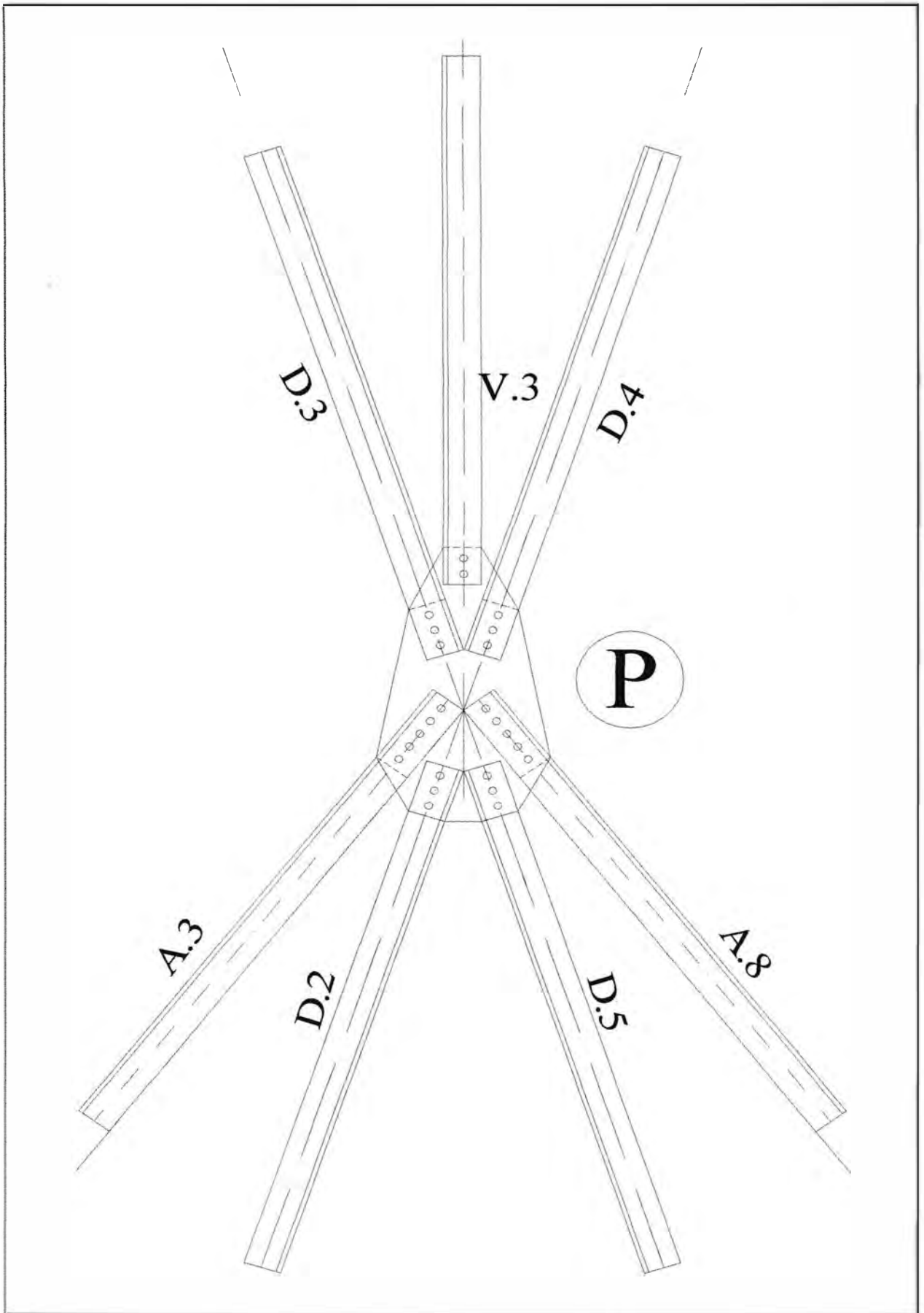
$$d^2 \geq \sqrt{1.406}$$

$$d^2 \geq 1.19 \text{ CM}$$

Diambil Diameter Batang Tarik Besi Besi Beton ϕ 13 mm



TUGAS WAJIB KONSTRUKSI BAJA



TUGAS WAJIB KONSTRUKSI BAJA

1. TITIK BUHUL - A

1.1 Profil A1

$$N = 2,240.58 \text{ Kg (-)}$$

$$Pds = 784.00 \text{ Kg/cm}^2$$

$$Pgs = 430.00 \text{ Kg/cm}^2$$

$$\text{Jumlah Paku} = \frac{N}{Pds} = \frac{2,240.58}{784.00} = 2.86 \text{ Bh} = 3.00 \text{ Bh} = \boxed{3.00 \text{ Bh}}$$

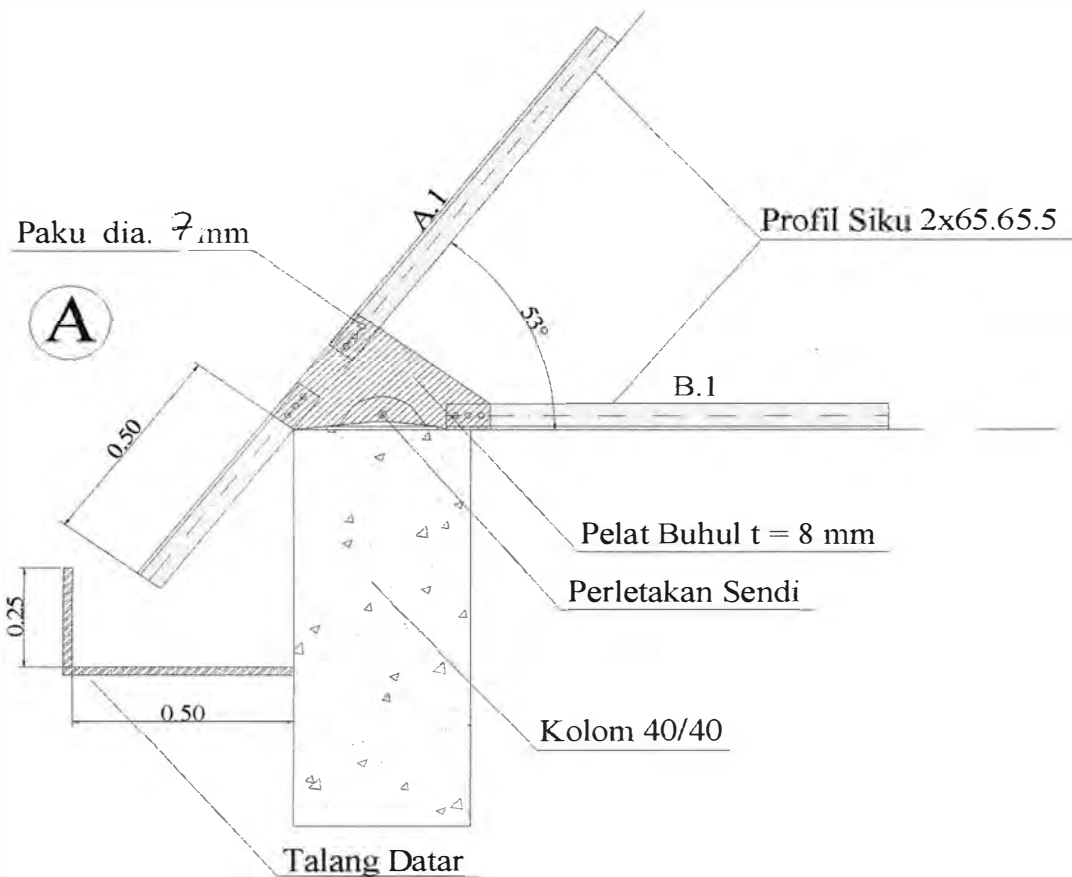
1.2 Profil B1

$$N = 2,097.51 \text{ Kg (+)}$$

$$Pds = 784.00 \text{ Kg/cm}^2$$

$$Pgs = 430.00 \text{ Kg/cm}^2$$

$$\text{Jumlah Paku} = \frac{N}{Pgs} = \frac{2,097.51}{430.00} = 4.88 \text{ Bh} = 5.00 \text{ Bh} = \boxed{5.00 \text{ Bh}}$$



TUGAS WAJIB KONSTRUKSI BAJA

2. TITIK BUHUL - C DAN O

2.1 Profil B1 Dan B2

$$N = 2,097.51 \text{ Kg (-)}$$

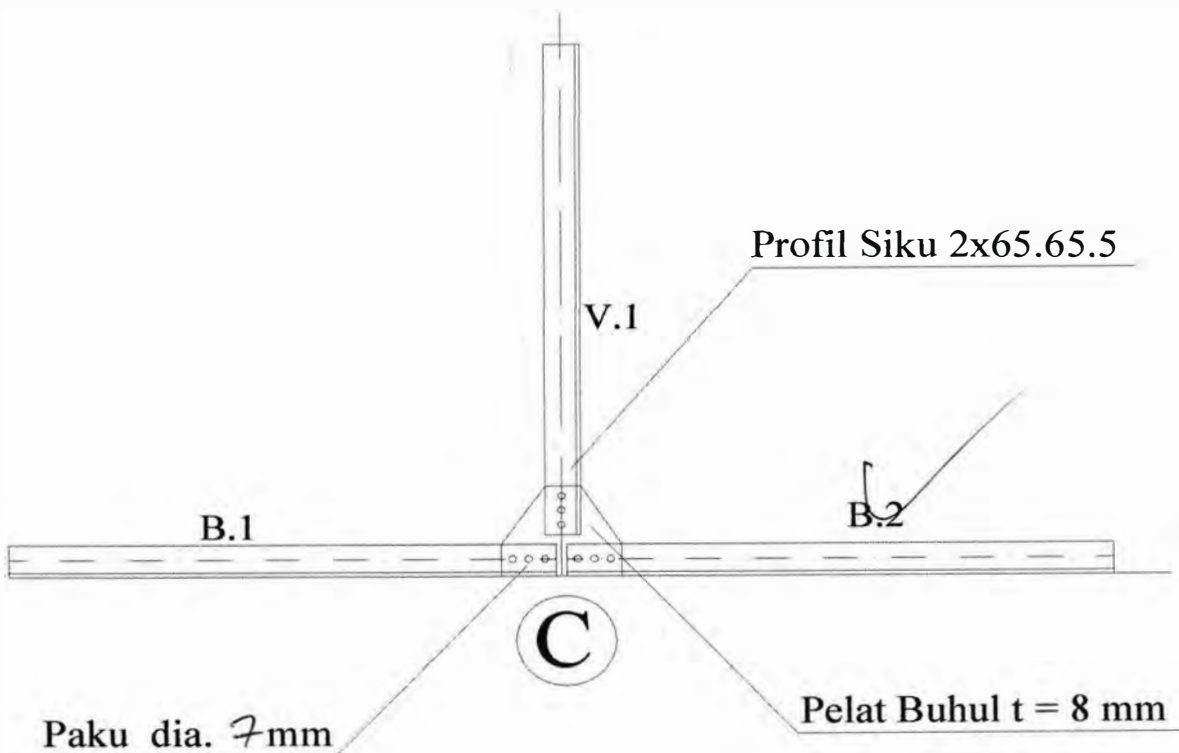
$$Pds = 784.00 \text{ Kg/cm}^2$$

$$Pgs = 430.00 \text{ Kg/cm}^2$$

$$\text{Jumlah Paku} = \frac{N}{Pgs} = \frac{2,097.51}{430.00} = 4.88 \text{ Bh} = 5.00 \text{ Bh} = \boxed{5.00 \text{ Bh}}$$

1.2 Profil V1

$$N = 0.00 \text{ Kg (+)}$$



TUGAS WAJIB KONSTRUKSI BAJA

3. TITIK BUHUL - N DAN E

3.1 Profil B3 Dan B4

$$N = 2,097.51 \text{ Kg (-)}$$

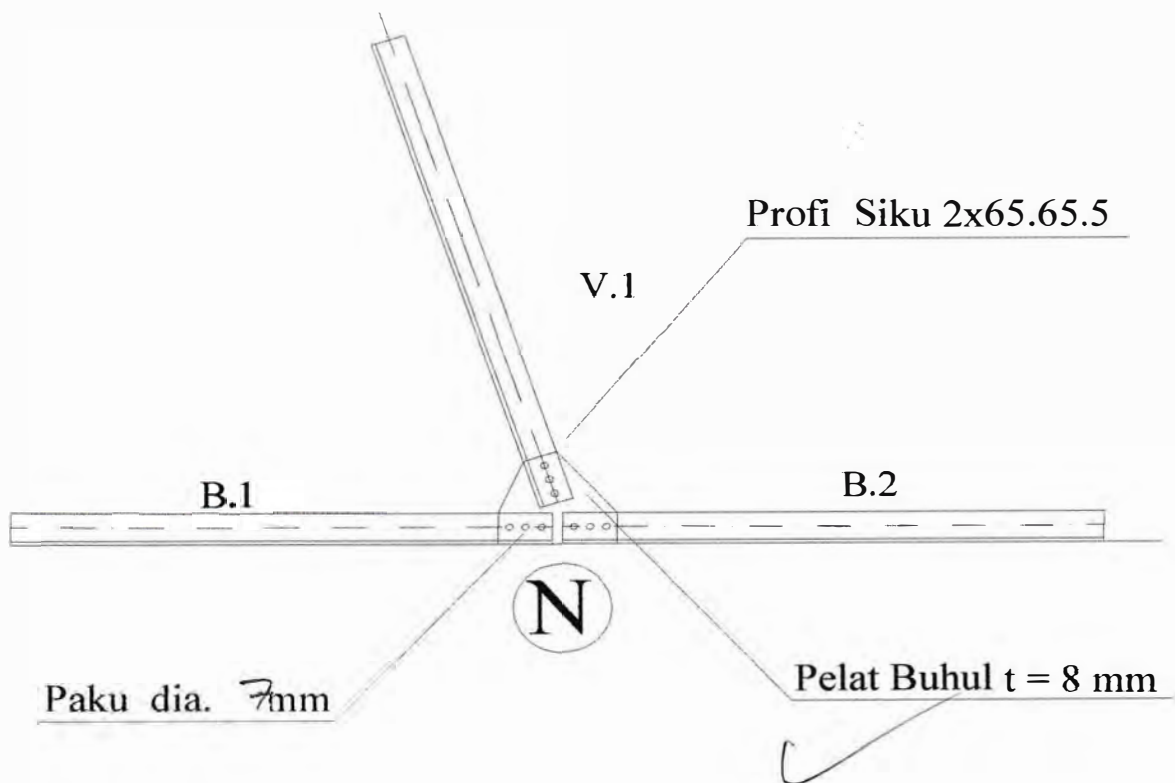
$$Pds = 784.00 \text{ Kg/cm}^2$$

$$Pgs = 430.00 \text{ Kg/cm}^2$$

$$\text{Jumlah Paku} = \frac{N}{Pgs} = \frac{2,097.51}{430.00} = 4.88 \text{ Bh} = 5.00 \text{ Bh} = \boxed{5.00 \text{ Bh}}$$

3.2 Profil D6

$$N = 0.00 \text{ Kg (+)}$$



TUGAS WAJIB KONSTRUKSI BAJA

4. TITIK BUHUL - L DAN F

4.1 Profil D5

$$N = 897.43 \text{ Kg (+)}$$

$$Pds = 784.00 \text{ Kg/cm}^2$$

$$Pgs = 430.00 \text{ Kg/cm}^2$$

$$\text{Jumlah Paku} = \frac{N}{Pgs} = \frac{897.43}{430.00} = 2.09 \text{ Bh} = 3.00 \text{ Bh} = \boxed{3.00 \text{ Bh}}$$

4.2 Profil D6

$$N = 0.00 \text{ Kg (+)}$$

4.3 Profil V4

$$N = 735.00 \text{ Kg (+)}$$

$$Pds = 784.00 \text{ Kg/cm}^2$$

$$Pgs = 430.00 \text{ Kg/cm}^2$$

$$\text{Jumlah Paku} = \frac{N}{Pds} = \frac{735.00}{430.00} = 1.71 \text{ Bh} = 2.00 \text{ Bh} = \boxed{2.00 \text{ Bh}}$$

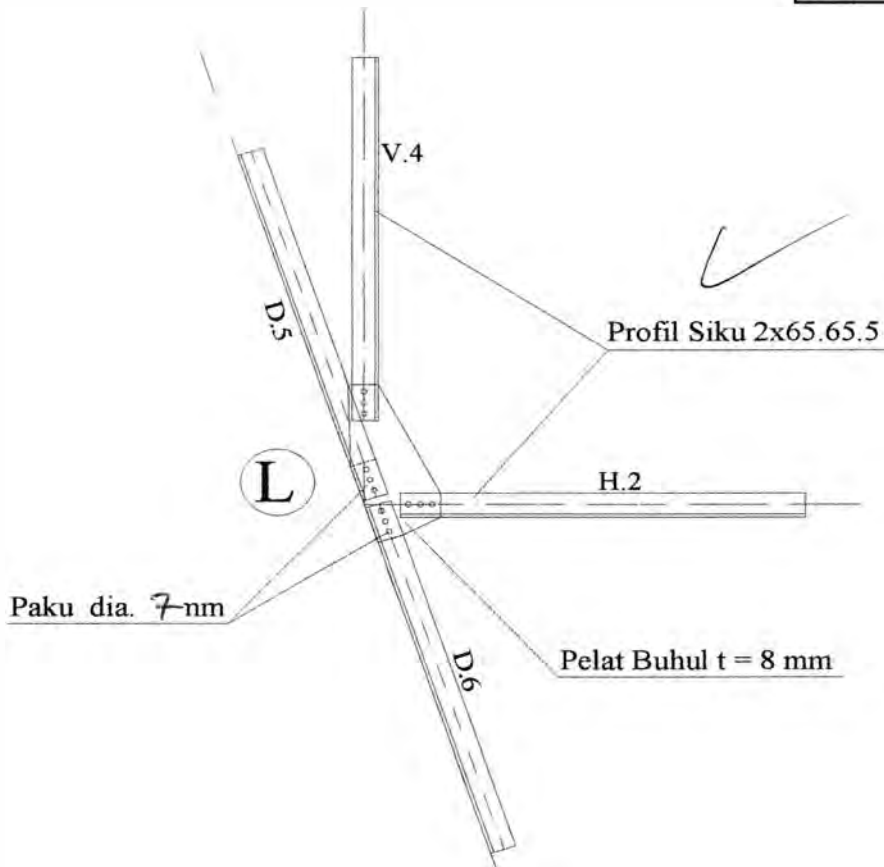
4.4 Profil H2

$$N = 581.67 \text{ Kg (+)}$$

$$Pds = 784.00 \text{ Kg/cm}^2$$

$$Pgs = 430.00 \text{ Kg/cm}^2$$

$$\text{Jumlah Paku} = \frac{N}{Pds} = \frac{581.67}{430.00} = 1.35 \text{ Bh} = 2.00 \text{ Bh} = \boxed{2.00 \text{ Bh}}$$



TUGAS WAJIB KONSTRUKSI BAJA

5. TITIK BUHUL - D DAN M

5.1 Profil A1

$$N = 2,240.58 \text{ Kg (-)}$$

$$Pds = 784.00 \text{ Kg/cm}^2$$

$$Pgs = 430.00 \text{ Kg/cm}^2$$

$$\text{Jumlah Paku} = \frac{N}{Pds} = \frac{2,240.58}{784.00} = 2.86 \text{ Bh} = 3.00 \text{ Bh} = \boxed{3.00 \text{ Bh}}$$

5.2 Profil A2

$$N = 1,517.02 \text{ Kg (-)}$$

$$Pds = 784.00 \text{ Kg/cm}^2$$

$$Pgs = 430.00 \text{ Kg/cm}^2$$

$$\text{Jumlah Paku} = \frac{N}{Pds} = \frac{1,517.02}{784.00} = 1.93 \text{ Bh} = 2.00 \text{ Bh} = \boxed{2.00 \text{ Bh}}$$

5.3 Profil V1

$$N = 0.00 \text{ Kg (+)}$$

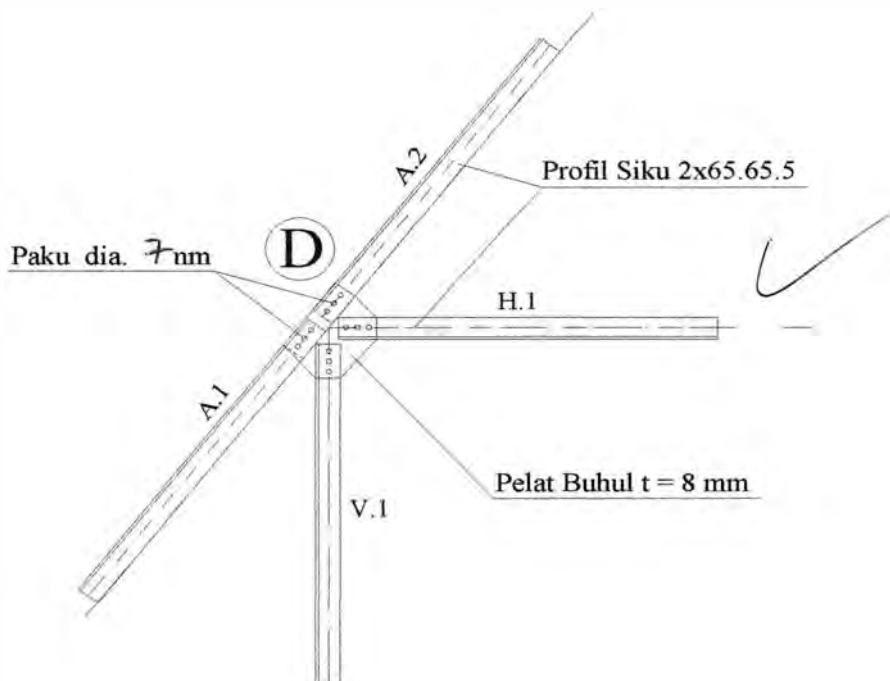
5.4 Profil H1

$$N = 164.61 \text{ Kg (+)}$$

$$Pds = 784.00 \text{ Kg/cm}^2$$

$$Pgs = 430.00 \text{ Kg/cm}^2$$

$$\text{Jumlah Paku} = \frac{N}{Pds} = \frac{164.61}{430.00} = 0.38 \text{ Bh} = 1.00 \text{ Bh} = \boxed{3.00 \text{ Bh}}$$



TUGAS WAJIB KONSTRUKSI BAJA

6. TITIK BUHUL - G DAN K

6.1 Profil A2

$$N = 1,517.02 \text{ Kg (-)}$$

$$Pds = 784.00 \text{ Kg/cm}^2$$

$$Pgs = 430.00 \text{ Kg/cm}^2$$

$$\text{Jumlah Paku} = \frac{N}{Pds} = \frac{1,517.02}{430.00} = 3.53 \text{ Bh} = 4.00 \text{ Bh} = \boxed{4.00 \text{ Bh}}$$

6.2 Profil A3

$$N = 1,882.34 \text{ Kg (-)}$$

$$Pds = 784.00 \text{ Kg/cm}^2$$

$$Pgs = 430.00 \text{ Kg/cm}^2$$

$$\text{Jumlah Paku} = \frac{N}{Pds} = \frac{1,882.34}{784.00} = 2.40 \text{ Bh} = 3.00 \text{ Bh} = \boxed{3.00 \text{ Bh}}$$

6.3 Profil V2

$$N = 234.87 \text{ Kg (-)}$$

$$Pds = 784.00 \text{ Kg/cm}^2$$

$$Pgs = 430.00 \text{ Kg/cm}^2$$

$$\text{Jumlah Paku} = \frac{N}{Pgs} = \frac{234.87}{430.00} = 0.55 \text{ Bh} = 2.00 \text{ Bh} = \boxed{2.00 \text{ Bh}}$$

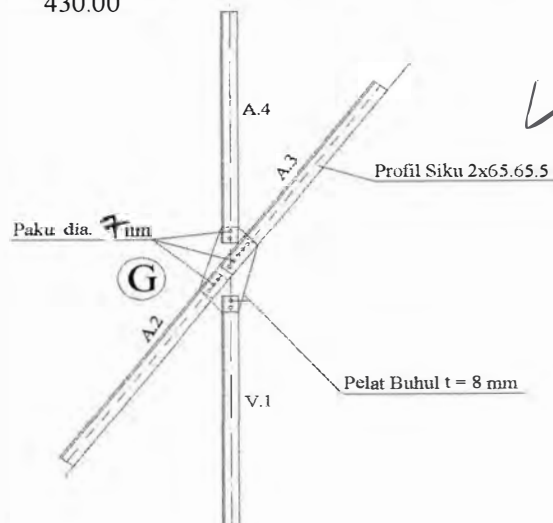
6.4 Profil A4

$$N = 735.54 \text{ Kg (-)}$$

$$Pds = 784.00 \text{ Kg/cm}^2$$

$$Pgs = 430.00 \text{ Kg/cm}^2$$

$$\text{Jumlah Paku} = \frac{N}{Pds} = \frac{735.54}{430.00} = 1.71 \text{ Bh} = 2.00 \text{ Bh} = \boxed{2.00 \text{ Bh}}$$



TUGAS WAJIB KONSTRUKSI BAJA

7. TITIK BUHUL - H DAN J

7.1 Profil A4

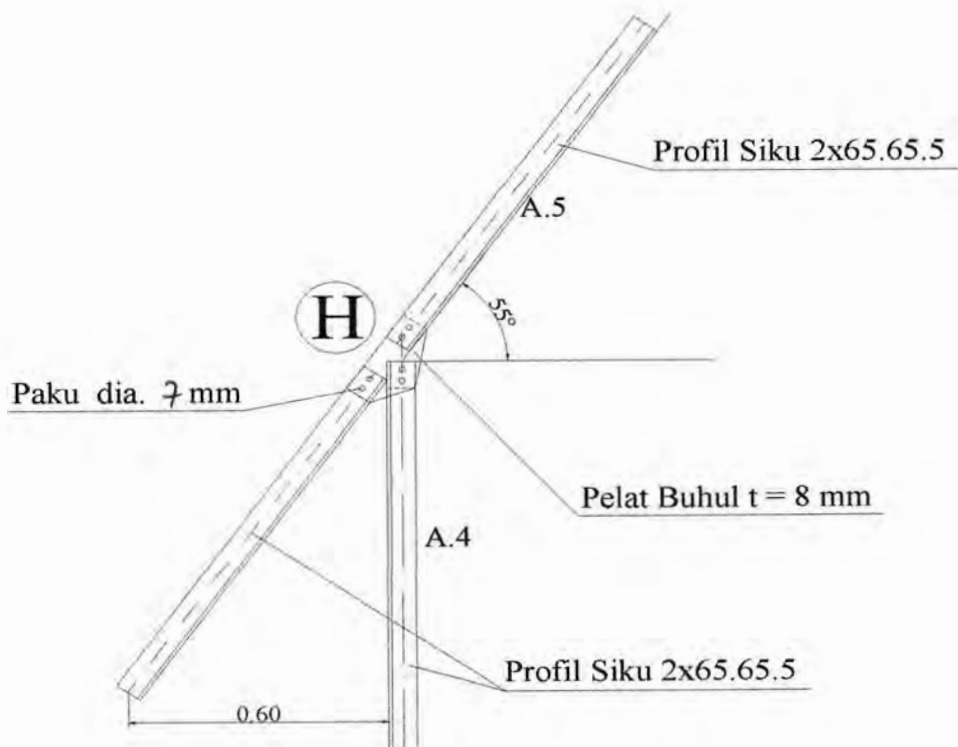
$$\begin{aligned} N &= 735.54 \text{ Kg (-)} \\ Pds &= 784.00 \text{ Kg/cm}^2 \\ Pgs &= 430.00 \text{ Kg/cm}^2 \end{aligned}$$

$$\text{Jumlah Paku} = \frac{N}{Pds} = \frac{735.54}{430.00} = 1.71 \text{ Bh} = 2.00 \text{ Bh} = \boxed{2.00 \text{ Bh}}$$

7.1 Profil A5

$$\begin{aligned} N &= 302.92 \text{ Kg (-)} \\ Pds &= 784.00 \text{ Kg/cm}^2 \\ Pgs &= 430.00 \text{ Kg/cm}^2 \end{aligned}$$

$$\text{Jumlah Paku} = \frac{N}{Pds} = \frac{302.92}{430.00} = 0.70 \text{ Bh} = 1.00 \text{ Bh} = \boxed{2.00 \text{ Bh}}$$



TUGAS WAJIB KONSTRUKSI BAJA

8. TITIK BUHUL - i

8.1 Profil A5

$$N = 302.92 \text{ Kg (-)}$$

$$Pds = 784.00 \text{ Kg/cm}^2$$

$$Pgs = 430.00 \text{ Kg/cm}^2$$

$$\text{Jumlah Paku} = \frac{N}{Pds} = \frac{302.92}{430.00} = 0.70 \text{ Bh} = 2.00 \text{ Bh} = \boxed{2.00 \text{ Bh}}$$

8.2 Profil A5

$$N = 302.92 \text{ Kg (-)}$$

$$Pds = 784.00 \text{ Kg/cm}^2$$

$$Pgs = 430.00 \text{ Kg/cm}^2$$

$$\text{Jumlah Paku} = \frac{N}{Pds} = \frac{302.92}{784.00} = 0.39 \text{ Bh} = 1.00 \text{ Bh} = \boxed{2.00 \text{ Bh}}$$



TUGAS WAJIB KONSTRUKSI BAJA

9. TITIK BUHUL - P

9.1 Profil A3

$$\begin{aligned} N &= 1,882.34 \text{ Kg (-)} \\ Pds &= 784.00 \text{ Kg/cm}^2 \\ Pgs &= 430.00 \text{ Kg/cm}^2 \end{aligned}$$

$$\text{Jumlah Paku} = \frac{N}{Pds} = \frac{1,882.34}{430.00} = 4.38 \text{ Bh} = 5.00 \text{ Bh} = \boxed{5.00 \text{ Bh}}$$

9.2 Profil D5

$$\begin{aligned} N &= 897.43 \text{ Kg (+)} \\ Pds &= 784.00 \text{ Kg/cm}^2 \\ Pgs &= 430.00 \text{ Kg/cm}^2 \end{aligned}$$

$$\text{Jumlah Paku} = \frac{N}{Pds} = \frac{897.43}{430.00} = 2.09 \text{ Bh} = 3.00 \text{ Bh} = \boxed{3.00 \text{ Bh}}$$


9.3 Profil D3

$$\begin{aligned} N &= 178.42 \text{ Kg (-)} \\ Pds &= 784.00 \text{ Kg/cm}^2 \\ Pgs &= 430.00 \text{ Kg/cm}^2 \end{aligned}$$

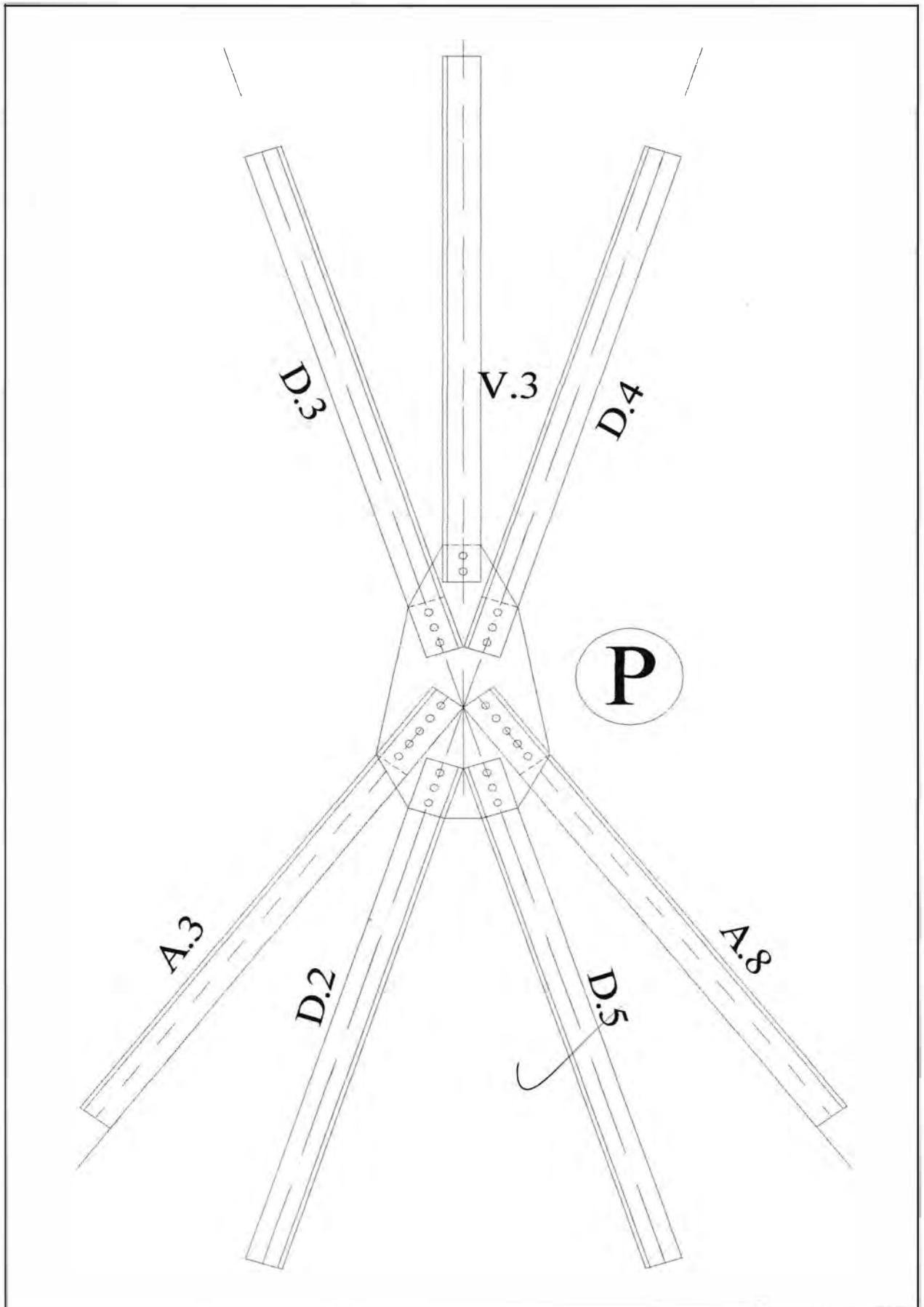
$$\text{Jumlah Paku} = \frac{N}{Pds} = \frac{178.42}{430.00} = 0.41 \text{ Bh} = 3.00 \text{ Bh} = \boxed{3.00 \text{ Bh}}$$

9.4 Profil V3

$$\begin{aligned} N &= 99.13 \text{ Kg (-)} \\ Pds &= 784.00 \text{ Kg/cm}^2 \\ Pgs &= 430.00 \text{ Kg/cm}^2 \end{aligned}$$

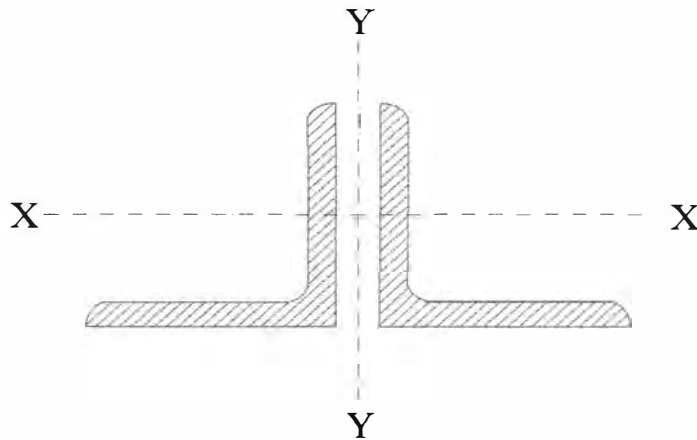
$$\text{Jumlah Paku} = \frac{N}{Pgs} = \frac{99.13}{430.00} = 0.23 \text{ Bh} = 2.00 \text{ Bh} = \boxed{2.00 \text{ Bh}}$$


TUGAS WAJIB KONSTRUKSI BAJA



TUGAS WAJIB KONSTRUKSI BAJA

DIMENSI PROFIL BATANG



BATANG TARIK

a Batang tarik tersusun dari baja siku ganda.

b. Gaya batang , Pembebanan Tetap = 2,009.55 kg (N)

Ketentuan

a Tegangan izin dasar, pembebanan tetap = 1,600.00 kg/cm²

b. Tegangan izin tarik (75% x 5), pembebanan tetap = 1,200.00 kg/cm²

c. Kelangsingan maksimum $A = \frac{P}{s} = \frac{2098}{1600} = 1 \text{ cm}^2$

d. Jari-jari inersia $i_{\min} > Lk / \chi_{\text{mak}} = \frac{0}{240} = 0.00 \text{ cm}$

e. Jumlah lubang $< 15\% \times F_{\text{netto}}$

f. Ditentukan profil minimum batang struktur $\text{JL } 65. 65. 5$

Perhitungan

$$A_{\text{netto}} = \frac{N}{\sigma_a} = \frac{2,009.55}{1,200.00} = 1.75 \text{ cm}^2$$

$$A_{\text{bruto}} = \frac{A_{\text{bruto}}}{85\%} = \frac{1.75}{0.85} = 2.06 \text{ cm}^2$$

$$i_{\min} = \frac{1.75}{2.06} = 1$$

Dari tabel diperoleh $\text{JL } 65. 65. 5$, $F=4.69 \text{ cm}^2$, $2F=9.33$, $i_x = 1.35 > 1 \dots \text{ok!}$

Kontrol Tegangan

$$A_{\text{netto}} = 85\% = 2F = 7.97 \text{ cm}^2$$

$$\sigma = \frac{N}{A_{\text{netto}}} = \frac{2,009.55}{7.97} = 263.18 \text{ kg/cm}^2 < 1,200.00 \text{ kg/cm}^2 \dots \text{ok!}$$

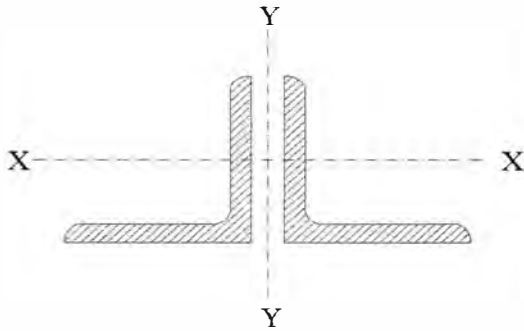
TUGAS WAJIB KONSTRUKSI BAJA

Kontrol Kelangsingan

$$\chi = \frac{Lk}{ix} = \frac{0}{1.99} = 0.00 < 2,400.00 \text{ kg/cm}^2 \dots\dots\text{ok!}$$

Batang tarik yang menggunakan **∟ 65. 65. 5**

- Batang bawah = B₁ , B₂ , B₃ , B₄ Dan B₅
- Batang diagonal = D₁ , D₂ , D₃ , D₄ , D₅ Dan D₆ serta batang , A₁ Dan A₁₀



PROFIL ∟ 65. 65. 5

t = 5.00 mm	I _x = 50.60 cm ⁴
T = 10.00 mm	I _y = 116.5 cm ⁴
r ₁ = 8.50 mm	i _x = 1.99 cm
r ₂ = 3.00 mm	i _y = 3.02 cm
F = 12.74 mm	S _x = 10.70 cm
w = 10.00 mm	S _y = 16.61 cm

TUGAS WAJIB KONSTRUKSI BAJA

BATANG TEKAN

- a. Batang tekan tersusun dari baja siku ganda.
 b. Gaya batang, Pembebanan Tetap = $-2,475,34$ kg (N)
 c. Panjang Tekuk = 4,030.00 mm (Lk)

Ketentuan

- a. Tebal pelat buhul = 8 mm
 b. Tebal pelat kopel = 4 mm
 c. Alat sambung paku = 7 mm
- Tegangan izin dsr. $\bar{\sigma} = 1,400.00$ kg/cm²
 - Geser $I = 1,120.00$ kg/cm²
 - Desak $S1 > 2d$ $\bar{\sigma}_{ds} = 2,800.00$ kg/cm²
 - Desak $1.5d < S1$ $\bar{\sigma}_{ds} = 2,400.00$ kg/cm²
- $S1 < 2d$
- Tegangan izin plt $\bar{\tau} = 812.00$ kg/cm²

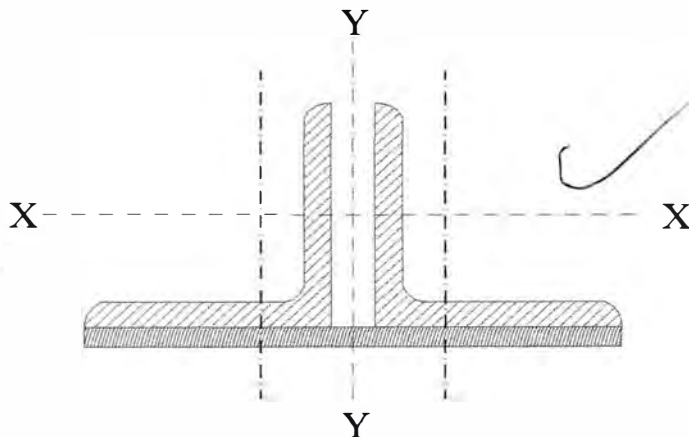
- d. Kelangsingan maksimum $\chi_{mak} = 200$
 e. Jari-jari inersia $i_{min} > Lk / \chi_{mak} = \frac{403}{200} = 2.02$ cm
 f. Ditentukan profil minimum batang struktur $\llcorner 65.65.5$

$$\chi_x > 110$$

$$\chi = \frac{Lk}{i_x} = \frac{403}{1.99} = 202.51 > 110.00 \text{ kg/cm}^2 \dots \text{ok!}$$

Momen Inersia ditaksir :

$$I_{\text{taksir}} = 1.21 \times -2,475,34 \times 4.03^2 = 46.34 \text{ cm}^4 \text{ satu profil} = 23.17 \text{ cm}^4$$



TUGAS WAJIB KONSTRUKSI BAJA

Kontrol Tekuk

a. Terhadap Tekuk \perp sb-x

$$\chi = \frac{L_k}{i_x} = \frac{403}{1.99} = 202.51 > 200.00 \text{ kg/cm}^2$$

Faktor Tekuk

$$\chi_g = \pi \times \sqrt{\frac{E}{0.70 \times 1200}} \times \sqrt{\frac{2500}{\dots}} \quad \chi_g = \frac{\chi_x}{\chi_g} = \frac{202.51}{157.00} = 1.29$$

$$= 3.14 \times \sqrt{\frac{2500}{\dots}} \quad w_x = 1.61$$

$$\chi_g = 157.00$$

Tegangan Tekuk

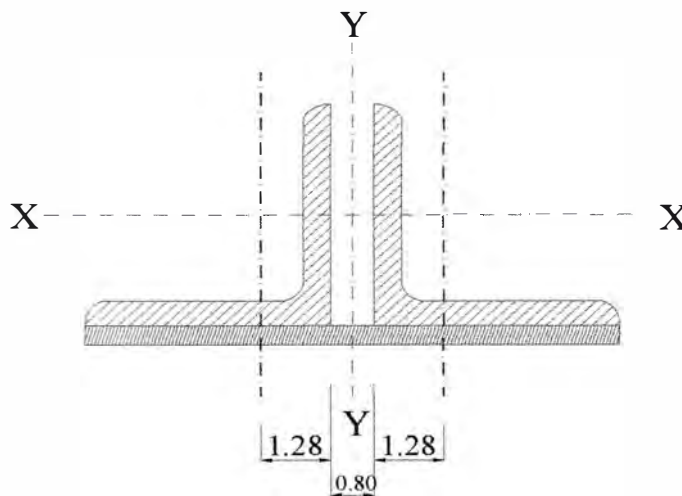
$$\sigma_x = W_x \frac{N}{A_{total}} = 1.61 \frac{2,475.34}{12.74} = 297.98 < 1,200.00 \text{ kg/cm}^2 \text{ ok!}$$

b. Terhadap Tekuk \perp sb-y

$$I_y \text{ total} = 2 (I_y + A (1/2a)^2)$$

$$a = 2e + \gamma = 3.36 \text{ cm}$$

$$I_y = 304.92 \text{ cm}^4$$



$$i_y = \sqrt{\frac{I_y \text{ tot}}{A_{tot}}} = \sqrt{\frac{304.92}{12.74}} = 4.89 \text{ cm}$$

$$\chi_y = \frac{L_k}{i_y} = \frac{403.00}{4.89} = 82.38 \text{ cm}$$



TUGAS WAJIB KONSTRUKSI BAJA

$$\chi_{iy} = \sqrt{\chi_y^2 + \frac{m}{2} \chi_1^2}$$

Dimana

$$\chi_y = 82.38$$

$$m = 2$$

$$\chi_y = \frac{Lk/n}{i_{\min}} \leq 50$$

$$50 = \frac{403/n}{2.02}$$

$$n = \frac{403}{101}$$

$$= 3.99 \text{ buah medan pelat kopel}$$

Diambil = 4 buah medan plat kapel

$$\chi_1 = \frac{Lk/n}{i_{\min}} = \frac{403/4}{2.02} = 50.00$$

Maka :

$$\begin{aligned} \chi_{iy} &= \sqrt{\chi_y^2 + \frac{m}{2} \chi_1^2} \\ &= \sqrt{82.38^2 + \frac{m}{2} 50.00^2} \end{aligned}$$

$$\chi_{iy} = 96.40$$

Faktor Tekuk $w = 0.85$

$$\sigma_x = W_x \frac{N}{A_{\text{total}}} = 0.85 \frac{2.475.34}{12.74} = 157.32 < 1,200.00 \text{ kg/cm}^2 \text{ ok!}$$

KONTROL KESTABILAN

$$\chi_1 = 50.00 \longrightarrow 1.20 \quad \chi_1 = 50.00$$

$$\chi_{Ix} > 1.20 \quad \chi_1 \quad \chi_{iy} > 1.20 \quad \chi_1$$

$$202.51 > 60.00 \quad 96.40 > 60.00$$

TUGAS WAJIB KONSTRUKSI BAJA

RENCANA PELAT KOPEL

Kekakuan pelat kopel

$$\frac{I_p}{a} \leq 10 \frac{I_1}{L_1} \quad \text{atau} \quad I_p \leq 10 a \frac{I_1}{L_1}$$

Diaman:

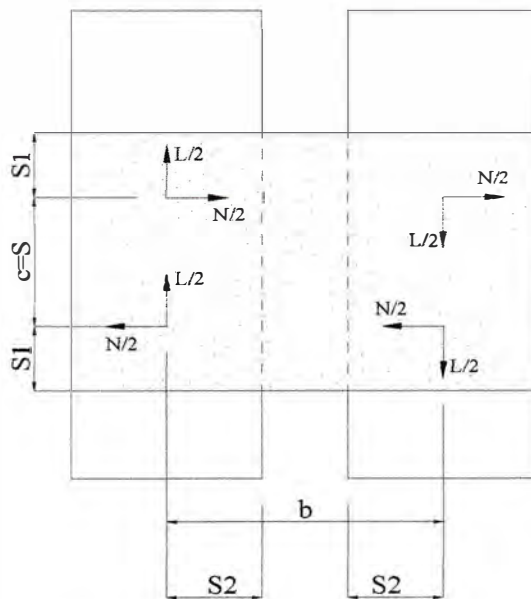
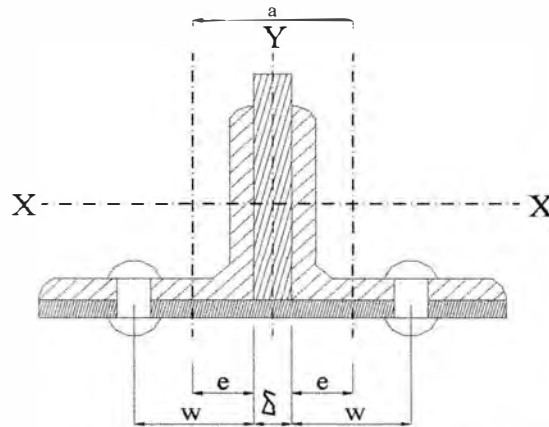
$$I_p = 1/12 t h^3 \quad t = 0.40 \text{ cm}$$

$$L_1 = 23.32 \text{ cm}$$

$$I_1 = I_n = I_{\min} = 3.25 \text{ cm}^4$$

$$h \geq 5.108 \text{ cm}$$

$$a = 3.36 \text{ cm}$$



Handwritten notes and a checkmark:

$\sigma < \sigma_{\text{allow}}$
 $\tau < \tau_{\text{allow}}$
 6.5×6.5
 ✓

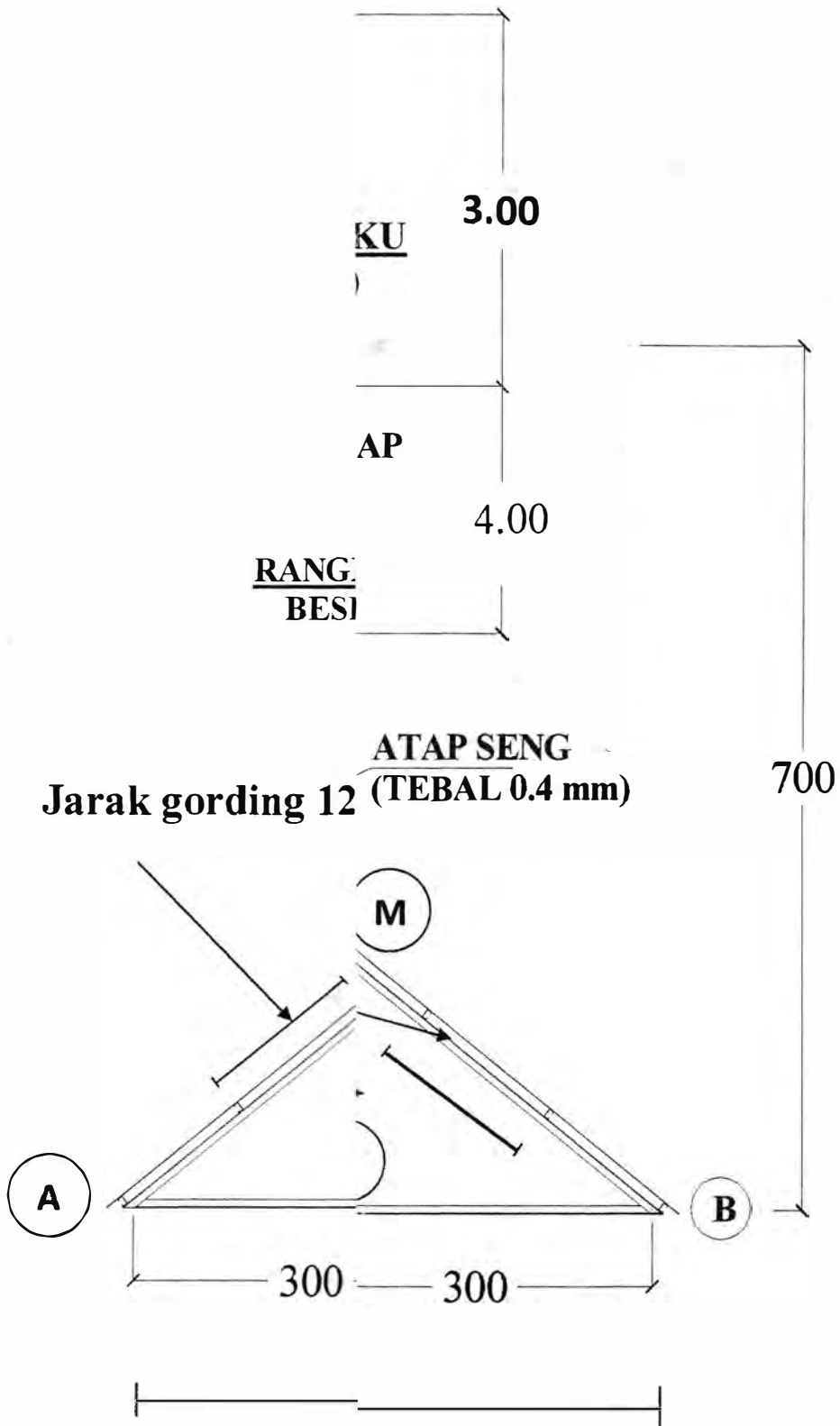
TUGAS WAJIB KONSTRUKSI BAJA

RENCANA PAKU

Paku, diameter	=	7	mm
$S1 = 2d$	=	14	mm
S1 diambil	=	15	mm
$C = S = 3d$	=	21	mm
$C = S1$ diambil	=	30	mm
$h = 2 S1$ diambil + S	=	60	mm
$S2 = w$	=	35	mm
$b = 2S2 + \gamma$	=	78	mm

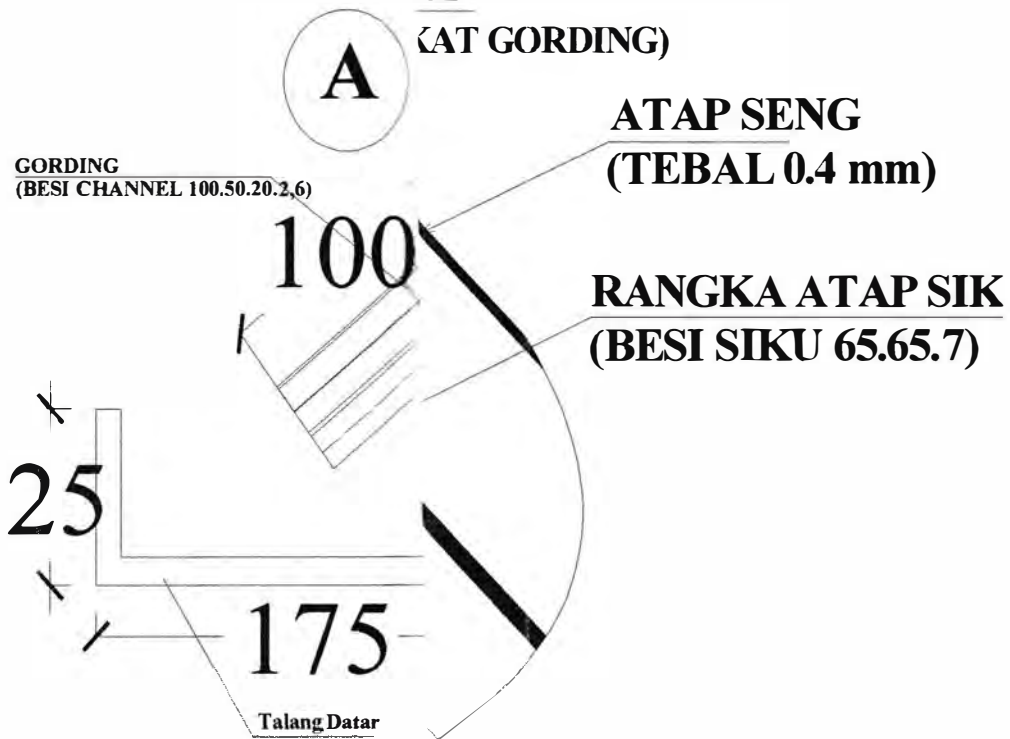
KEKUATAN PAKU

$S1 > 2d \cdot \sigma_{ds}$	=	2,800	kg/cm ²
$P_{gs} = (2)^{1/4} \pi d^2 \tau$	=	430	kg/cm ²
$P_{ds} = t \cdot d \cdot \sigma_{ds}$	=	784	kg/cm ²



DING ATAP
(C 75.40.15.3,2)

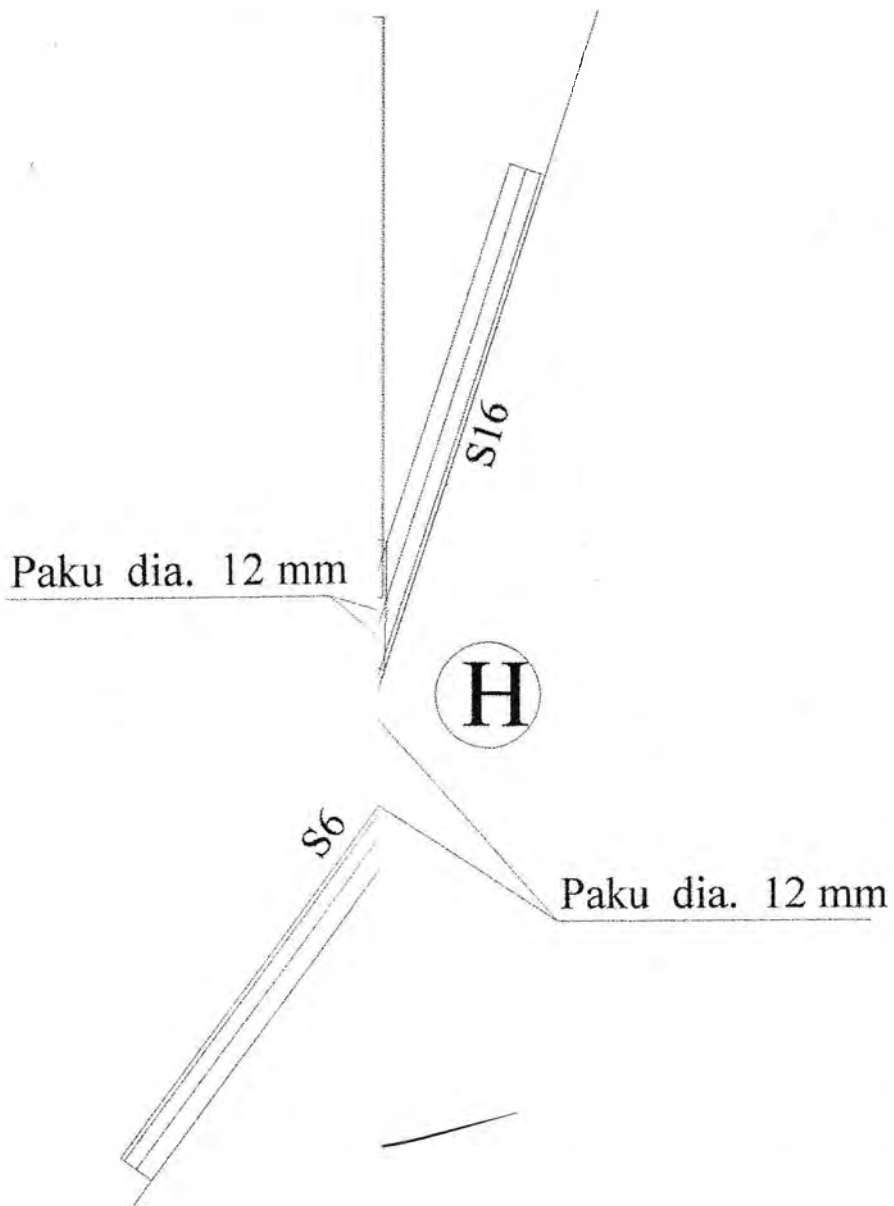
SI
(KAT GORDING)





Paku dia. 8 mm

Paku dia. 12 mm





**RANGKA ATAP SIKU
(BESI SIKU 2L 100.100.8)**

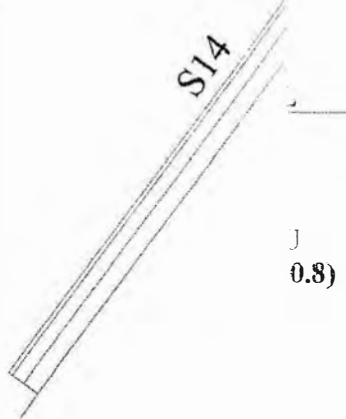
Paku dia. 12 mm

**RANGKA ATAP SIKU
(BESI SIKU 2L 100.100.8)**

K



S14



J
0.8)

Paku dia. 12 mm

Pelat Buhul t = 10 mm

D6

D5

D7

Profil Siku 2x100.100.8

