MASTER INDEX HELP

TUGAS
KONSTRUKSI KAYU

DOSEN PEMBIMBING
Ir. TIRTA DJUSMAN ARIEF, M.Sc

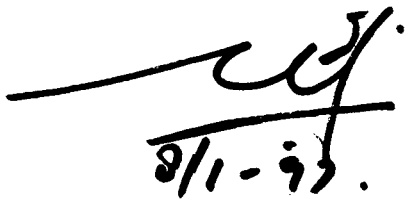
DISUSUN OLEH:
HARTONO
Nrp. 21393011

FAKULTAS TEKNIK
JURUSAN TEKNIK SIPIL
UNIVERSITAS KRISTEN PETRA
S U R A B A Y A
1 9 9 7

Lembar Pengesahan

TUGAS KONSTRUKSI KAYU

menyetujui,



Ir. TIRTA DJUSMAN ARIEF, M.Sc

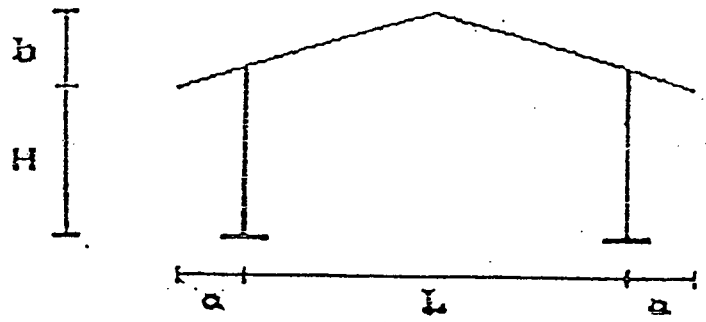
Disusun oleh:
HARTONO
Nrp. 21393011

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI KAYU	DIBUAT OLEH : HARTONO (21393011)
	JENIS STRUKTUR :	
	INFORMASI PERENCANAAN	DIPERIKSA OLEH :
	Peraturan Konstruksi Kayu Indonesia NI-5 1961 Peraturan Pembebanan Indonesia Untuk Gedung 1983	PERATURAN-PERATURAN YANG DIPAKAI
	Tidak Diperhitungkan	KEMUNGKINAN PENGEMBANG-AN DAN PERUBAHAN
	Tidak Diperhitungkan	SYARAT-SYARAT KETAHANAN TERHADAP KEBAKARAN
	Beban Mati : Berat sendiri struktur Beban Hidup : 100 kg	PEMBEBANAN
KECEPATAN FAKTOR-FAKTOR LAIN	Tekanan Tiup : 25 kg/m²	BEBAN ANGIN
FAKTOR DAERAH FAKTOR KEPENTINGAN FAKTOR TIPE STRUKTUR	Tidak Diperhitungkan	BEBAN GEMPA
	Tidak Diperhitungkan	PENGARUH LINGKUNGAN
	ø = 13° c = 0,3 kg/cm²	KONDISI TANAH
	Pondasi Lajur (Batu Kali)	TIPE PONDASI
	Kayu Kelas Kuat I fc' = 25 Mpa fy = 240 Mpa Penutup Atap : Genteng	DATA BAHAN
	Tabel CUR jilid 4	LAIN-LAIN

UNIVERSITAS KRISTEN PETRA
FAKULTAS TEKNIK SIPIL & PERENCANAAN PROGRAM DIPLOMA III

TUGAS: KOSTRUKSI KAYU	Nama Mahasiswa : 1. HARTONO ..... Nrp. 9139301 2. ..... Nrp.		Diberikan tgl. 9/9-96
	Asisten :	Paraf	Selesai tgl. .....

RENCANAKAN BANGUNAN DENGAN KONSTRUKSI TERSEBUT DIBAWAH INI :



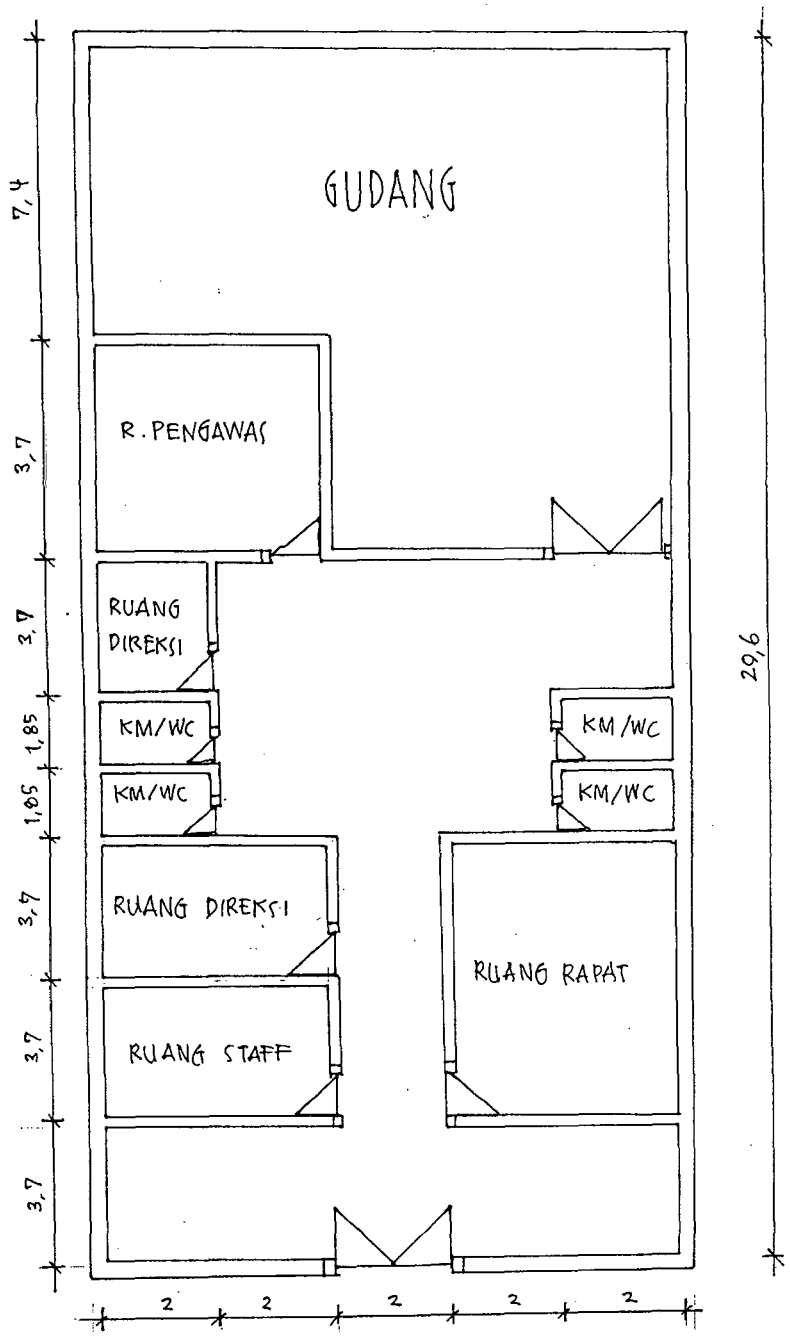
b = 5.0 m
H = 5.0 m
a = 2.5 m
L = 10.0 m

KAYU KELAS KUAT : (I) / II / III
PENUTUP ATAP : genteng
JARAK GORDING : sesuaikan
JUMLAH KUDA-KUDA : 9 x 3.70 m
JENIS PONDASI : sesuaikan
6tanah : c = 0.3 kg/cm² ϕ = 13°

PERHITUNGAN MELIPUTI :

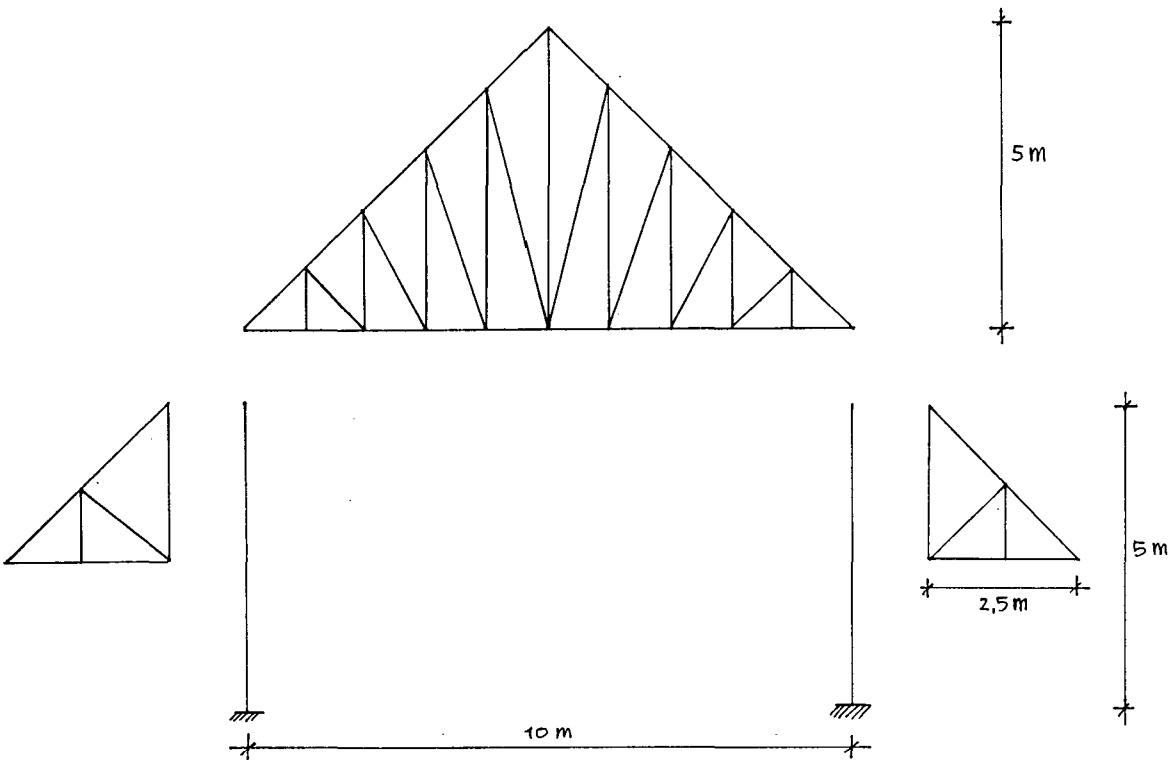
1). Setiap elemen struktur dari konstruksi tersebut diatas, termasuk sambungan-sambungannya.
2). Pondasi yang digunakan sesuai dengan data diatas.

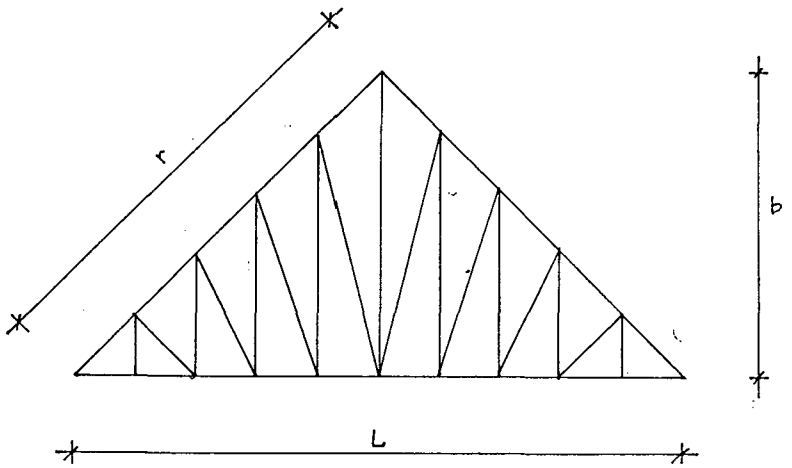
FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI KAYU	DIBUAT OLEH :
	JENIS STRUKTUR :	
	RINGKASAN/IDEALISASI STRUKTUR	DIPERIKSA OLEH :



FAKULTAS TEKNIK SIPIL
UNIVERSITAS KRISTEN PETRA

TUGAS KONSTRUKSI KAYU	DIBUAT OLEH :
JENIS STRUKTUR :	
RINGKASAN/IDEALISASI STRUKTUR	DIPERIKSA OLEH :





FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI KAYU	HALAMAN : 1
	BAGIAN STRUKTUR : NO. GAMBAR :	NRP : 2139301l

PERHITUNGAN

Kayu Kelas Kuat I

E // = 125000 kg/cm²

$\bar{\sigma}$ lt = 150 kg/cm²

$\bar{\sigma}tk// = \bar{\sigma}tr//$ = 130 kg/cm²

$\bar{\sigma}tk\perp$ = 40 kg/cm²

$\bar{\tau}//$ = 20 kg/cm²

Berat Jenis = 910 kg/m²

$$tg = \frac{b}{\frac{1}{2}L} = \frac{5}{5} = 45°$$

$\cos \alpha = 5 \div r$

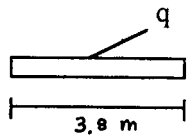
$\cos 45° = 5 \div r$

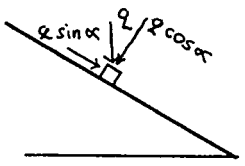
$r = 7{,}071$

jarak gording untuk genteng = 7,071÷5 = 1,4142 m

- jarak gording = 1,4142 m
- jarak kuda-kuda = 3,70 m
- dimensi gording = 8/12 cm
- penutup atap : genteng = 50 kg/m²
- α (sudut kemiringan atap) = 45°

Idealisasi gording:





PERHITUNGAN

Beban Mati:

• berat sendiri genteng + seng + usuk	= 50 × 1,4142	= 70,71 kg/m'
• berat sendiri gording	= 0,08 × 0,12 × 910	= 8,736 kg/m'
• berat sendiri aat penyambung	= 10% (75+8,736)	= 87,3906 kg/m'

Beban Hidup:

- beban pekerja (P) = 100 kg
- beban air hujan = (40 -0,8. α) kg/m²
  = (40 -0,8×45) kg/m²
  = 4 kg/m²
- beban angin :
  » tekanan angin = 25 kg/m²
  » di pihak angin = 25×1,4142×(0,02×45°-0,04) = 17,68 kg/m²
  » di belakang angin = -0,4×25×1,4142 = -14,142 kg/m²

Perhitungan Momen Lentur:

1. Beban Mati

qx = q cos 45° = 87,3906×cos 45° = 61,8 kg/m

Mx1 = (61,8×3,7²) ÷ 8 = 105,76 kgm

qy = q sin 45° = 87,9306×sin 45° = 61,8 kg/m

My1 = [(61,8×(3,7÷4)²)] ÷ 8 = 6,61 kgm

2. Beban Hidup

Px = P cos 45° = 100 cos 45° = 70,712 kg

Mx2 = (70,712×3,7)÷4 = 65,41 kgm

Py = P sin 45° = 100 sin 45° = 70,712 kg

My2 = [70,712×(3,7÷4)²] = 16,35 kgm

3. Beban Air Hujan

q = 4 + 1,4142 = 5,4142 kg/m

qx = q cos 45° = 5,4142 cos 45° = 3,83 kg/m

Mx = (3,83×3,7²) ÷ 8 = 6,544 kgm

qy = q sin 45° = 5,4142 sin 45° = 3,83 kg/m

My = [3,83×(3,7÷4)²] ÷ 8 = 0,410 kgm

PERHITUNGAN

4. Beban Angin

di pihak angin = Mp = (17,68 × 3,7²) ÷ 8 = 30,2549 kgm

di belakang angin = Mb = (-14,142×3,7²) ÷ 8 = -24,2 kgm

Kombinasi Pembebanan:

1. Beban Tetap

Mx = Mx1 + Mx2 = 105,76 + 65,41 = 171,17 kgm

My = My1 + My2 = 6,61 + 16,35 = 22,96 kgm

2. Beban Sementara

Mx = Mx1 + Mx2 + Mp = 171,17 + 30,2549 + 201,4249 kgm

My = My1 + My2 = 6,61 + 16,35 = 22,96 kgm

• untuk beban sementara $\bar{\sigma}$lt boleh dinaikkan sebesar 25% maka $\bar{\sigma}$lt = 150 kg/cm², menjadi sebesar 187,5 kg/cm² .

Tegangan Lentur

Ix = (b×h³)÷12 = (8×12³)÷12 = 1152 cm⁴

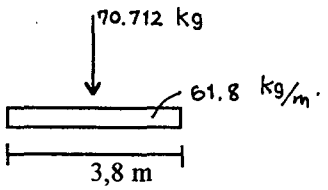
Wx = Ix ÷ 0,5h = 1152 ÷ 0,5. 12 = 192 cm³

Iy = (b³×h) ÷ 12 = (8³×12) ÷ 12 = 512 cm4

Wy = Iy ÷ 0,5b = 512 ÷ 0,5. 8 = 128 cm³

σmax = [Mx÷Wx]+[My÷Wy] = [13866÷192]+[1513÷128] = 84,04 kg/cm² < 187,5 kg/cm² ...**(OK!)**

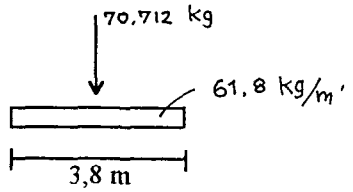
Tegangan Geser



D max= {(61,8 x 3,7) + (70,712/2)} = 264,016 kg

$$\tau x = \frac{3D}{2bh} = \frac{3 \times 264{,}016}{2 \times 8 \times 12} = 4{,}125 \text{ kg/cm}^2$$

PERHITUNGAN



D max= {(61,8 x 0,5) + (70,712/2)} = 66,256 kg

$$\tau y = \frac{3D}{2bh} = \frac{3 \times 66{,}256}{2 \times 8 \times 12} = 1{,}035 \text{ kg/cm}^2$$

$$= 4{,}125^2 + 1{,}035^2 = 4{,}235 \text{ kg/cm}^2 < \bar{\tau} = 20 \text{ kg/cm}^2$$

Kontrol Lendutan

Untuk Gording $f = \frac{1}{200} \times 370 = 1{,}85$ cm

$$\mathbf{fx = \frac{5.qx.lx^4}{384.E.Ix} + \frac{Px.Lx^3}{48.E.Ix}}$$

$$fx = \frac{5.\ 0{,}618.\ 370^4}{384.125000.1152} + \frac{70{,}712.\ 370^3}{48.125000.1152}$$

$$= 1{,}047 + 0{,}52$$

$$= 1{,}567 \text{ cm}$$

$$\mathbf{fy = \frac{5.qy.ly^4}{384.E.Iy} + \frac{Py.Ly^3}{48.E.Iy}}$$

$$fy = \frac{5.\ 0{,}618.\ (370/4)^4}{384.125000.512} + \frac{70{,}712.\ (370/4)^3}{48.125000.512}$$

$$= 0{,}0092 + 0{,}01822$$

$$= 0{,}02742 \text{ cm}$$

$$f = \sqrt{fx^2 + fy^2}$$

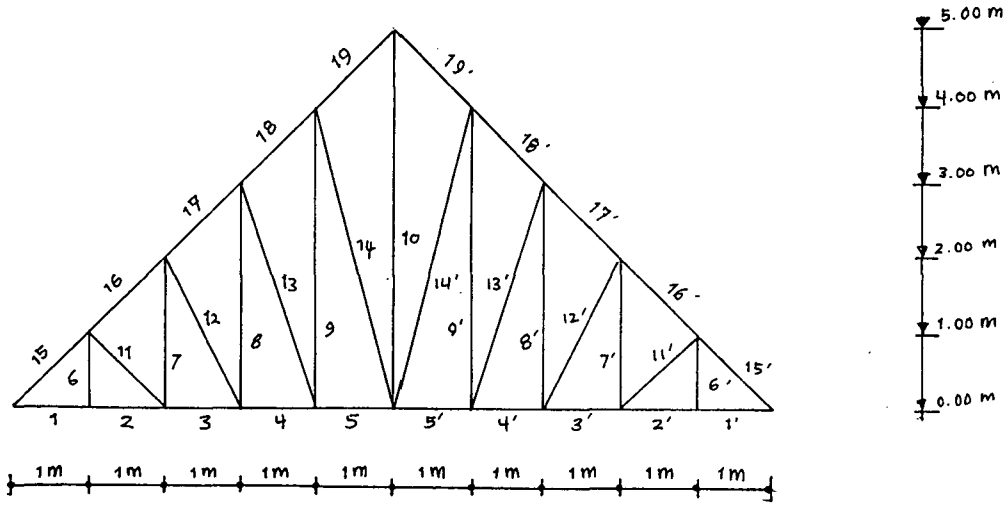
$$= 1{,}567^2 + 0{,}02742^2$$

$$= 1{,}567 \text{ cm} < \bar{f} = 1{,}85 \text{ cm}$$ **(OK!)**

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI KAYU	HALAMAN : 5
	BAGIAN STRUKTUR : KUDA - KUDA NO. GAMBAR :	NRP : 21393011

PERHITUNGAN

Kuda-Kuda



Panjang batang:

Batang 11 = 1,4142 x 2 = 2,8284 m

Batang 12 = 2,236 x 2 = 4,472 m

Batang 13 = 3,1623 x2 = 6,3246 m

Batang 14 = 4,1231 x 2 = 8,2462 m

Panjang batang keseluruhan = 2,8284 + 4,4720 + 6,3246 + 8.2462 + 10 + 14,1421 = 46,0133 m

Pembebanan:

1. Akibat berat atap

   - beban mati karena atap = 87,3906 x 3,7 = 323,34 kg

2. Akibat berat sendiri

   - berat sendiri kuda-kuda : 0,08 x 0,15 x 46,0133 x 910 = 502,47 kg
   - alat penyambung : 10 % x 502,47 = 50,247 kg

   552,717 kg +

   Beban untuk satu titik buhul = 323,34 + (552,717÷ 10) = 378,6117 kg

PERHITUNGAN

3. Akibat plafon

   • Jarak kuda-kuda = 3,7 m

   • Rangka memakai usuk = 5/7 cm

   • Penggantung plafon = 6/10 cm

   Berat plafon (eternit + usuk) = 8 x 1 x 3,7 = 29,6

   Berat penggantung plafon = 0,06 x 0,10 x 3,7 x 910 = 20,202

   Berat total = berat plafon + berat penggantung plafon = 29,6 + 20,202 = 49,802 kg

4. Beban hidup (P) = 100 kg

5. Beban angin

   • di pihak angin = 17,68 x 3,7 = 65,416 kg

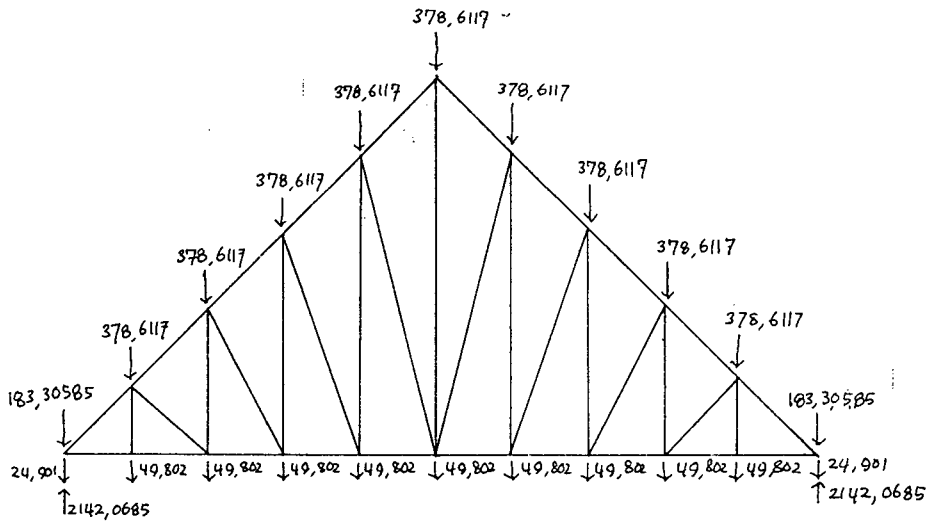
   • di belakang angin = - 14,142 x 3,7 = 52,3254 kg

6. Beban air hujan = 4 x 1,4142 x 3,7 = 20,93016 kg

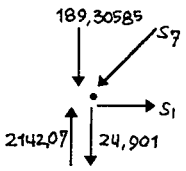
FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI KAYU	HALAMAN : 7
	BAGIAN STRUKTUR : KUDA ~ KUDA NO. GAMBAR :	NRP : 2139301

PERHITUNGAN

Gaya Batang Akibat Beban Mati



Titik 1



ΣY = 0

2142,07 - 24,90 - 189,31 - S7 sin 45°

1927,86 = S7 sin45°

S7 = 2726,41 kg (batang tekan)

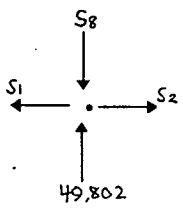
ΣX = 0

S1 - S7 cos 45° = 0

S1 - 2726,41 cos 45° = 0

S1 = 1927,86 kg (batang tekan)

Titik 2



ΣY = 0

S8 - 49,802 = 0

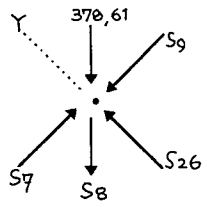
S8 = 49,802 kg (batang tekan)

$\Sigma X = 0$

S2 =S1

S2 = 1927,86 kg (batang tarik)

Titik 12



$\Sigma Y = 0$

378,61 cos 45° - S26 + S8 cos 45° = 0

267,72 - S26 + 35,21 = 0

S26 = 302,93 kg (batang tekan)

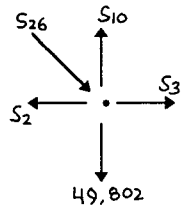
$\Sigma X = 0$

S7 - S9 - 378,62 sin 45° - S8 sin 45° = 0

2726,41 - S9 - 267,72 - 35,21 = 0

S9 = 2423,48 kg (batang tekan)

Titik 3



$\Sigma Y = 0$

S10 - 49,8 - S26 sin 45° = 0

S10 - 49,8 - 214,20 = 0

S10 = 264,01 kg (batang tarik)

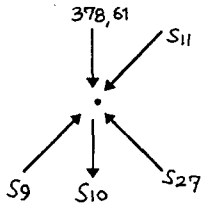
$\Sigma X = 0$

S3 - S2 + S26 cos 45° = 0

S3 - 1927,86 + 214,20 = 0

S3 = 1713,66 kg (batang tarik)

Titik 13



ΣY = 0

378,61 cos 45° - S27 + S10 cos 45° = 0

267,72 - S27 + 186,68 = 0

S27 = 454,4 kg (batang tekan)

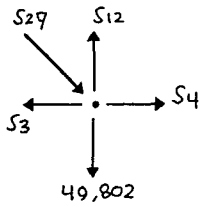
ΣX = 0

S9 - S11 - 378,61 sin 45° - S10 sin 45° = 0

2423,48 - S11 - 267,72 - 186,68 = 0

S11 = 1969,08 kg (batang tekan)

Titik 4



ΣY = 0

S12 - 49,8 - S7 sin 45° = 0

S12 - 49,8 - 321,4\31 = 0

S12 = 371,11 kg (batang tekan)

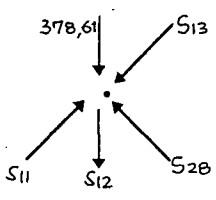
ΣX = 0

S4 - S3 + S27 cos 45° = 0

S4 - 1713,66 + 321,31 = 0

S4 = 1392,35 kg (batang tarik)

Titik 14



ΣY = 0

378,61 cos 45° - S28 + S12 cos 45° = 0

267,72 - S28 + 262,41 = 0

S28 = 530,13 kg (batang tekan)

PERHITUNGAN

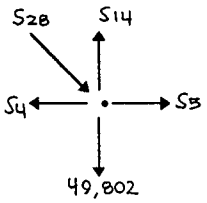
$\Sigma X = 0$

S11 - S13 - 378,61 sin 45° - S12 sin 45° = 0

1969,08 - S13 - 267,72 - 262,41 = 0

S13 = 1438,95 kg (batang tekan)

Titik 5



$\Sigma Y = 0$

S14 - 49,8 - S28 cos 45° = 0

S14 = 424,66 kg (batang tekan)

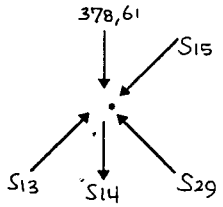
$\Sigma X = 0$

S5 - S4 + S28 cos 45° = 0

S5 - 1392,36 + 374,86 = 0

S5 = 1017,49 kg (batang tarik)

Titik 15



$\Sigma Y = 0$

378,61 cos 45° - S29 + S14 cos 45° = 0

267,72 - S29 + 300,28 = 0

S29 = 569 kg (batang tekan)

$\Sigma X = 0$

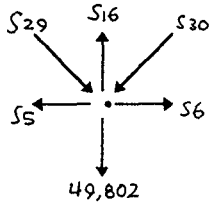
S13- S15 - 378,61 sin 45° - S14 sin 45° = 0

1438,95 - S15 - 267,72 - 300,28 = 0

S15 = 870,85 kg (batang tekan)

PERHITUNGAN

Titik 6



ΣX = 0

S29 = S30

S30 = 568 kg (batang tekan)

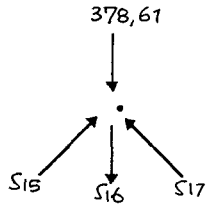
ΣY = 0

S16 - 49,8 - S29 sin 45° - S30 sin 45° = 0

S16 - 49,8 - 401,64 - 401,64 = 0

S16 = 853,08 kg (batang tarik)

Titik 16



ΣX = 0

S15 = S17

S17 = 870,95 kg (batang tekan)

ΣY = 0

378,61 + S16 - S15 cos 45° - S17 cos 45° = 0

378,61 + 853,08 - 615,85 - 615,85 = 0

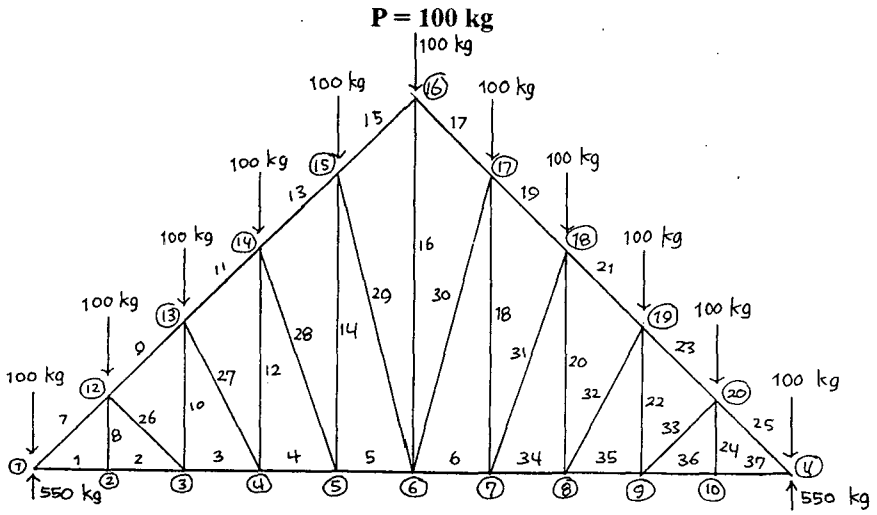
1231,7 - 1231,7 = 0 ... **(OK!)**

FAKULTAS TEKNIK SIPIL
UNIVERSITAS KRISTEN PETRA

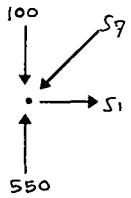
TUGAS KONSTRUKSI KAYU	HALAMAN : 12
BAGIAN STRUKTUR : KUDA ~ KUDA	NO. GAMBAR : NRP : 21393011

PERHITUNGAN

Gaya Batang Akibat Beban Pekerja



Titik 1



$\Sigma Y = 0$

$550 - 100 - S7 \sin 45° = 0$

$450 = S7 \sin 45°$

$S7 = 636{,}4$ kg (batang tekan)

$\Sigma X = 0$

$S1 - S7 \cos 45° = 0$

$S1 = 450$ kg (batang tarik)

Titik 2

$\Sigma Y = 0$

$S8 = 0$ kg

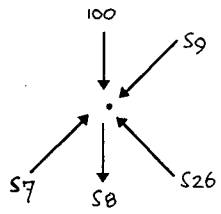
$\Sigma X = 0$

$S1 = S2$

$S2 = 450$ kg (batang tarik)

PERHITUNGAN

Titik 12



ΣY = 0

100 cos 45° - S26 + S8 cos 45° = 0

70,71 - S26 = 0

S26 = 70,71 kg (batang tekan)

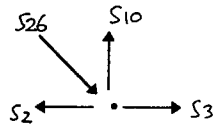
ΣX = 0

S7 - S9 - 100 sin 45° - S8 sin 45° = 0

636,4 - S9 - 70,71 = 0

S9 = 565,69 kg (batang tekan)

Titik 3



ΣY = 0

S10 - S26 sin 45° = 0

S10 = 50 kg (batang tarik)

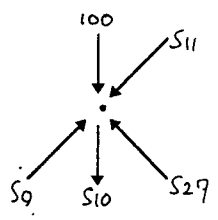
ΣX = 0

S3 + S26 cos 45° - S2 = 0

S3 + 50 - 450 = 0

S3 = 400 kg (batang tarik)

Titik 13



ΣY = 0

100 cos 45° - S27 + S10 cos 45° = 0

70,71 - S27 + 35,36 = 0

S27 = 106,07 kg (batang tekan)

PERHITUNGAN

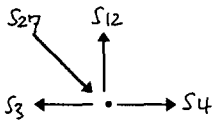
$\Sigma X = 0$

S9 - S11 - 100 sin 45° - S10 sin 45° = 0

565,69 - S11 - 70,71 - 35,36 = 0

S11 = 459,62 kg (batang tekan)

Titik 4



$\Sigma Y = 0$

S12 - S27 sin 45° = 0

S12 = 75 kg (batang tekan)

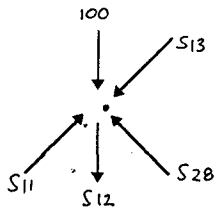
$\Sigma X = 0$

S4 - S3 + S27 cos 45° = 0

S4 - 400 + 75 = 0

S4 = 325 kg (batang tarik)

Titik 14



$\Sigma Y = 0$

100 cos 45° - S28 + S12 cos 45° = 0

70,71 - S28 + 53,03 = 0

S28 = 123,74 kg (batang tekan)

$\Sigma X = 0$

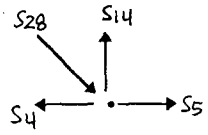
S11 - S13 - 100 sin 45° - S12 sin 45° = 0

459,62 - S13 - 70,71 - 53,03 = 0

S13 = 335,88 kg (batang tekan)

PERHITUNGAN

Titik 5



$\Sigma Y = 0$

$S14 - S28 \sin 45° = 0$

$S14 = 87,5$ kg (batang tekan)

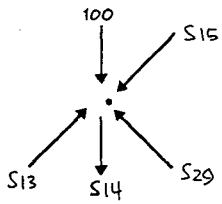
$\Sigma X = 0$

$S5 - S4 + S28 \cos 45° = 0$

$S5 - 325 + 87,5 = 0$

$S5 = 237,5$ kg (batang tarik)

Titik 15



$\Sigma Y = 0$

$100 \cos 45° - S29 + S14 \cos 45° = 0$

$70,71 - S29 + 61,87 = 0$

$S29 = 132,58$ kg (batang tekan)

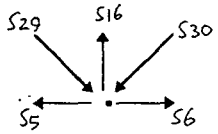
$\Sigma X = 0$

$S13 - S15 - 100 \sin 45° - S14 \sin 45° = 0$

$335,88 - S15 - 70,71 - 61,87 = 0$

$S15 = 203,3$ kg (batang tekan)

Titik 6



$\Sigma X = 0$

$S29 = S30$

$S30 = 132,58$ kg (batang tekan)

PERHITUNGAN

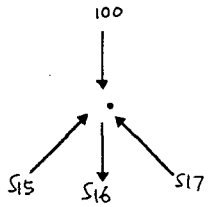
$\Sigma Y = 0$

S16 - S29 sin 45° - S30 sin 45° = 0

S16 - 93,75 - 93,75= 0

S16 = 187,5 kg (batang tarik)

Cek titik 16



$\Sigma X = 0$

S15 = S17

S17 = 203,3 kg (batang tekan)

$\Sigma Y = 0$

100 + S16 - S15 cos 45° - S17 cos 45° = 0

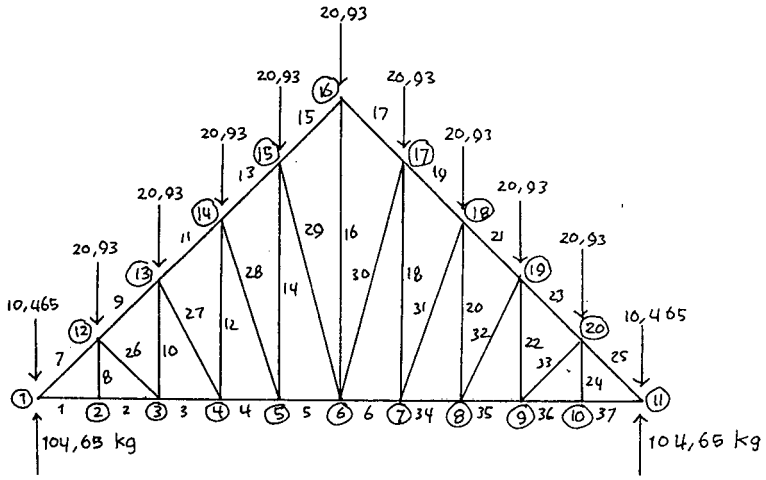
100 - 143,75 - 143,75 + 187,5 = 0

287,5 - 287,5 = 0 ... **(OK!)**

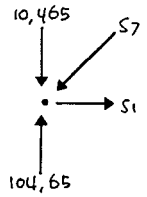
FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI KAYU	HALAMAN : 17
	BAGIAN STRUKTUR : KUDA ~ KUDA	NO. GAMBAR :
		NRP : 21393011

PERHITUNGAN

Gaya Batang Akibat Beban Air Hujan



Titik 1



$\Sigma Y = 0$

$104,65 - 10,465 - S7 \sin 45° = 0$

$94,185 = S7 \sin 45°$

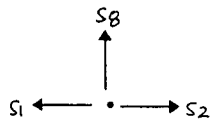
$S7 = 133,2$ kg (batang tekan)

$\Sigma X = 0$

$S1 - S7 \cos 45° = 0$

$S1 = 94,2$ kg (batang tarik)

Titik 2



$\Sigma Y = 0$

$S8 = 0$ kg

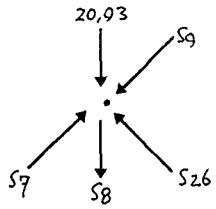
$\Sigma X = 0$

$S1 = S2$

$S2 = 94,2$ kg (batang tarik)

PERHITUNGAN

Titik 12



$\Sigma Y = 0$

$20,93 \cos 45° - S26 + S8 \cos 45° = 0$

$14,8 - S26 = 0$

$S26 = 14,8$ kg (batang tekan)

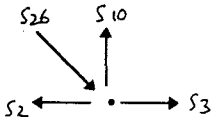
$\Sigma X = 0$

$S7 - S9 - 20,93 \sin 45° - S8 \sin 45° = 0$

$133,2 - S9 - 14,8 = 0$

$S9 = 118,4$ kg (batang tekan)

Titik 3



$\Sigma Y = 0$

$S10 - S26 \sin 45° = 0$

$S10 = 10,46$ kg (batang tarik)

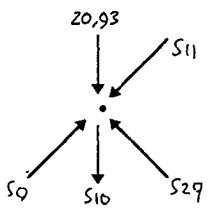
$\Sigma X = 0$

$S3 + S26 \cos 45° - S2 = 0$

$S3 + 10 - 94,2 = 0$

$S3 = 83,74$ kg (batang tarik)

Titik 13



$\Sigma Y = 0$

$20,93 \cos 45° - S27 + S10 \cos 45° = 0$

$14,8 - S27 + 7,4 = 0$

$S27 = 22,2$ kg (batang tekan)

PERHITUNGAN

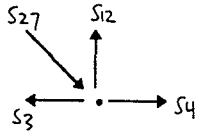
$\Sigma X = 0$

S9 - S11 - 20,93 sin 45° - S10 sin 45° = 0

118,4 - S11 - 14,8 - 7,4 = 0

S11 = 96,2 kg (batang tekan)

Titik 4



$\Sigma Y = 0$

S12 - S27 sin 45° = 0

S12 = 15,7 kg (batang tekan)

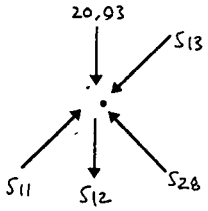
$\Sigma X = 0$

S4 - S3 + S27 cos 45° = 0

S4 - 83,74 + 15,7 = 0

S4 = 68,04 kg (batang tarik)

Titik 14



$\Sigma Y = 0$

20,93 cos 45° - S28 + S12 cos 45° = 0

14,8 - S28 + 11,1 = 0

S28 = 25,9 kg (batang tekan)

$\Sigma X = 0$

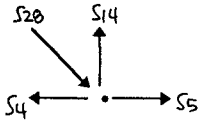
S11 - S13 - 20,93 sin 45° - S12 sin 45° = 0

96,2 - S13 - 14,8 - 11,1 = 0

S13 = 70,3 kg (batang tekan)

PERHITUNGAN

Titik 5



ΣY = 0

S14 - S28 sin 45° = 0

S14 = 18,31 kg (batang tarik)

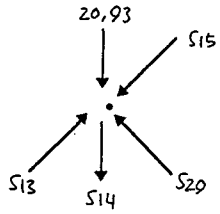
ΣX = 0

S5 - S4 + S28 cos 45° = 0

S5 - 68,04 + 18,31 = 0

S5 = 49,73 kg (batang tarik)

Titik 15



ΣY = 0

20,93 cos 45° - S29 + S14 cos 45° = 0

14,8 - S29 + 12,95 = 0

S29 = 27,75 kg (batang tekan)

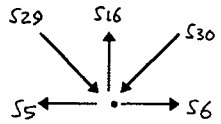
ΣX = 0

S13- S15 - 20,93 sin 45° - S14 sin 45° = 0

70,3 - S15 - 14,8 - 12,95 = 0

S15 = 42,55 kg (batang tekan)

Titik 6



ΣX = 0

S29 = S30

S30 = 27,75 kg (batang tekan)

PERHITUNGAN

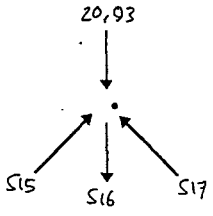
$\Sigma Y = 0$

S16 - S29 sin 45° - S30 sin 45° = 0

S16 - 19,62 - 19,62= 0

S16 = 39,24 kg (batang tarik)

Cek titik 16



$\Sigma X = 0$

S15 = S17

S17 = 42,55 kg (batang tekan)

$\Sigma Y = 0$

20,93 + S16 - S15 cos 45° - S17 cos 45° = 0

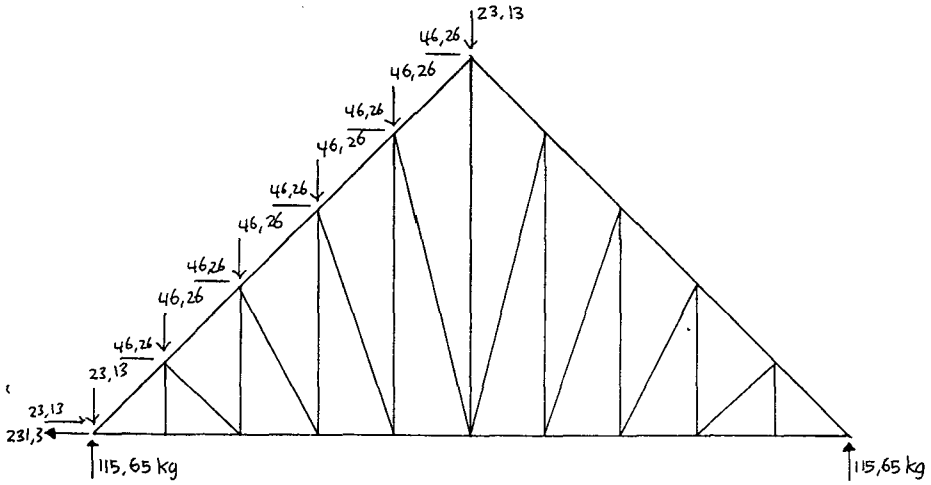
20,93 - 30,09 - 30,09 + 39,24 = 0

9,15 - 9,15 = 0 ... **(OK!)**

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI KAYU	HALAMAN : 22
	BAGIAN STRUKTUR : KUDA ~ KUDA	NO. GAMBAR :
		NRP : 2139301

PERHITUNGAN

Gaya Batang Akibat Angin Tiup



$\Sigma M_B = 0$

$(23{,}13 \times 10) + (46{,}26 \times 9) + (46{,}26 \times 8) + (46{,}26 \times 7) + (46{,}26 \times 6) + (23{,}13 \times 5) = 10V_A + (46{,}26 \times 1) + (46{,}26 \times 2) + (46{,}26 \times 3) + (46{,}26 \times 4) + (23{,}13 \times 5)$

$231{,}3 + 416{,}34 + 370{,}08 + 323{,}82 + 277{,}56 + 115{,}65 = 10\ V_A + 46{,}26 + 92{,}52 + 138{,}78 + 185{,}04 + 115{,}65$

$1734{,}75 = 10\ V_A + 578{,}25$

$1156{,}5 = 10\ V_A$

$V_A = 115{,}65$ kg ... ↑

$\Sigma V = 0$

$23{,}13 + 46{,}26 + 46{,}26 + 46{,}26 + 46{,}26 + 23{,}13 = V_A + V_B$

$231{,}13 = 115{,}65 + V_B$

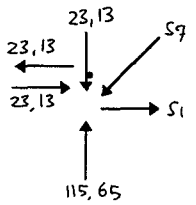
$V_B = 115{,}65$ kg ... ↑

$\Sigma H = 0$

$H_A = (2 \times 23{,}13) + (4 \times 46{,}26)$

$H_A = 231{,}13$ kg ... ←

PERHITUNGAN



$\Sigma Y = 0$

$23,13 - 115,65 + S7 \sin 45° = 0$

$92,52 = S7 \sin 45°$

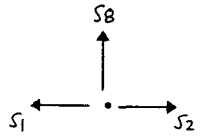
$S7 = 130,84$ kg (batang tekan)

$\Sigma X = 0$

$231,13 - S1 + S7 \cos 45° - 23,13 = 0$

$S1 = 300,69$ kg (batang tarik)

Titik 2



$\Sigma Y = 0$

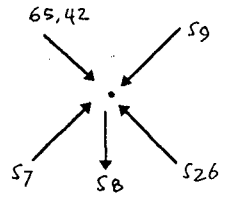
$S8 = 0$ kg

$\Sigma X = 0$

$S1 = S2$

$S2 = 300,69$ kg (batang tarik)

Titik 12



$\Sigma Y = 0$

$65,42 - S26 + S8 \cos 45° = 0$

$65,42 - S26 = 0$

$S26 = 65,42$ kg (batang tekan)

$\Sigma X = 0$

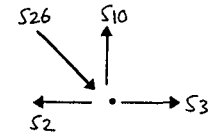
$S7 - S9 - S8 \sin 45° = 0$

$130,84 - S9 = 0$

$S9 = 130,84$ kg (batang tekan)

PERHITUNGAN

Titik 3



$\Sigma Y = 0$

S10 - S26 sin 45° = 0

S10 = 46,26 kg (batang tarik)

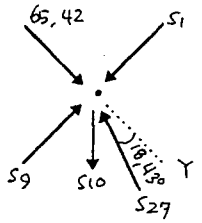
$\Sigma X = 0$

S3 + S26 cos 45° - S2 = 0

S3 + 46,26 - 300,69 = 0

S3 = 254,43 kg (batang tarik)

Titik 13



$\Sigma Y = 0$

65,42 - S27 cos 18,43° + S10 cos 45° = 0

65,42 - S27 cos 18,43° + 32,71 = 0

S27 = 103,44 kg (batang tekan)

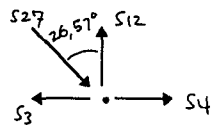
$\Sigma X = 0$

S9 - S11 - S10 sin 45° = 0

130,84 - S11 - 32,71 = 0

S11 = 98,13 kg (batang tekan)

Titik 4



$\Sigma Y = 0$

S12 - S27 sin 26,57° = 0

S12 = 92,52 kg (batang tekan)

PERHITUNGAN

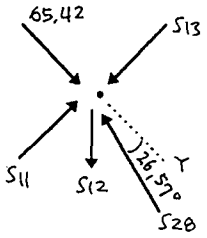
ΣX = 0

S4 - S3 + S27 cos 26,57° = 0

S4 - 254,43 + 46,27 = 0

S4 = 208,16 kg (batang tarik)

Titik 14



ΣY = 0

65,42 - S28 cos 26,57° + S12 cos 45° = 0

65,42 - S28 cos 26,57°+ 65,42 = 0

S28 = 146,29 kg (batang tekan)

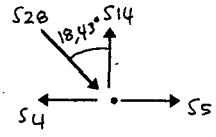
ΣX = 0

S11 - S13 - S12 sin 45° = 0

98,13 - S13 - 65,42 = 0

S13 = 32,71 kg (batang tekan)

Titik 5



ΣY = 0

S14 - S28 cos 18,43° = 0

S14 = 138,79 kg (batang tarik)

ΣX = 0

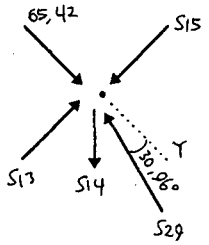
S4 - S5 - S28 sin 18,43° = 0

208,16 - S5 - 46,25 = 0

S5 = 161,91 kg (batang tarik)

PERHITUNGAN

Titik 15



ΣY = 0

65,42 - S29 cos 30,96° + S14 cos 45° = 0

65,42 - S29 cos 30,96° + 98,14 = 0

S29 = 190,73 kg (batang tekan)

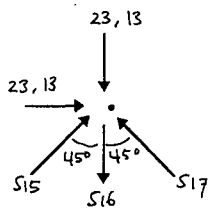
ΣX = 0

S15- S13 - S14 sin 45° = 0

S15 - 32,71 - 98,14 = 0

S15 = 130,85 kg (batang tekan)

Titik 16



ΣX = 0

23,13 + S15 sin 45° = S17 sin 45°

S17 = 163,55 kg (batang tekan)

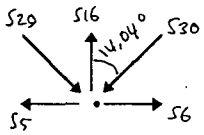
ΣY = 0

23,13 + S16 - S15 cos 45° - S17 cos 45° = 0

23,13 + S16 - 92,52 - 115,65 = 0

S16 = 185,04 kg (batang tarik)

Titik 6



ΣX = 0

S5 + S30 sin 14,04° - S6 - S29 sin 14,04° = 0

161,91 - S6 - 46,27 = 0

S30 = 115,64 kg (batang tarik)

PERHITUNGAN

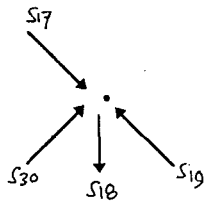
$\Sigma Y = 0$

S16 - S29 cos 14,04° - S30 cos 14,04° = 0

185,04 - 185,03 = S30 cos 14,04°

S30 = 0 kg

Titik 17

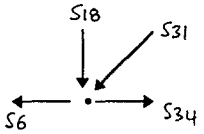


S18 = 0 kg

S17 = S19

S19 = 163,55 kg (batang tekan)

Titik 7

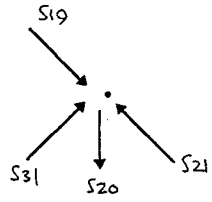


S31 = 0 kg

S6 = S34

S34 = 115,64 kg (batang tarik)

Titik 18



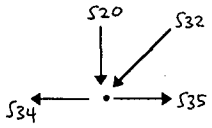
S20 = 0 kg

S19 = S21

S21 = 163,55 kg (batang tekan)

PERHITUNGAN

Titik 8

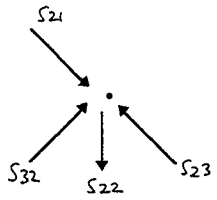


S32 = 0 kg

S35 = S34

S35 = 115,64 kg (batang tarik)

Titik 19

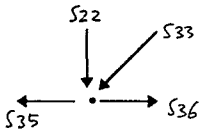


S22 = 0 kg

S23 = S21

S23 = 163,55 kg (batang tekan)

Titik 9

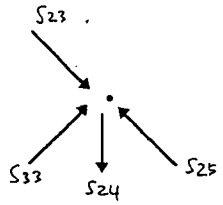


S33 = 0 kg

S36 = S34

S36 = 115,64 kg (batang tarik)

Titik 20

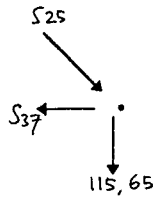


S24 = 0 kg

S23 = S25

S25 = 163,55 kg (batang tekan)

Titik 11



$\Sigma X = 0$

S25 sin 45° - S37 = 0

S37 = 115,65 kg (batang tarik)

$\Sigma Y = 0$

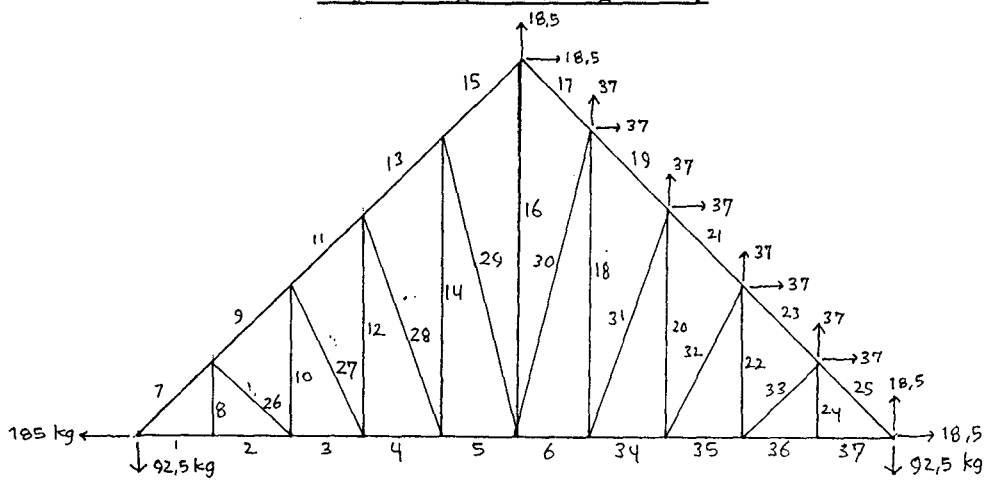
115,65 - S25 cos 45° =0

115,65 = S25 cos 45°

115,65 = 115,65 ... **(OK!)**

PERHITUNGAN

Gaya Batang Akibat Angin Hisap



$\Sigma M_B = 0$

$(18,5 \times 5) + (37 \times 4) + (37 \times 3) + (37 \times 2) + (37 \times 1) + 10V_B = (18,5 \times 5) + (37 \times 6) + (37 \times 7) + (37 \times 8) + (37 \times 9) + (18,5 \times 10)$

$92,5 + 148 + 111 + 74 + 37 + 10\ V_B = 92,5 + 222 + 259 + 296 + 333 + 185$

$462,5 + 10\ V_B = 1387,5$

$V_B = 92,5$ kg ...↓

$\Sigma V = 0$

$(2 \times 18,5) + (4 \times 37) = V_A + V_B$

$185 = V_A + 92,5$

$V_A = 92,5$ kg ...↓

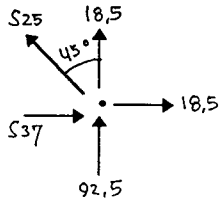
$\Sigma H = 0$

$H_A = (2 \times 18,5) + (4 \times 37)$

$H_A = 185$ kg ... ←

PERHITUNGAN

Titik 11



$\Sigma Y = 0$

18,5 - 92,5 + S25 cos 45° = 0

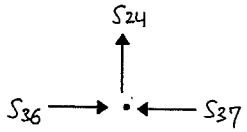
S25 = 104,65 kg (batang tarik)

$\Sigma X = 0$

18,5 + S37 - S25 sin 45° = 0

S37 = 55,5 kg (batang tekan)

Titik 10



$\Sigma Y = 0$

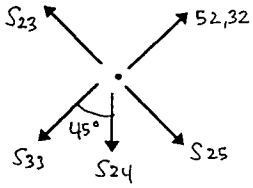
S24 = 0 kg

$\Sigma X = 0$

S36 = S37

S36 = 55,5 kg (batang tekan)

Titik 20



$\Sigma Y = 0$

S23 - S25 - S24 sin 45° = 0

S23 - 104,65 = 0

S23 = 104,65 kg (batang tekan)

$\Sigma X = 0$

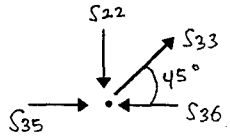
52,32 - S23 - S24 cos 45° = 0

52,32 - S33 = 0

S33 = 52,32 kg (batang tarik)

PERHITUNGAN

Titik 9



ΣY = 0

S22 - S33 sin 45° = 0

S22 = 37 kg (batang tekan)

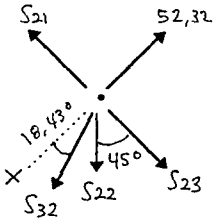
ΣX = 0

S35 + S33 cos 45° - S36 = 0

S35 + 37 - 55,5 = 0

S3 = 18,5 kg (batang tekan)

Titik 19



ΣY = 0

52,32 - S32 cos 18,43° + S22 cos 45° = 0

52,32 - S32 cos 18,43° + 26,16 = 0

S32 = 82,72 kg (batang tarik)

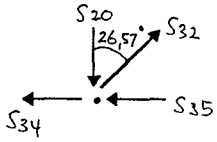
ΣX = 0

S21 - S23 + S22 cos 45° - S32 sin18,43°= 0

S21 - 104,65 + 26,16 - 26,15 = 0

S21 = 104,64 kg (batang tarik)

Titik 8



ΣY = 0

S20 - S32 sin 26,57° = 0

S20 = 74 kg (batang tekan)

PERHITUNGAN

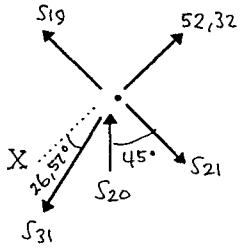
$\Sigma X = 0$

S34 + S35 - S32 sin 26,57° = 0

S34 - 37 + 18,5 = 0

S34 = 18,5 kg (batang tarik)

Titik 18



$\Sigma Y = 0$

52,32 - S31 cos 26,57° + S20 sin 45° = 0

52,32 + 52,33 - S31 cos 26,57° = 0

S31 = 117,01 kg (batang tarik)

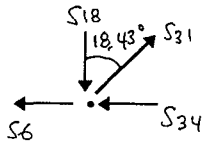
$\Sigma X = 0$

S19 - S21 + S20 cos 45° - S31 sin 26,57°= 0

S19 - 104,64 + 52,33 - 52,34 = 0

S19 = 104,65 kg (batang tarik)

Titik 7



$\Sigma Y = 0$

S18 - S31 cos 18,43° = 0

S18 = 111,01 kg (batang tekan)

$\Sigma X = 0$

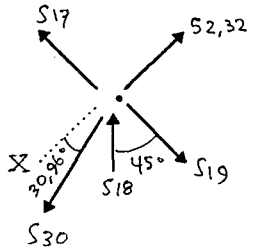
S6 - S31 sin 18,43° + S34= 0

S6 - 37 + 18,5 = 0

S6 = 18,5 kg (batang tarik)

PERHITUNGAN

Titik 17



$\Sigma X = 0$

52,32 - S30 cos 30,96° + S18 cos 45° = 0

52,32 - S30 cos 30,96° + 78,5 = 0

S30 = 152,26 kg (batang tarik)

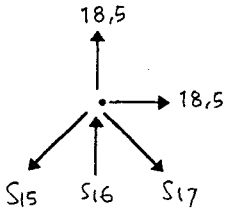
$\Sigma Y = 0$

S17- S19 - S30 cos 30,96° + S18 sin 45° = 0

S17 + 78,5 - 104,65 - 78,5 = 0

S17 = 104,65 kg (batang tarik)

Titik 16



$\Sigma X = 0$

18,5 + S17 sin 45° - S15 sin 45° = 0

18,5 + 74 - S15 sin 45° = 0

S15 = 130,81 kg (batang tarik)

$\Sigma Y = 0$

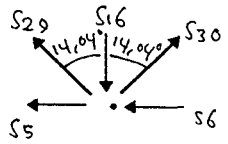
18,5 + S16 - S15 cos 45° - S17 cos 45° = 0

18,5 + S16 - 92,5 - 74 = 0

S16 = 148 kg (batang tekan)

PERHITUNGAN

Titik 6



$\Sigma Y = 0$

S16 - S29 cos 14,04° - S30 cos 14,04° = 0

S29 = 0 kg

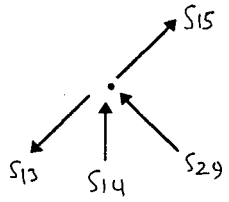
$\Sigma X = 0$

S30 sin 14,04° + S5 - S29 sin 14,04° - S6 = 0

37,01 + S5 - 18,5 = 0

S5 = 18,51 kg (batang tarik)

Titik 15

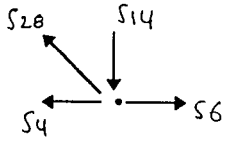


S14 = 0 kg

S15 = S13

S13 = 130,81kg (batang tekan)

Titik 5

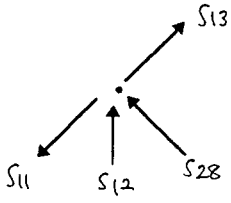


S28 = 0 kg

S4 = S5

S4 = 18,51 kg (batang tarik)

Titik 14



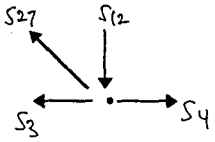
S12 = 0 kg

S13 = S11

S11 = 130,81 kg (batang tekan)

PERHITUNGAN

Titik 4

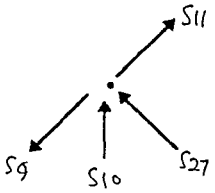


S27 = 0 kg

S3 = S4

S3 = 18,5 kg (batang tarik)

Titik 13

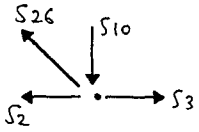


S10 = 0 kg

S9 = S11

S9 = 130,81 kg (batang tekan)

Titik 3

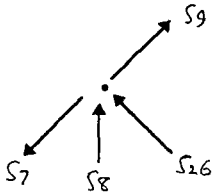


S26 = 0 kg

S2 = S3

S2 = 18,51 kg (batang tarik)

Titik 12



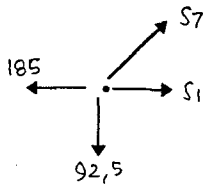
S8 = 0 kg

S7 = S9

S7 = 130,81 kg (batang tarik)

PERHITUNGAN

Titik 1



$\Sigma X = 0$

$185 - S1 - S7 \cos 45° = 0$

S1 = 92,5 kg (batang tarik)

$\Sigma Y = 0$

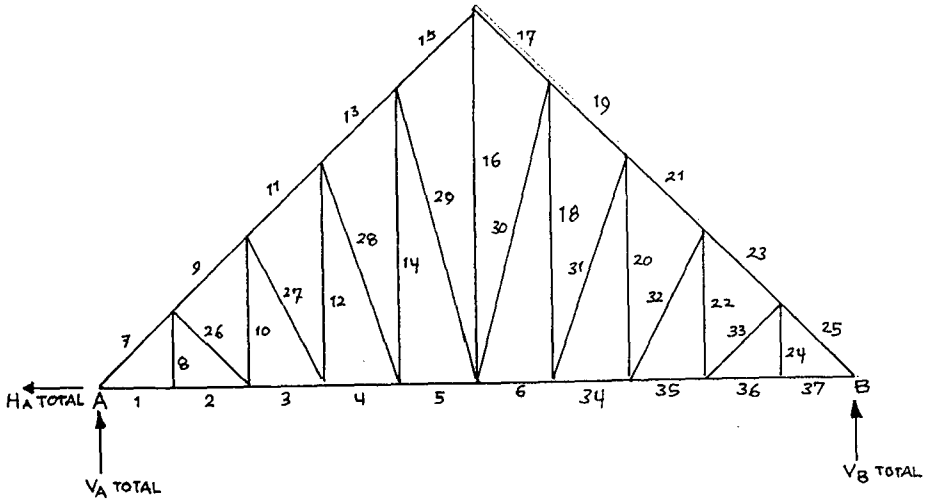
$92,5 - S7 \sin 45° = 0$

$92,5 = S7 \sin 45°$

92,5 = 92,5 ... **(OK!)**

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI KAYU	HALAMAN : 38
	BAGIAN STRUKTUR : KUDA-KUDA NO. GAMBAR :	NRP : 2139011

PERHITUNGAN



VA total = 2142,07 + 550 +115,65 = 2807,72 kg

VB total = 2141,07 + 550 + 115,65 = 2807,72 kg

HA total = 231,13+ 185 = 416,3 kg

FAKULTAS TEKNIK SIPIL
UNIVERSITAS KRISTEN PETRA

TUGAS KONSTRUKSI KAYU

HALAMAN : 1 13

BAGIAN STRUKTUR : NO. GAMBAR :

NRP : 2139011

PERHITUNGAN

BATANG	GAYA AKIBAT BEBAN (KG)					GAYA BATANG RENCANA
	B. MATI	B. PEKERJA	B. AIR HUJAN	B. ANGIN TIUP	B. ANGIN HISAP	
S1	1927,86	450	94,2	300,69	92,5	2678,55
S2	1927,86	450	94,2	300,69	18,51	2678,55
S3	1713,66	400	83,74	254,43	18,51	2368,09
S4	1392,35	325	68,04	208,16	18,51	1925,51
S5	1017,49	237,5	49,73	161,91	18,51	1416,9
S6	1017,49	237,5	49,73	115,64	18,51	1370,63
S7	-2726,41	-363,4	-133,2	-130,84	130,81	-3493,65
S8	49,8	0	0	0	0	49,8
S9	-2423,48	-565,69	-118,4	-130,84	130,81	-312,01
S10	264,01	0	10,46	46,26	0	360,27
S11	-1969,08	-459,62	-96,2	-98,13	130,81	-2526,83
S12	-371,11	-75	-15,7	-92,52	0	-538,63
S13	-1438,95	-335,88	-70,3	-32,71	130,81	-1807,54
S14	424,66	87,5	18,31	138,79	0	650,95
S15	-870,95	-203,3	-42,55	-130,85	130,81	-1205,1
S16	853,08	187,5	39,24	185,04	-148	1225,62
S17	-870,95	-203,3	-42,55	-163,55	104,65	-1237,8
S18	424,66	87,5	18,31	0	-111,01	442,97
S19	-1438,95	-335,88	-70,3	-163,55	104,65	-1938,38
S20	-371,11	-75	-15,7	0	-74	-446,1
S21	-1969,08	-459,62	-96,2	-163,55	104,64	-2592,25
S22	264,01	50	1,46	0	-37	314,01
S23	-2423,48	-565,69	-118,4	-163,55	104,65	-3152,72
S24	49,8	0	0	0	0	49,8
S25	-2726,41	-636,4	-133,2	-163,55	104,64	-3526,36
S26	-302,93	-70,71	-14,8	-65,42	0	-439,06
S27	-454,4	-106,07	-22,2	-103,44	0	-663,91
S28	-530,13	-123,74	-25,9	-146,29	0	-800,16
S29	-568	-132,58	-27,75	-190,73	0	-891,31
S30	-568	-132,58	-27,75	0	152,56	-700,58
S31	-530,13	-123,74	-25,9	0	117,01	-653,87
S32	-454,4	-106,07	-22,2	0	82,72	-560,47
S33	-302,93	-70,71	-14,8	0	52,32	-373,64
S34	1392,35	325	68,04	115,64	18,5	1832,99
S35	1713,66	400	83,74	115,64	-18,5	2229,3
S36	1927,86	450	94,2	115,64	-55,5	2493,5
S37	1927,86	450	94,2	115,64	-55,5	2493,5

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI KAYU	HALAMAN :
	BAGIAN STRUKTUR : KUDA ~ KUDA NO. GAMBAR :	NRP : 21393011

PERHITUNGAN

Kontrol Kekuatan Batang

(Pemilihan Dimensi)

1. **Batang tekan dari tepi atas rangka kuda-kuda yang menerima gaya tekan terbesar.**

Tinjau batang S25 = 3526,36 kg.

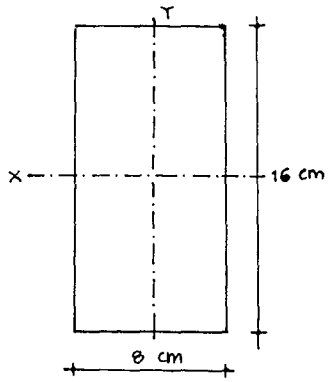
Lk = 1.4142 m

ix = 0,289 h = 0,289 x 16 = 4,624 cm

iy = 0,289 b = 0,289 x 8 = 2,312 cm

$$\lambda = \frac{Lk}{i_{min}} = \frac{141,42}{2,312} = 61,17 \longrightarrow \omega = 1,7$$

$\bar{\sigma}k$ = 77 kg/cm²



Kontrol tegangan

$$\sigma Tk// = \frac{S \times \omega}{b \times h} = \frac{3526,36 \times 17}{8 \times 16} = 46,83 \text{ kg/cm}^2 < \sigma Tk// = 130 \text{ kg/cm}^2$$

σk = 77 kg/cm²

2. **Batang tekan diagonal yang menerima gaya tekan terbesar**

Tinjau batang S29 = 891,31 kg

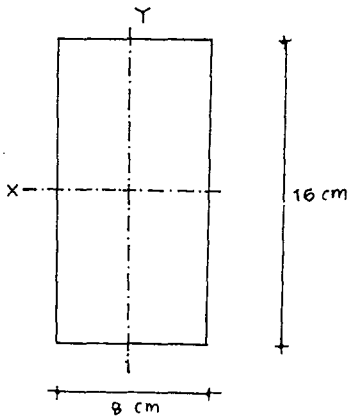
Lk = 4.1231 m

ix = 0,289 h = 0,289 x 16 = 4,624 cm

iy = 0,289 b = 0,289 x 8 = 2,312 cm

$$\lambda = \frac{Lk}{i_{min}} = \frac{141,42}{2,312} = 61,17 \longrightarrow \omega = 7,65$$

$\bar{\sigma}k$ = 17 kg/cm²



PERHITUNGAN

Kontrol tegangan

$$\sigma Tk// = \frac{S \times \omega}{b \times h} = \frac{891{,}31 \times 7{,}65}{8 \times 16} = 53{,}27 \text{ kg/cm}^2 \quad < \quad \bar{\sigma}Tk// = 130 \text{ kg/cm}^2$$

$$\bar{\sigma}k = 17 \text{ kg/cm}^2$$

3. Batang tarik dari tepi bawah rangka kuda-kuda yang menerima gaya tarik terbesar.

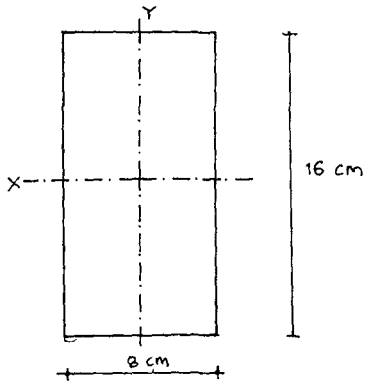
Tinjau batang S1= S2 = 2678,55 kg

Fnetto = Fbrutto - F akibat perlemahan

= (16 x 8) - 20% (16 x 8)

= 128 - 25,6

= 102,4 cm²



Kontrol tegangan

$$\sigma tr// = \frac{S}{Fnetto} = \frac{2678{,}55}{102{,}4} = 26{,}16 \text{ kg/cm}^2 \quad < \quad \bar{\sigma}tr// = 130 \text{ kg/cm}^2$$

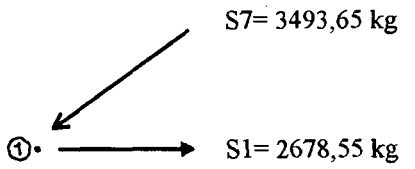
FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI KAYU	HALAMAN : 12
	BAGIAN STRUKTUR : KUDA ~ KUDA NO. GAMBAR :	NRP : 2139011

PERHITUNGAN

PERENCANAAN SAMBUNGAN

1. **Sambungan pada titik 1**

Dipakai sambungan gigi tunggal



$$tv1 = \frac{S}{112 \times b} = \frac{3493,65}{112 \times 8} = 3,9 \text{ cm}$$

$45° < 50°$

$tv1 < 1/4\ h = 1/4 \times 16 = 4$ cm

berarti 3,9 cm < 4 cm ... **(OK!)**

kontrol tv1 = 3,9 cm

$$\sigma_{½\alpha} = \frac{S\cos^2 ½\alpha}{b \times tv1} < \bar{\sigma}_{½\alpha}$$

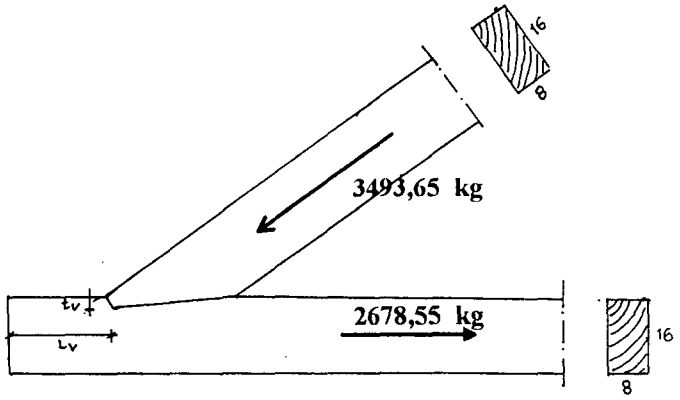
$$= \frac{3493,65 \times \cos^2 22,5}{8 \times 3,9}$$

$= 95,58$ kg/cm² < $\bar{\sigma}_{½\alpha}$ = 96 kg/cm² ... **(OK!)**

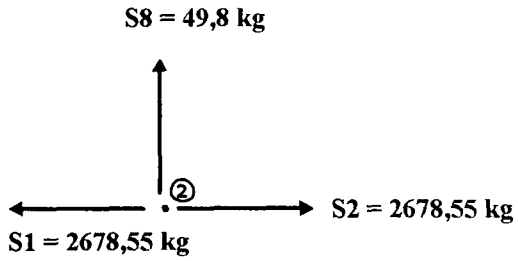
$$= \frac{S \times \cos\alpha}{b \times \tau_{//}} = \frac{3493,65 \cos 45°}{8 \times 20}$$

$= 15,44$ cm ~ 16 cm

PERHITUNGAN



2. **Sambungan pada titik 2**



Batang Vertikal

» Sambungan tampang dua, $\alpha = 0°$, ø baut = 3/8" = 0,95 cm

$\bar{P} = 250.d.l\,(1-0{,}6 \sin\alpha)\,\eta\,ø$

$= 250.0{,}95.4\,(1-0{,}6 \sin 0°) \times 1 \times 1$

$= 950$ kg

$\bar{P} = 480.d^2\,(1-0{,}35 \sin\alpha)\,\eta\,ø$

$= 480.0{,}95^2\,(1-0{,}35 \sin 0°) \times 1 \times 1$

$= 433{,}2$ kg

PERHITUNGAN

Batang horisontal

» Sambungan tampang dua, $\alpha = 0°$, ø baut = 3/8" = 0,95 cm

$\bar{P} = 125.d.m\,(1\text{-}0{,}6 \sin\alpha)\ \eta\ ø$

$= 125.0{,}95.8\,(1\text{-}0{,}6 \sin 45°) \times 1 \times 1$

$= 546.95$ kg

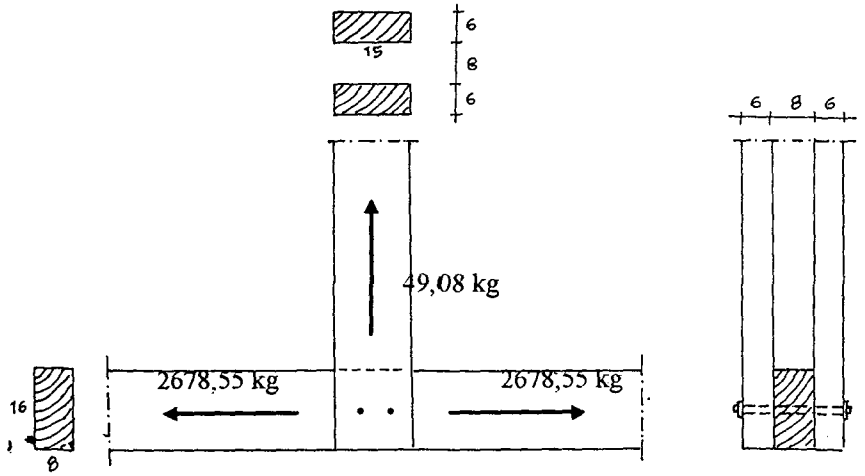
$\bar{P} = 480.d^2\,(1\text{-}0{,}35 \sin\alpha)\ \eta\ ø$

$= 480.0{,}95^2\,(1\text{-}0{,}35 \sin 45°) \times 1 \times 1$

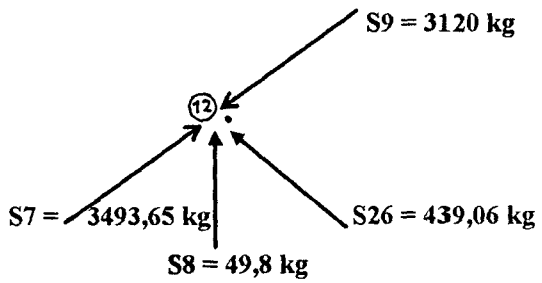
$= 325{,}99$ kg

Jadi $\bar{P}$ yang dipakai = 325,99 kg

Jadi jumlah baut yang dibutuhkan $= \dfrac{49{,}8}{325{,}99} = 0{,}153 = 2$ baut



3. **Sambungan pada titik 12**



PERHITUNGAN

Sambungan S7, S9 dan S26 menggunakan sambungan gigi tunggal

$$tv1 = \frac{S}{112 \times b} = \frac{493,06}{112 \times 8} = 0,49 \text{ cm}$$

$90° > 60°$

$tv1 < 1/6\ h = 1/6 \times 16 = 2,67$ cm

tv1 diambil = 2 cm

kontrol tv1 = 2 cm

$$\sigma_{\frac{1}{2}\alpha} = \frac{S\cos^2 \frac{1}{2}\alpha}{b \times tv1} < \bar{\sigma}_{\frac{1}{2}\alpha}$$

$$= \frac{493,06 \times \cos^2 45°}{8 \times 2}$$

$= 13,72 \text{ kg/cm}^2 < 65 \text{ kg/cm}^2$ ... **(OK!)**

Sambungan S8 dengan S7 dan S9

Batang S8

» Sambungan tampang 2, $\alpha = 0°$, ø baut = 3/8" = 0,95 cm

$\bar{P} = 250 \times d \times l\ (1-0,6 \sin \alpha)\eta\ ø$

$= 250.0,95.4\ (1-0,6 \sin 0°) \times 1 \times 1$

$= 950$ kg

$\bar{P} = 480 \times d^2\ (1-0,35 \sin \alpha)\ \eta\ ø$

$= 480.0,95^2\ (1-0,35 \sin 0°) \times 1 \times 1$

$= 433,2$ kg

Sambungan S7 dan S9

» Sambungan tampang 2, $\alpha = 45°$, ø baut = 3/8" = 0,95 cm

$\bar{P} = 125 \times d \times l\ (1-0,6 \sin \alpha)\eta\ ø$

$= 125.0,95.8\ (1-0,6 \sin 45°) \times 1 \times 1$

$= 546,95$ kg

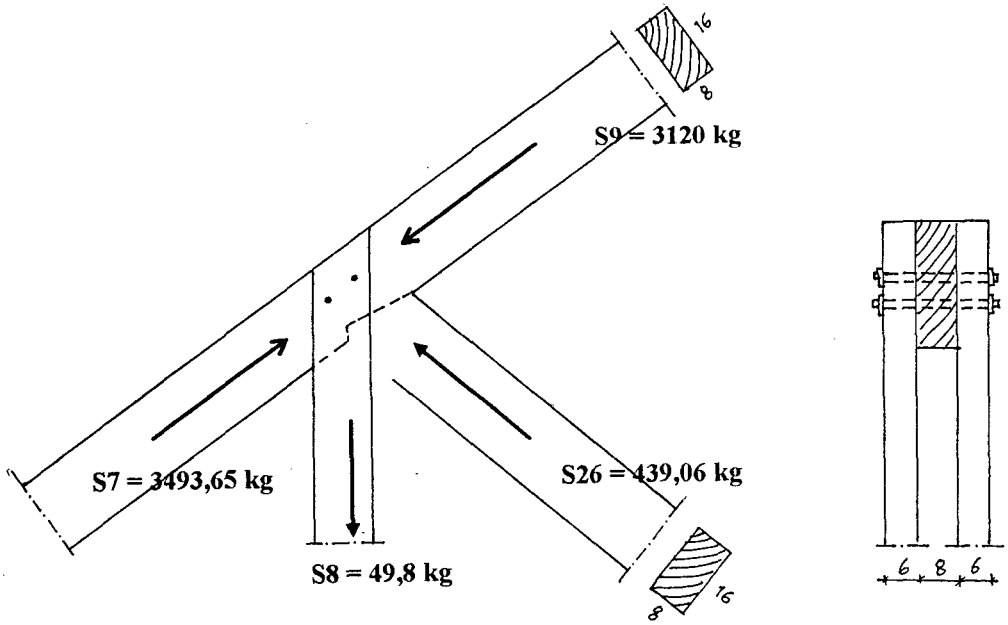
$\bar{P} = 480 \times d^2\ (1-0,35 \sin \alpha)\eta\ ø$

$= 480.0,95^2\ (1-0,35 \sin 45°) \times 1 \times 1$

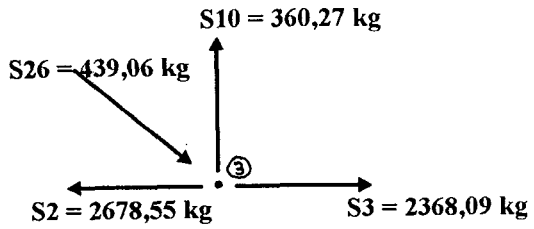
$= 325,99$ kg

Jadi $\bar{P}$ yang dipakai = 325,99 kg

Jadi jumlah baut yang dibutuhkan = 49,8 ÷ 325,99 = 0,153 = 2 baut



4. **Sambungan pada titik 3**



Sambungan S26 dengan S2, S3 menggunakan sambungan gigi tunggal

$$tv1 = \frac{S}{112 \times b} = \frac{493,06}{112 \times 8} = 0,49 \text{ cm}$$

45° > 50°

tv1 < 1/4 h = 1/4 x 16 = 4 cm

tv1 diambil = 2 cm

kontrol tv1 = 2 cm

PERHITUNGAN

$$\sigma \frac{1}{2}\alpha = \frac{S\cos^2 \frac{1}{2}\alpha}{b \times tvl} < \bar{\sigma}\frac{1}{2}\alpha$$

$$= \frac{493{,}06 \times \cos^2 22{,}5^\circ}{8 \times 2}$$

$= 23{,}42 \text{ kg/cm}^2 < 96 \text{ kg/cm}^2$ ... **(OK!)**

Sambungan S10 dengan S2 dan S3

Batang Vertikal

» Sambungan tampang 2, $\alpha = 0^\circ$, ø baut = 3/8" = 0,95 cm

$\bar{P} = 250 \times d \times l\,(1\text{-}0{,}6 \sin\alpha)\eta\,ø$

$= 250.0{,}95.4\,(1\text{-}0{,}6 \sin 0^\circ) \times 1 \times 1$

$= 950$ kg

$\bar{P} = 480 \times d^2\,(1\text{-}0{,}35 \sin\alpha)\,\eta\,ø$

$= 480.0{,}95^2\,(1\text{-}0{,}35 \sin 0^\circ) \times 1 \times 1$

$= 433{,}2$ kg

Sambungan S7 dan S9

» Sambungan tampang 2, $\alpha = 45^\circ$, ø baut = 3/8" = 0,95 cm

$\bar{P} = 125 \times d \times l\,(1\text{-}0{,}6 \sin\alpha)\eta\,ø$

$= 125.0{,}95.8\,(1\text{-}0{,}6 \sin 90^\circ) \times 1 \times 1$

$= 380$ kg

$\bar{P} = 480 \times d^2\,(1\text{-}0{,}35 \sin\alpha)\,\eta\,ø$

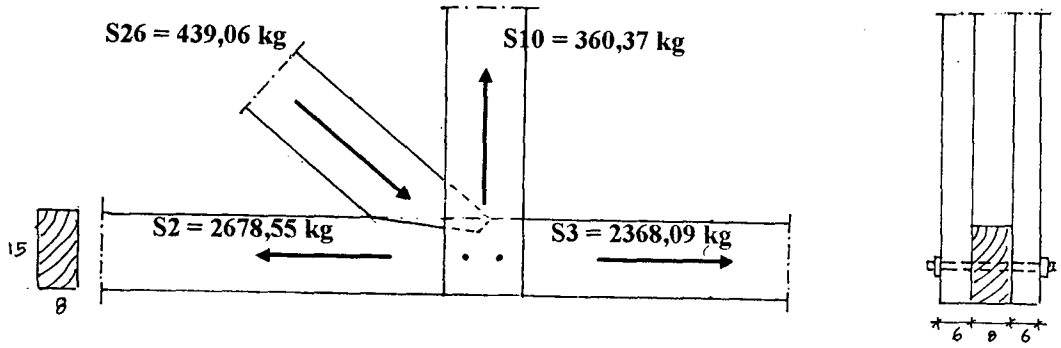
$= 480.0{,}95^2\,(1\text{-}0{,}35 \sin 90^\circ) \times 1 \times 1$

$= 281{,}58$ kg

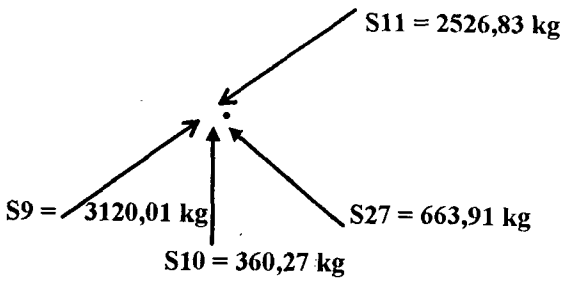
Jadi $\bar{P}$ yang dipakai = 281,58 kg

Jadi jumlah baut yang dibutuhkan = 360,27 ÷ 281,58 = 1,28 = 2 baut

PERHITUNGAN



5. **Sambungan pada titik 13**



Sambungan S9, S11 dan S27 menggunakan sambungan gigi tunggal

$$tv1 = \frac{S}{112 \times b} = \frac{663,91}{112 \times 8} = 0,74 \text{ cm}$$

$108,43° > 60°$

$tv1 < 1/6\ h = 1/6 \times 16 = 2,67$ cm

tv1 diambil = 2 cm

kontrol tv1 = 2 cm

$$\sigma_{½\alpha} = \frac{S\cos^2 ½\alpha}{b \times tv1} < \bar{\sigma}_{½\alpha}$$

$$= \frac{663,91 \times \cos^2 54,215°}{8 \times 2}$$

$= 14,19$ kg/cm² < 55 kg/cm² ... **(OK!)**

PERHITUNGAN

Sambungan S10 dengan S9 dan S11

Batang S10

» Sambungan tampang 2, $\alpha = 0°$, ø baut = 3/8" = 0,95 cm

$\bar{P}$ = 250 x d x l (1-0,6 sin α) η ø

= 250.0,95.4 (1-0.6 sin 0°) x 1 x 1

= 950 kg

$\bar{P}$ = 480 x d^2 (1- 0,35 sin α) η ø

= 480.0,95^2 (1-0,35 sin 0°) x 1 x 1

= 433,2 kg

Sambungan S9 dan S11

» Sambungan tampang 2, $\alpha = 45°$, ø baut = 3/8" = 0,95 cm

$\bar{P}$ = 125 x d x m (1-0,6 sin α) η ø

= 125.0,95.8 (1-0,6 sin 45°) x 1 x 1

= 546,95 kg

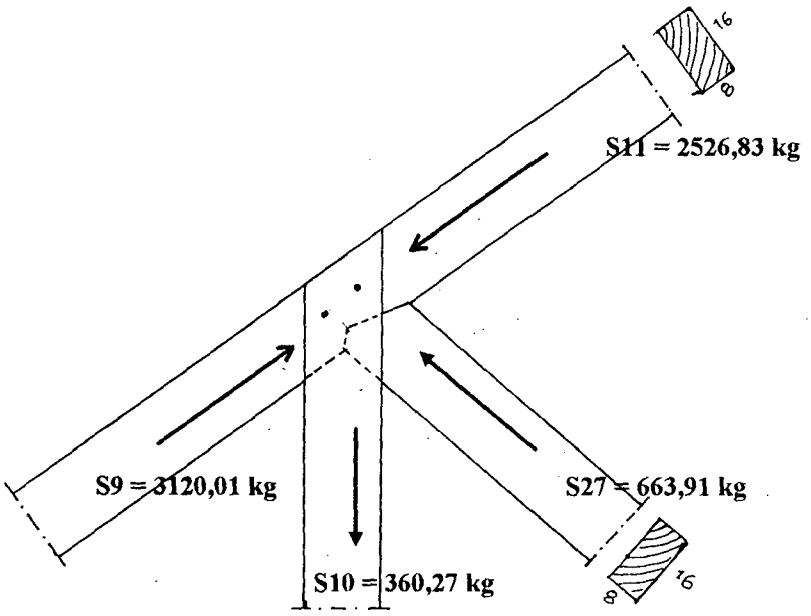
$\bar{P}$ = 480 x d^2 (1- 0,35 sin α) η ø

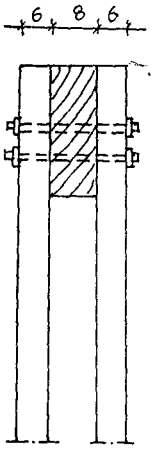
= 480.0,95^2 (1-0,35 sin 45°) x 1 x 1

= 325,99 kg

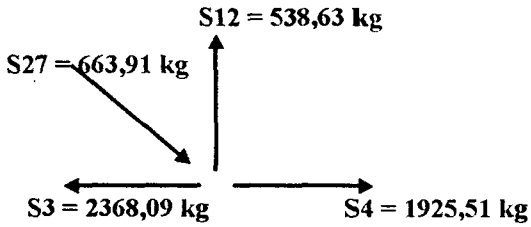
Jadi $\bar{P}$ yang dipakai = 325,99 kg

Jadi jumlah baut yang dibutuhkan = 360,27 ÷ 325,99 = 1,105 = 2 baut





6. **Sambungan pada titik 4**



Sambungan S27 dengan S3, S4 menggunakan sambungan gigi tunggal

$$tv1 = \frac{S}{112 \times b} = \frac{6633,91}{112 \times 8} = 0,74 \text{ cm}$$

$63,43° > 60°$

$tv1 < 1/6\ h = 1/6 \times 16 = 2,67$ cm

tv1 diambil = 2 cm

kontrol tv1 = 2 cm

$$\sigma \alpha/2 = \frac{S \cos^2 \alpha/2}{b \times tv1} < \sigma \alpha/2$$

$$= \frac{663,91 \times \cos^2 31715°}{8 \times 2}$$

$= 70,03 \text{ kg/cm}^2 < 80 \text{ kg/cm}^2$ ... **(OK!)**

Sambungan S10 dengan S2 dan S3

Batang Vertikal

» Sambungan tampang 2, $\alpha = 0°$, ø baut = 3/8" = 0,95 cm

$P = 250 \times d \times l\ (1-0,6 \sin \alpha)\ \eta\ ø$

$= 250.0,95.4\ (1-0,6 \sin 0°) \times 1 \times 1$

$= 950$ kg

$P = 480 \times d^2\ (1-0,35 \sin \alpha)\ \eta\ ø$

$= 480.0,95^2\ (1-0,35 \sin 0°) \times 1 \times 1$

$= 433,2$ kg

Sambungan S7 dan S9

» Sambungan tampang 2, $\alpha = 45°$, ø baut = 3/8" = 0,95 cm

$\bar{P} = 125 \times d \times l\,(1-0{,}6 \sin\alpha)\,\eta\,ø$

$= 125.0{,}95.8\,(1-0{,}6 \sin 90°) \times 1 \times 1$

$= 380$ kg

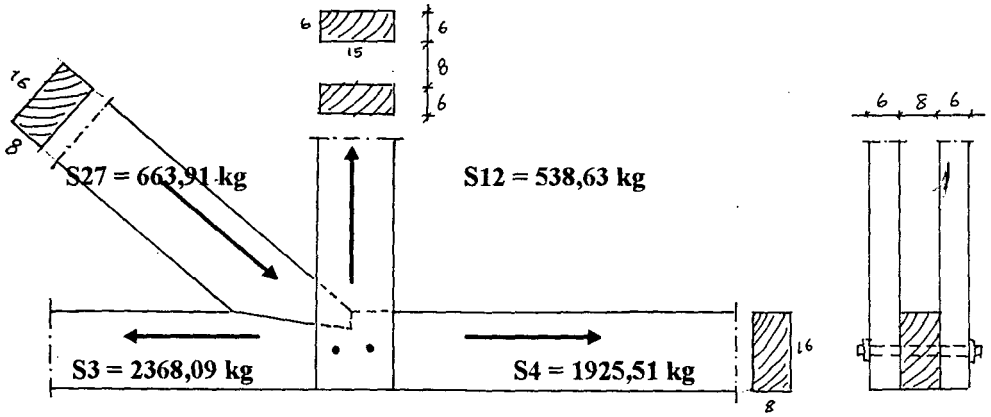
$\bar{P} = 480 \times d^2\,(1-0{,}35 \sin\alpha)\,\eta\,ø$

$= 480.0{,}95^2\,(1-0{,}35 \sin 90°) \times 1 \times 1$

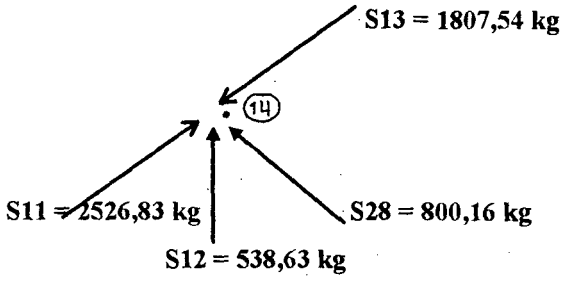
$= 281{,}58$ kg

Jadi $\bar{P}$ yang dipakai = 281,58 kg

Jadi jumlah baut yang dibutuhkan = 538,63 ÷ 281,58 = 1,913 = 2 baut



7. **Sambungan pada titik 14**



Sambungan S11, S13 dan S28 menggunakan sambungan gigi tunggal

$$tv1 = \frac{S}{112 \times b} = \frac{800,16}{112 \times 8} = 0,893 \text{ cm}$$

$116,57° > 60°$

$tv1 < 1/6\ h = 1/6 \times 16 = 2,67$ cm

tv1 diambil = 2 cm

kontrol tv1 = 2 cm

$$\sigma_{½\alpha} = \frac{S\cos^2 ½\alpha}{b \times tv1} < \bar{\sigma}_{½\alpha}$$

$$= \frac{800,16 \times \cos^2 58,285°}{8 \times 2}$$

$= 13,82 \text{ kg/cm}^2 < 52 \text{ kg/cm}^2$ ... **(OK!)**

Sambungan S12 dengan S11 dan S13

Batang S12

» Sambungan tampang 2, $\alpha = 0°$, ø baut = 3/8" = 0,95 cm

$\bar{P} = 250 \times d \times l\ (1-0,6 \sin \alpha)\ \eta\ ø$

$= 250.0,95.4\ (1-0,6 \sin 0°) \times 1 \times 1$

$= 950$ kg

$\bar{P} = 480 \times d^2\ (1-0,35 \sin \alpha)\ \eta\ ø$

$= 480.0,95^2\ (1-0,35 \sin 0°) \times 1 \times 1$

$= 433,2$ kg

Sambungan S9 dan S11

» Sambungan tampang 2, $\alpha = 45°$, ø baut = 3/8" = 0,95 cm

$\bar{P} = 125 \times d \times m\ (1-0,6 \sin \alpha)\ \eta\ ø$

$= 125.0,95.8\ (1-0,6 \sin 45°) \times 1 \times 1$

$= 546,95$ kg

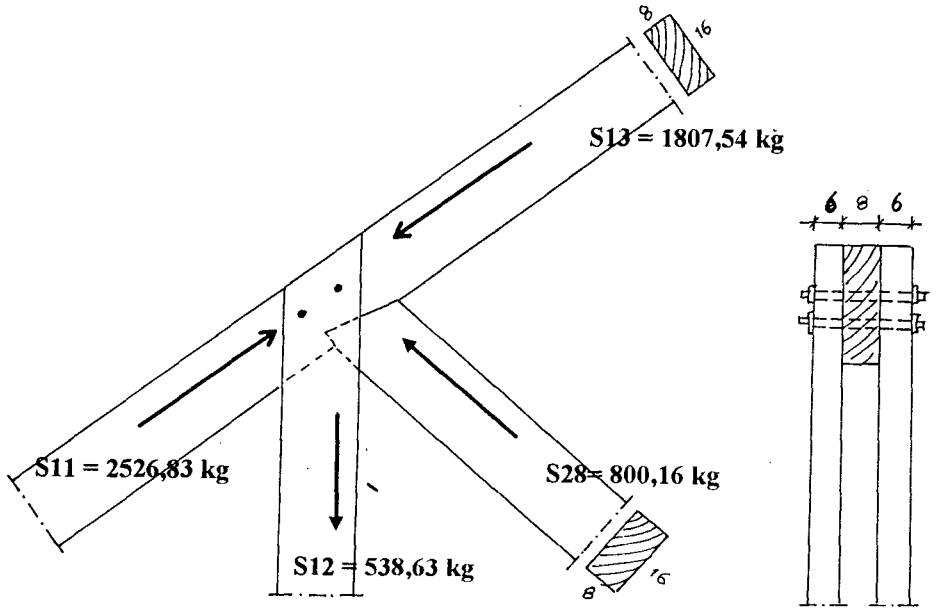
$\bar{P} = 480 \times d^2\ (1-0,35 \sin \alpha)\ \eta\ ø$

$= 480.0,95^2\ (1-0,35 \sin 45°) \times 1 \times 1$

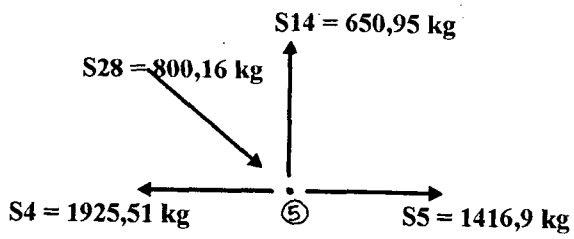
$= 325,99$ kg

Jadi $\bar{P}$ yang dipakai = 325,99 kg

Jadi jumlah baut yang dibutuhkan = 538,63 ÷ 325,99 = 1,65 = 2 baut



5. **Sambungan pada titik 5**



Sambungan S28 dengan S4, S5 menggunakan sambungan gigi tunggal

$$tv1 = \frac{S}{112 \times b} = \frac{800,16}{112 \times 8} = 0,893 \text{ cm}$$

71,57° > 60°

tv1 < 1/6 h = 1/6 x 16 = 2,67 cm

tv1 diambil = 2 cm

kontrol tv1 = 2 cm

$$\sigma_{\frac{1}{2}\alpha} = \frac{S\cos^2 \frac{1}{2}\alpha}{b \times tv1} < \bar{\sigma}_{\frac{1}{2}\alpha}$$

$$= \frac{800{,}16 \times \cos^2 35{,}785^\circ}{8 \times 2}$$

$= 32{,}91 \text{ kg/cm}^2 < 76 \text{ kg/cm}^2$ ... **(OK!)**

Sambungan S10 dengan S2 dan S3

Batang Vertikal

» Sambungan tampang 2, $\alpha = 0^\circ$, ø baut = 3/8" = 0,95 cm

$\bar{P} = 250 \times d \times l\,(1\text{-}0{,}6 \sin\alpha)\,\eta\,ø$

$= 250.0{,}95.4\,(1\text{-}0{,}6 \sin 0^\circ) \times 1 \times 1$

$= 950$ kg

$\bar{P} = 480 \times d^2\,(1\text{-}0{,}35 \sin\alpha)\,\eta\,ø$

$= 480.0{,}95^2\,(1\text{-}0{,}35 \sin 0^\circ) \times 1 \times 1$

$= 433{,}2$ kg

Sambungan S7 dan S9

» Sambungan tampang 2, $\alpha = 45^\circ$, ø baut = 3/8" = 0,95 cm

$\bar{P} = 125 \times d \times l\,(1\text{-}0{,}6 \sin\alpha)\,\eta\,ø$

$= 125.0{,}95.8\,(1\text{-}0{,}6 \sin 90^\circ) \times 1 \times 1$

$= 380$ kg

$\bar{P} = 480 \times d^2\,(1\text{-}0{,}35 \sin\alpha)\,\eta\,ø$

$= 480.0{,}95^2\,(1\text{-}0{,}35 \sin 90^\circ) \times 1 \times 1$

$= 281{,}58$ kg

Jadi $\bar{P}$ yang dipakai = 281,58 kg

Jadi jumlah baut yang dibutuhkan = 650,95 ÷ 281,58 = 2,31 = 3 baut

$$\sigma_{\frac{1}{2}\alpha} = \frac{S\cos^2 \frac{1}{2}\alpha}{b \times tvl} < \bar{\sigma}_{\frac{1}{2}\alpha}$$

$$= \frac{891{,}31 \times \cos^2 60{,}48°}{8 \times 2}$$

$= 13{,}52 \text{ kg/cm}^2 < 50 \text{ kg/cm}^2$ ... **(OK!)**

Sambungan S14 dengan S13 dan S15

Batang S14

» Sambungan tampang 2, $\alpha = 0°$, ø baut = 3/8" = 0,95 cm

$\bar{P} = 250 \times d \times l \,(1\text{-}0{,}6 \sin \alpha)\, \eta\, ø$

$= 250.0{,}95.4 \,(1\text{-}0{,}6 \sin 0°) \times 1 \times 1$

$= 950$ kg

$\bar{P} = 480 \times d^2 (\,1\text{-}\, 0{,}35 \sin \alpha)\, \eta\, ø$

$= 480.0{,}95^2 \,(1\text{-}0{,}35 \sin 0°) \times 1 \times 1$

$= 433{,}2$ kg

Sambungan S9 dan S11

» Sambungan tampang 2, $\alpha = 45°$, ø baut = 3/8" = 0,95 cm

$\bar{P} = 125 \times d \times m \,(1\text{-}0{,}6 \sin \alpha)\, \eta\, ø$

$= 125.0{,}95.8 \,(1\text{-}0{,}6 \sin 45°) \times 1 \times 1$

$= 546{,}95$ kg

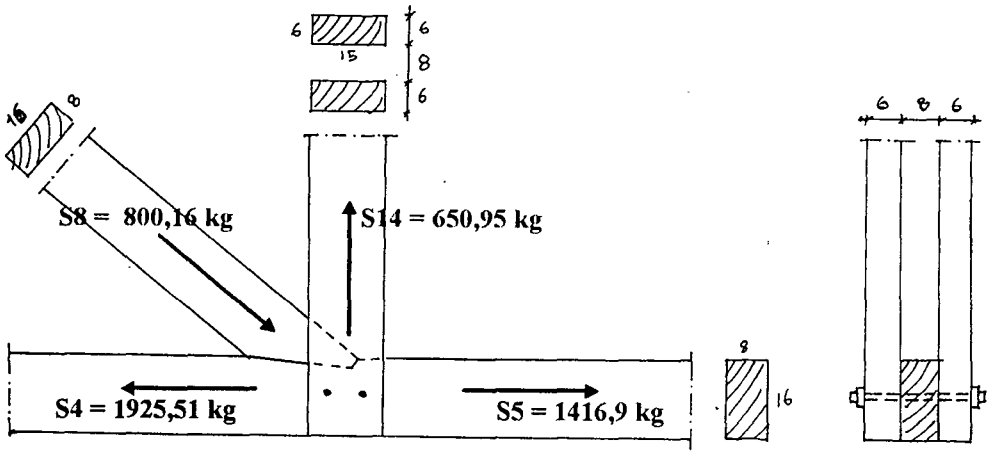
$\bar{P} = 480 \times d^2 \,(\,1\text{-}\, 0{,}35 \sin \alpha)\, \eta\, ø$

$= 480.0{,}95^2 \,(1\text{-}0{,}35 \sin 45°) \times 1 \times 1$

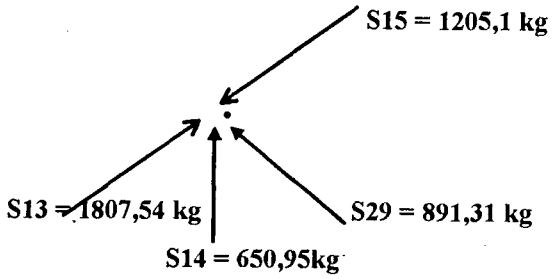
$= 325{,}99$ kg

Jadi $\bar{P}$ yang dipakai = 325,99 kg

Jadi jumlah baut yang dibutuhkan = 650,95 ÷ 325,99 = 1,996 = 2 baut



9. **Sambungan pada titik 15**



Sambungan S11, S13 dan S28 menggunakan sambungan gigi tunggal

$$tv1 = \frac{S}{112 \times b} = \frac{891,31}{112 \times 8} = 0,995 \text{ cm}$$

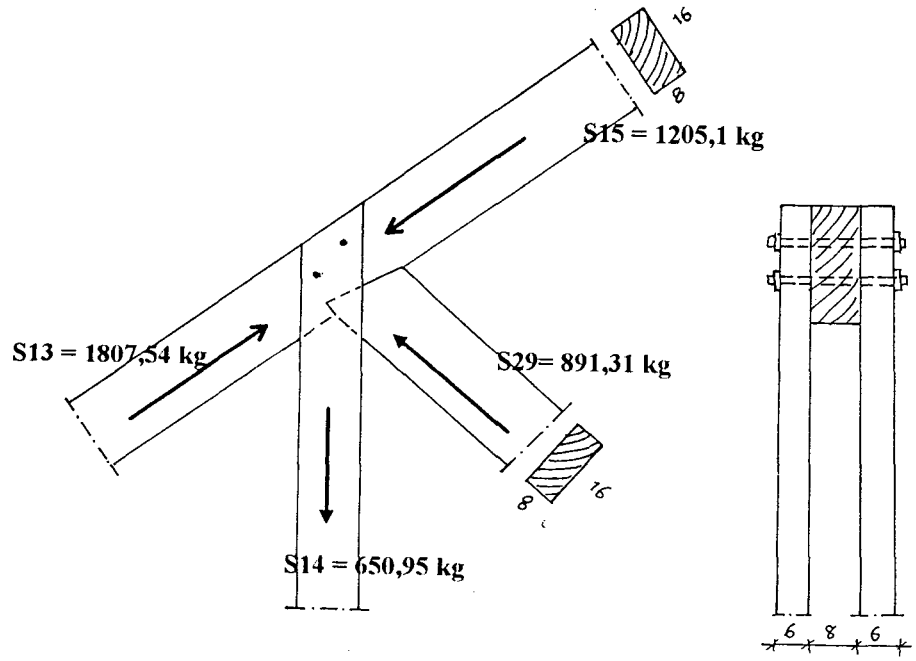
120,96° > 60°

tv1 < 1/6 h = 1/6 x 16 = 2,67 cm

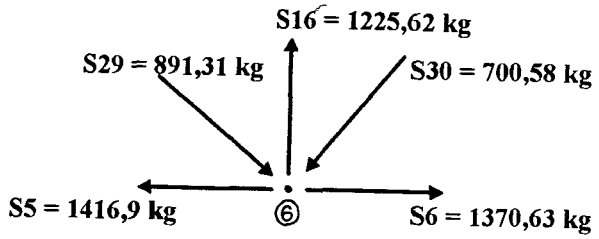
tv1 diambil = 2 cm

kontrol tv1 = 2 cm

PERHITUNGAN



10. **Sambungan pada titik 6**



Sambungan S28 dengan S4, S5 menggunakan sambungan gigi tunggal

$$tv1 = \frac{S}{112 \times b} = \frac{891,31}{112 \times 8} = 0,995 \text{ cm}$$

$14,04° > 50°$

$tv1 < 1/4\ h = 1/4 \times 16 = 4$ cm

tv1 diambil = 2 cm

kontrol tv1 = 2 cm

$$\sigma_{½\alpha} = \frac{S\cos^2 ½\alpha}{b \times tv1} < \bar{\sigma}_{½\alpha}$$

$$= \frac{891{,}31 \times \cos^2 7{,}02°}{8 \times 2}$$

$= 54{,}87 \text{ kg/cm}^2 < 117{,}5 \text{ kg/cm}^2$ ... **(OK!)**

$$Lv = \frac{S \times \cos\alpha}{b \times \tau//} = \frac{891{,}31 \cos 14{,}04°}{8 \times 20}$$

$= 5{,}4$ cm

Syarat Lv > 15 cm

maka Lv diambil = 15 cm

Sambungan S16 dengan beugel 65 × 4

Dipakai baut ø 5/8"

F bruto $= 0{,}4 \times 6{,}5 = 2{,}6 \text{ cm}^2$

F lubang $= 0{,}4 \times 1{,}59 = 0{,}636 \text{ cm}^2$

F netto $= 2{,}6 - 0{,}636 = 1{,}964 \text{ cm}^2$

$$\sigma = \frac{1225{,}62}{b \times tv1} = 624{,}04 \text{ kg/cm}^2 < \bar{\sigma} \text{ baja} = 1200 \text{ kg/cm}^2 \text{ ...(OK!)}$$

Cek : sambungan kayu dengan beugel 65 × 4

Batang vertikal

» Sambungan tampang 2, $\alpha = 0°$, ø baut = 5/8" = 1,59 cm

$\bar{P} = 125 \times d \times m (1\text{-}0{,}6 \sin\alpha) \eta \ ø$

$= 125.1{,}59.8 (1\text{-}0{,}6 \sin 0°) \times 1 \times 1$

$= 636$ kg

$\bar{P} = 480 \times d^2 (1\text{-} 0{,}35 \sin\alpha) \eta \ ø,$

$= 480.1{,}59^2 (1\text{-}0{,}35 \sin 0°) \times 1 \times 1$

$= 1213{,}49$ kg

PERHITUNGAN

Batang horisontal

» Sambungan tampang 2, $\alpha = 90°$, ø baut = 5/8" = 1,59 cm

$\bar{P} = 125 \times d \times m (1-0{,}6 \sin \alpha) \eta \ ø$

$= 125.1{,}59.8 (1-0{,}6 \sin 90°) \times 1 \times 1$

$= 636$ kg

$\bar{P} = 480 \times d^2 (1- 0{,}35 \sin \alpha) \eta \ ø$

$= 480.1{,}59^2 (1-0{,}35 \sin 90°) \times 1 \times 1$

$= 788{,}77$ kg

• Sambungan kayu dengan besi, $\bar{P}$ dapat dinaikkan sebesar 25%

$\bar{P} = 636 \times 125\% = 795$ kg

Jadi $\bar{P}$ yang dipakai = 795 kg

Jumlah baut yang dibutuhkan = $1225{,}62 \div 795 = 1{,}541 = 2$ baut

PERHITUNGAN

Sambungan batang S16 dengan S5 dan S6

Batang Vertikal

» Sambungan tampang 1, $\alpha = 0°$, ø baut = 5/8" = 1,59 cm

$P = 50 \times d \times l \,(1-0{,}6 \sin \alpha)\, \eta\, ø$

$= 50.1{,}59.8\,(1-0{,}6 \sin 0°) \times 1 \times 1$

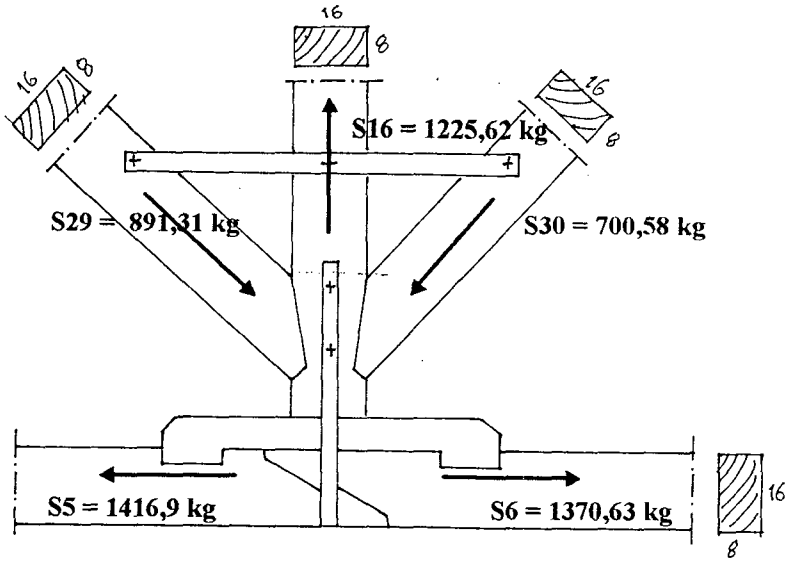
$= 636$ kg

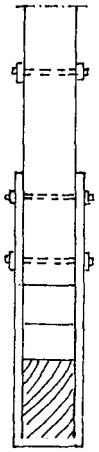
$P = 240 \times d^2\,(1-0{,}35 \sin \alpha)\, \eta\, ø$

$= 240.1{,}59^2\,(1-0{,}35 \sin 0°) \times 1 \times 1$

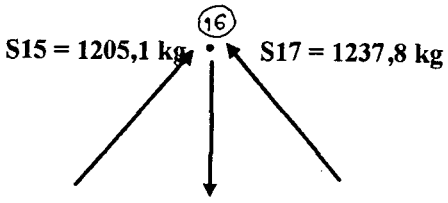
$= 606{,}74$ kg

Jadi jumlah baut yang dibutuhkan = 1225,62 ÷ 606,74 = 2,02 = 2 baut





11. **Sambungan pada titik 16**



Sambungan batang S17 degan S16 menggunakan sambungan gigi tunggal

$$tv1 = \frac{S}{112 \times b} = \frac{1237,8}{112 \times 8} = 1,38 \text{ cm}$$

$45° < 50°$

$tv1 < 1/4\ h = 1/4 \times 16 = 4$ cm

tv1 diambil = 2 cm

kontrol tv1 = 2 cm

$$\sigma_{1/2\alpha} = \frac{S\cos^2 1/2\alpha}{b \times tv1} < \bar{\sigma}_{1/2\alpha}$$

$$= \frac{1237,8 \times \cos^2 22,5°}{8 \times 2}$$

$= 66,03$ kg/cm² < 96 kg/cm² ... **(OK!)**

$$Lv = \frac{S \times \cos\alpha}{b \times \tau_{//}} = \frac{1237,8 \cos 22,5°}{8 \times 20}$$

$= 7,15$ cm

Syarat Lv > 15 cm

maka Lv diambil = 15 cm

FAKULTAS TEKNIK SIPIL
UNIVERSITAS KRISTEN PETRA

TUGAS KONSTRUKSI KAYU

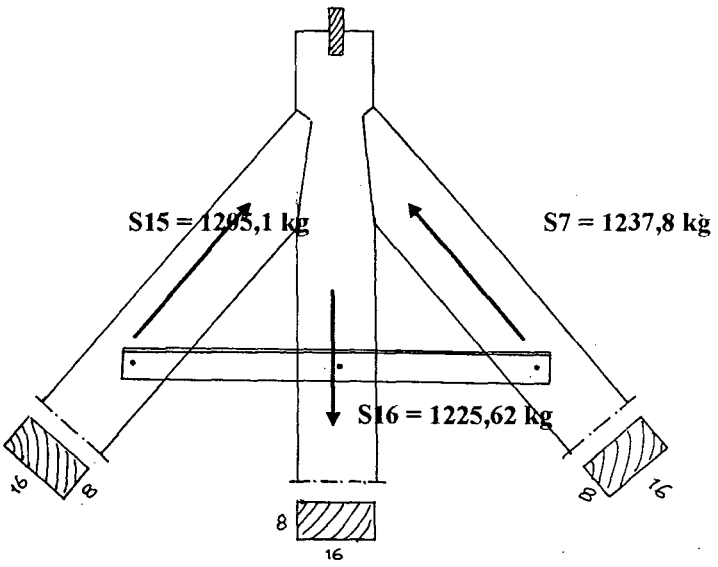
HALAMAN : 62

BAGIAN STRUKTUR :

NO. GAMBAR :

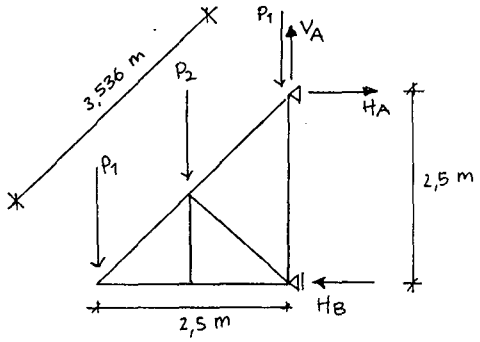
NRP : 21393011

PERHITUNGAN



PERHITUNGAN

KANTILEVER



Dipakai kayu 5/7

Panjang batang = 2,5 + 2,5 + (½ × 2,5) + (2,5² + 2,5²) + 2 × (½ ×2,5²)

= 14,678 m

Pembebanan :

- Berat sendiri = 0,05 × 0,07 × 14,678 × 310 = 46,75 kg
- Beban pekerja = = 100 kg
- Beban mati = 87,3906 × 3,7 = 323,35 kg

P1 = 100 + ½(46,75 +323,35) = 285,05 kg

P2 = 100 + 46,75 + 323,35 = 470,1 kg

ΣMA = 0

Hb × 2,5 - P1 × 2,5 - P2× (½.2,5) = 0

2,5Hb - 712,625 - 587,625 = 0

2,5Hb = 1300,25

Hb = 520,1 kg

ΣH = 0

Ha = Hb

Ha = 520,1 kg

ΣV = 0

Va = 2P1 + P2

= 2.285,05 + 470,1

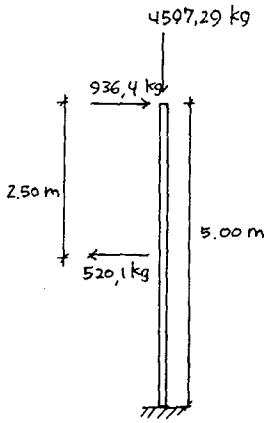
= 1040,2 kg

PERHITUNGAN

KOLOM

Dimensi kolom = 25 × 25 cm

Beban yang bekerja pada kolom :



N1 = 2807,72 + 1040,2 = 3847,92 kg

N2 = 0,25 × 0,25 × 5 × 2400 = 750 kg

N total = N1 + N2 = 3847,92 + 750 = 4597,92 kg

H = 520,1 + 416,3 = 936,4 kg

M = (936,4 × 5) - [520 -(5 - 2,5)] = 3381,75 kgm

Mu = 1,6 × 3381,75 = 5410,8 kgm = 53,08 kNm

Pu = 1,6 × 4597,92 = 7356,672 kgm = 72,169 kNm

Agr = 250 × 250 mm²

fc' = 25 Mpa

fy = 240 Mpa

$$\frac{Pu}{\text{ø. Agr. } 0{,}85.\ fc'} = \frac{72170}{0{,}8 \times (250 \times 250) \times 0{,}85 \times 25} = 0{,}068$$

$$ef = \frac{Mu}{Pu} = \frac{53{,}08}{71{,}169} = 0{,}735 \text{ m} = 735 \text{ mm}$$

$$\frac{ef}{h} = \frac{735}{250} = 2{,}94$$

$$\left[\frac{Pu}{\text{ø. Agr. } 0{,}85.\ fc'}\right] \times \left[\frac{ef}{h}\right] = 0{,}068 \times 2{,}94 = 0{,}199 = 0{,}2$$