TUGAS
KONSTRUKSI BAJA

DOSEN PEMBIMBING
Ir. IMA MULJATI

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 BAJA

menyetujui,

Ir. IMA MULJATI

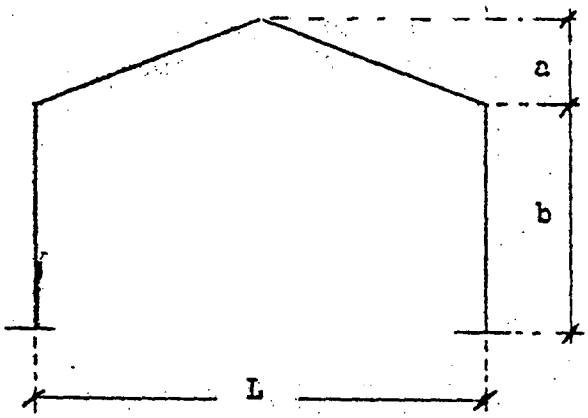
Disusun oleh:
HARTONO
Nrp. 21393011

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	JENIS STRUKTUR :	
	INFORMASI PERENCANAAN	DIPERIKSA OLEH :
Tata Cara Perhitungan Struktur Beton Untuk Bangunan Gedung SKSNI T-15-1991-03 Peraturan Pembebanan Indonesia Untuk Gedung 1983 Peraturan Perencanaan Bangunan Baja Indonesia 1983		PERATURAN-PERATURAN YANG DIPAKAI
Tidak Diperhitungkan		KEMUNGKINAN PENGEMBANGAN DAN PERUBAHAN
Tidak Diperhitungkan		SYARAT-SYARAT KETAHANAN TERHADAP KEBAKARAN
Beban Mati : Berat Sendiri Struktur Beban Hidup : Atap = 100 kg / m²		PEMBEBANAN
KECEPATAN FAKTOR-FAKTOR LAIN Sesuai Dengan PPIUG 1983		BEBAN ANGIN
FAKTOR DAERAH FAKTOR KEPENTINGAN FAKTOR TIPE STRUKTUR Tidak Diperhitungkan		BEBAN GEMPA
Tidak Diperhitungkan		PENGARUH LINGKUNGAN
Lampiran Data Sondir		KONDISI TANAH
Pondasi Telapak		TIPE PONDASI
fc' = 25 Mpa fy = 240 Mpa		DATA BAHAN
Tabel CUR jilid 4 Tabel Profil Baja		LAIN-LAIN

F.T. SIPIL & PERENCANAAN PROGRAM D.III - UNIVERSITAS KRISTEN PETRA

TUGAS : KONST. BAJA	Nama Mhs.: 1. HARTOWO Nrp. 2139301		Diberikan tgl. 14/9 96
	2. ..... Nrp.		
	Asisten :	Paraf	Selesai tgl. .....

Rencanakan bangunan industri dengan konstruksi portal tersebut dibawah ini :



Dimensi : L = 22

a = 1½ m

b = 6 m

Macam baja : Bj. 37

Penutup atap : Asbes

D i n d i n g : Bata

Panjang bangunan : 30 m

Perhitungan meliputi :

1). Setiap elemen struktur dari konstruksi tersebut diatas, termasuk sambungan-sambungannya.

2). Pondasi yang digunakan sesuai dengan data dibawah ini :

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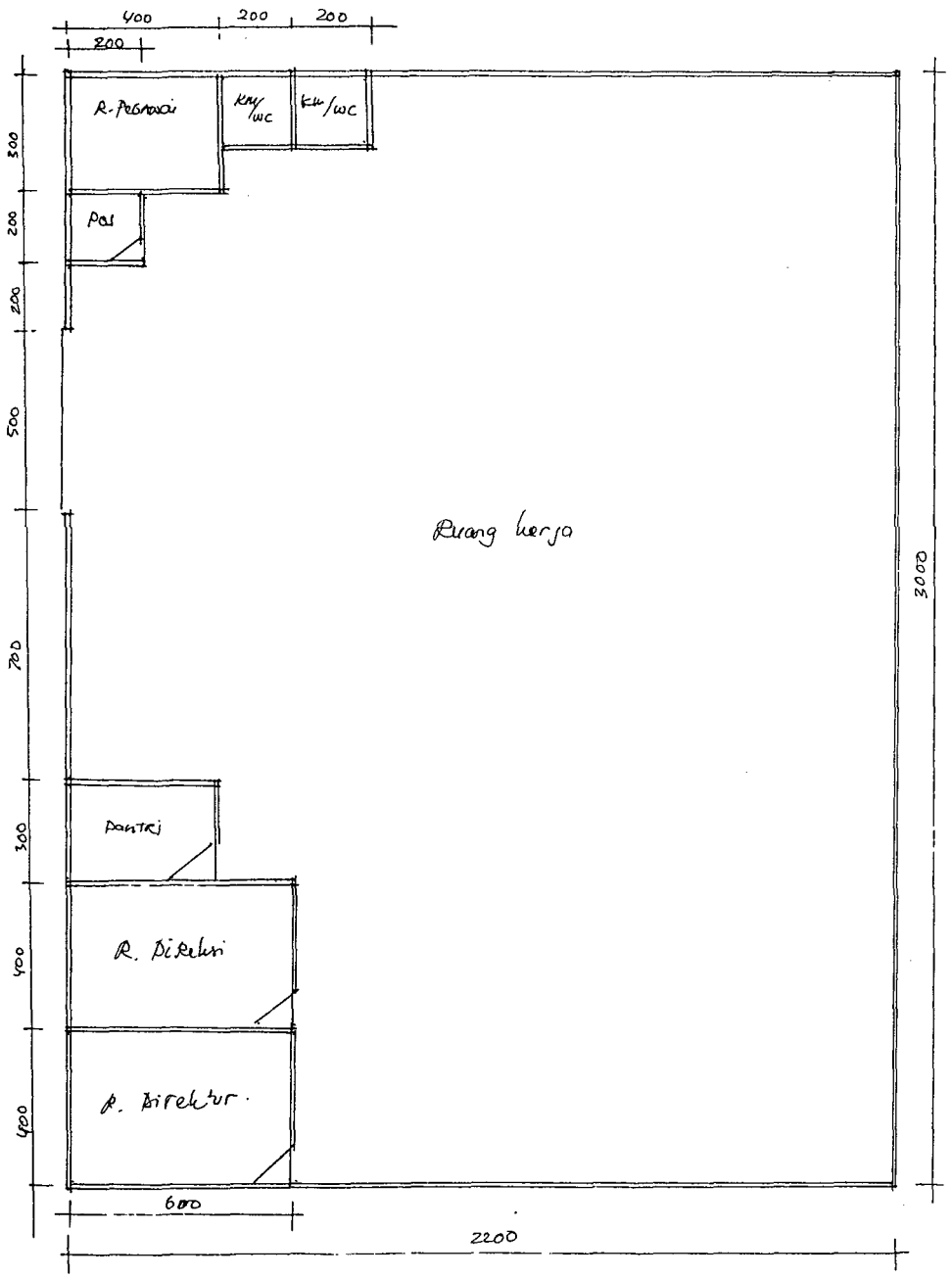
	JENIS STRUKTUR :	
	RINGKASAN/IDEALISASI STRUKTUR	DIPERIKSA OLEH :



DENAH

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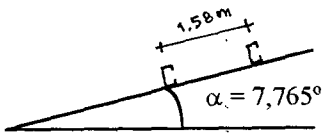
PERHITUNGAN



Penutup atap dari asbes gelombang

jarak rafter = 6 m

jarak gording = 1,58 m

Data asbes gelombang sebagai berikut:

- Panjang = 1800 mm
- Lebar = 1097 mm
- Tebal = 5 mm
- Berat = 20 kg/m²

Dipakai profil kanal [**150. 65. 20. 2,3**

Ix = 248 cm⁴	A = 7,012 cm²
Iy = 41,1 cm⁴	h = 150 mm
Wx = 33 cm³	b = 65 mm
Wy = 9,37 cm³	ix = 5,94 cm
q = 5,5 kg/m'	iy = 2,42 cm

Panjang overlap direncanakan = 22 cm

Jarak gording direncanakan = 158 cm dengan pertimbangan 7 pias.

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PERHITUNGAN

Perhitungan Beban:

* Beban tetap

I. Beban mati : • Beban Asbes : 20 × 1,58 = 31,6 kg/m'

• Beban Gording : = 5,5 kg/m'

Total = 37,1 kg/m' +

• Beban alat penyambung : 10% × 37,1 = 3,71 kg/m'

• Beban mati total = 37,1 + 3,71 = 40,81 kg/m'

II. Beban Hidup : • Beban Pekerja = 100 kg

• Beban air hujan = (40 -0,8 α)

= (40 - 0,8×7,765)

= 33,788 kg/m² > 20 kg/m²

= 20 kg/m²

= 20 × 1,12 = 22,4 kg/m'

Tegangan

Sumbu X:

• Beban mati = 40,81 cos 7,765° = 40,4 kg/m'

• Beban hidup = -100 cos 7,765° = 99 kg/m'

- 22,4 cos 7,765° = 22,2 kg/m'

Momen Lentur akibat :

beban mati = 1/8 × 40,44 × 6² = 185,98 kgm

beban hidup = 1/4 × 99 × 6 = 148,5 kgm

1/8 × 22,2 × 6² = 100 kgm

Momen lentur akibat beban tepusat manusia lebih besar daripada momen lentur akibar beban air hujan.

$$\sigma x = \frac{Mx}{Wx} = \frac{181{,}98 + 148{,}5}{33} = 1001 \text{ kg/cm}^2$$

PERHITUNGAN

Sumbu Y

- Beban mati = 40,44 sin 7,765° = 5,46 kg/m'
- Beban hidup = 100 sin 7,765° = 13,51 kg/m'
  22,4 sin 7,765° = 3,03 kg/m'

Direncanakan 2 buah sagrod maka Ly = 6÷3 = 2 m

Momen lentur akibat:

beban mati = 1/8 × 5,46 × 2² = 2,73 kgm
1/4 × 13,51 × 2 = 6,76 kgm
1/8 × 3,03 × 2² = 1,513 kgm

Momen lentur akibat beban tepusat manusia lebih besar daripada momen lentur akibat beban air hujan.

$$\sigma x = \frac{Mx}{Wx} = \frac{2{,}73 + 6{,}76}{9{,}37} = 101{,}3 \text{ kg/cm}^2$$

Tegangan kombinasi = $\sqrt{(1001^2 + 101{,}3^2)}$ = 1006,11 kg/cm² < $\bar{\sigma}$ = 1600 kg/cm²...**(OK)**

Lendutan

$$fx = \frac{P \times Lx^3}{48 \times E \times Ix} + \frac{5 \times q \times Lx^4}{384 \times E \times Ix}$$

$$= \frac{99 \times 600^3}{48 \times 2{,}1 \cdot 10^6 \times 248} + \frac{5 \times 40{,}44 \times 600^4}{384 \times 2{,}1.10 \times 248}$$

= 0,86 + 1,31

= 2,17 cm

$$fy = \frac{P \times Ly^3}{48 \times E \times Iy} + \frac{5 \times q \times Ly^4}{384 \times E \times Iy}$$

$$= \frac{13{,}51 \times 200^3}{48 \times 2{,}1 \cdot 10^6 \times 41{,}1} + \frac{5 \times 5{,}46 \times 200^4}{384 \times 2{,}1.10 \times 41{,}1}$$

= 0,026 + 0,013

= 0,039 cm

f = $\sqrt{(2{,}17^2 + 0{,}039^2)}$ = 2,17 cm < $\bar{f}$ = 600/250 = 2,4 cm.....**(OK)**

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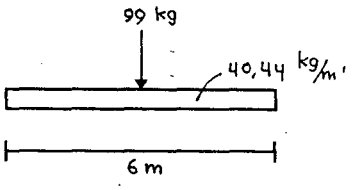
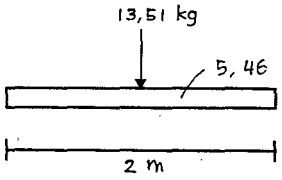
PERHITUNGAN

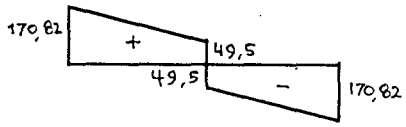
Geser

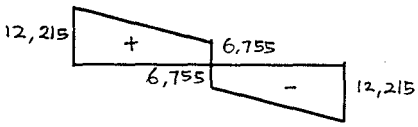
τx



τy







$$\tau x = \frac{D.s}{b.I} = \frac{170{,}82 \times 33}{0{,}23 \times 248}$$

$= 98{,}85 \text{ kg/cm}^2$

$$\tau y = \frac{D.s}{b.I} = \frac{12{,}215 \times 9{,}37}{0{,}23 \times 41{,}1}$$

$= 12{,}11 \text{ kg/cm}^2$

$$\tau \text{ kombinasi} = \sqrt{(98{,}83^2 + 12{,}11^2)}$$

$= 99{,}57 \text{ kg/cm}^2 < \bar{\tau} = 0.58 \times \bar{\sigma}$

$= 928 \text{ kg/cm}^2 \ldots$ **(OK)**

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PERHITUNGAN

KIP

$\frac{h}{b} = \frac{150}{2,3} = 65,22 < 75$

$\frac{L}{h} = \frac{2000}{150} = 13,33 < 1,25 \times (50 \div 2,3) = 27,17$

Jadi termasuk penampang berubah bentuk

A' = A sayap + 1/6 A badan

= [(65 × 2,3) + (20 - 2,3) 2,3] + 1/6[(150 - 2,3 × 2).2,3]

= 190,21 + 55,74

= 245,95 mm² = 2,4595 cm²

iy tepi = $\sqrt{\frac{1/2.Iy}{A'}} = \sqrt{\frac{1/2.41,1}{2,4595}} = 2,89$

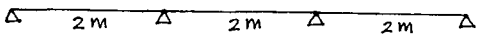
λy = Lky ÷ iy tepi = 200 ÷ 2,89 = 69,2

ωy = 1,451

$\bar{\sigma}kip$ = 1600/1,451 = 1102,69 kg/cm²

σmax = 1006,11 kg/cm² < $\bar{\sigma}kip$ = 1102,69 kg/cm²...**(OK)**

SAGROD



Beban yang terjadi pada gording:

- beban mati = 40,81 kg/m'
- beban hidup = 100 kg

Beban yang dipikul sagrod:

- beban mati = 40,81 sin 7,765°×2 = 11,03 kg/m'
- beban hidup = 100 sin 7,765° = 13,51 kg

Panjang bentang = 158 cm

Gording yang dipikul 8 buah

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PERHITUNGAN

$Ti = n \times g \times \sin 7{,}765^{o} \times 2 + P \sin 7{,}765^{o} \times n$

$= 8 \times 11{,}3 \times \sin 7{,}765^{o} \times 2 + 13{,}51 \times 8$

$= 24{,}43 + 108{,}08$

$= 132{,}51$ kg

A ulir = o,7 A brutto

A brutto = $132{,}51/(0{,}7 \times 0{,}75 \times 1600) = 0{,}16\ cm^2 = 16\ mm^2$

$\frac{1}{4} \times \pi \times d^2 = 16$

$d^2 = 20{,}37$

$d = 4{,}51$ mm diambil 3 mm

Syarat d min > L/500 = 1580/500 = 3,16 mm

d= 8 mm > 3,16 mm...**(OK)**

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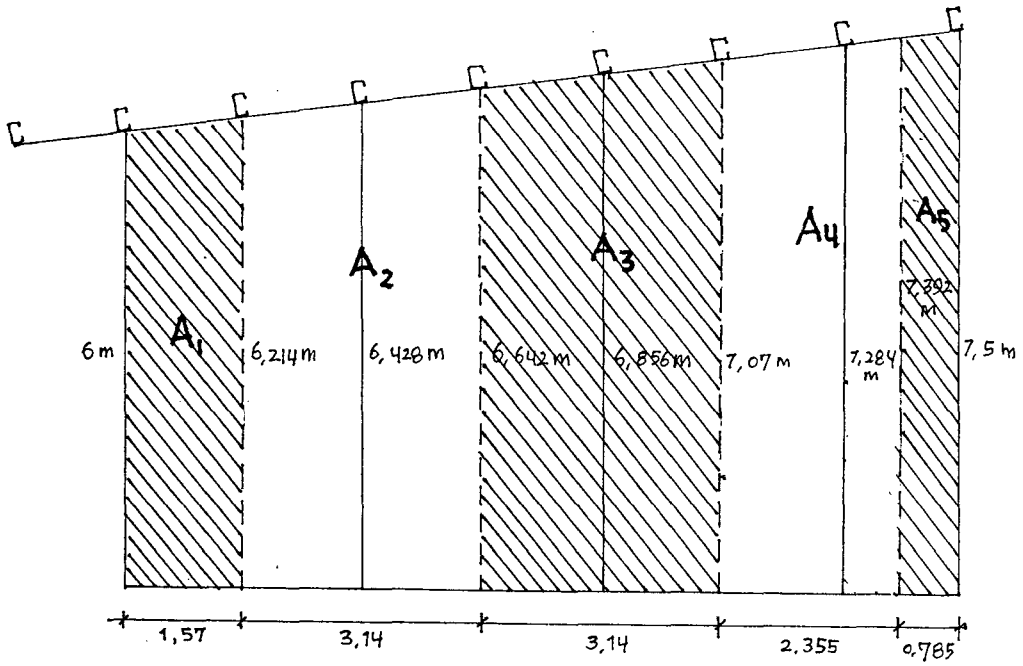
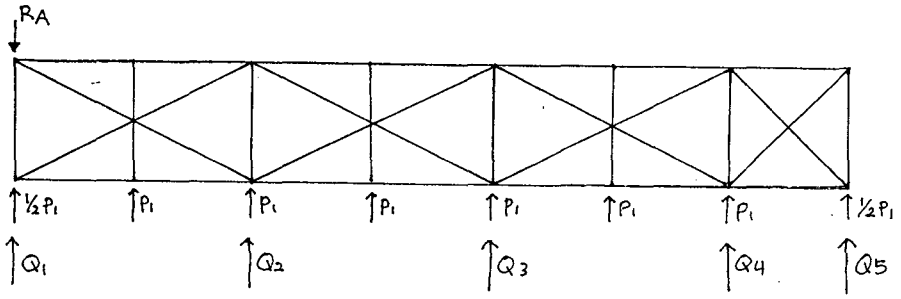
PERHITUNGAN

IKATAN ANGIN





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PERHITUNGAN

A1 = (6+6,214) × 1,57 × 0,5 = 9,59 m²

A2 = (6,214 + 6,642) × 3,14 × 0,5 = 20,184 m²

A3 = (6,642 + 7,07) × 3,14 × 0,5 = 21,529 m²

A4 = (7,07 + 7,392) × 2,355 × 0,5 = 17,03 m²

A5 = (7,392 + 7,5) × 0,785 × 0,5 = 5,845 m²

Q1 = 3,59 × 0,9 × 25 × 50% = 107,89 kg

Q2 = 20,184 × 0,9 × 25 × 50% = 227,07 kg

Q3 = 21,529 × 0,9 × 25 × 50% = 242,20 kg

Q4 = 17,03 × 0,9 × 25 × 50% = 191,59 kg

Q5 = 5,845 × 0,9 × 25 × 50% = 65,76 kg +

Total = 834,51 kg

Perhitungan Pkuda^2:

akibat beban mati = 40,81 × 6 = 244,86 kg

akibat beban hidup = 100 kg

akibat air hujan = 20 × 1,58 × 6 = 189,6 kg

Pkuda^2= 244,86 + 189,6

= 434,46 kg

P' = 0,001×Pkuda^2 + 0,005×n×g×dk×dg

= 0,001 × 434,46 + 0,005 × 1 × 40,81 × 6 × 1,58

= 2,369 kg

R1 = Q1 + 1,5 P'

= 107,89 + 1,5 × 2,369 = 111,44 kg

R2 = Q2 + 2P'

= 227,07 + 2× 2,369 = 1075,86 kg

R3 = Q3 + 2P'

= 242,2 + 2 × 2,2369 = 1147,53 kg

R4 = Q4 + 1,5P'

= 191,59 + 1,5 × 2,369 = 307,75 kg

R5 = Q5 + 0,75P'

= 65,76 + 0,75 × 2,369 = 116,84 kg +

Total = 3359,42 kg

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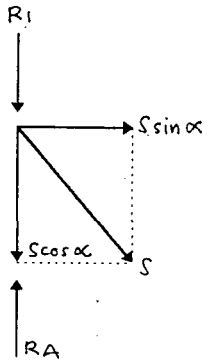
PERHITUNGAN



tg α = 3,14/6

α = 27,62

$\Sigma V = 0$

S cos α = RA - R1

S cos 27,62° = 3359,42 - 111,44

S cos 27,62° = 3247,98

S = 3665,72 kg

A ulir = 0,7 A brutto

$$\text{A brutto} = \frac{S}{0{,}7 \times \overline{\sigma d}} = \frac{3665{,}72}{0{,}7 \times 1600} = 3{,}273\ \text{cm}^2$$

¼ × π × d² = 3,272

d² = 0,26

d = 0,51 cm .....diambil d = 5,1 mm

d min ≥ L/500

d min ≥ 1/500 × $\sqrt{(6000^2 + 3140^2)}$

d min ≥ 13,544

d = 24 mm ≥ 13,544 mm ...**(OK)**

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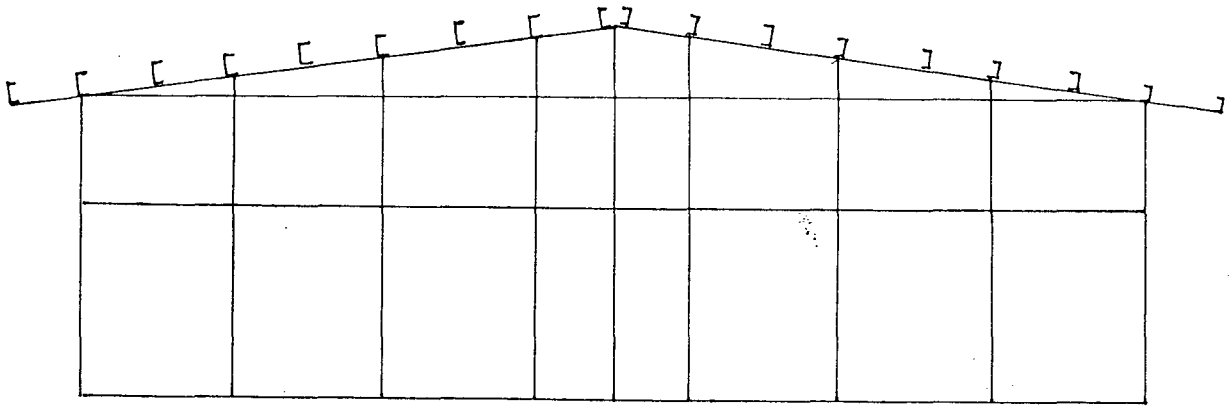
PERHITUNGAN

HORISONTAL dan VERTIKAL GRID



Perhitungan Horisontal Grid Arah Melintang:

Dimensi : WF 150.150.7.10

q = 31,5 kg/m'	Ix = 1640 cm^4
h = 150 mm	Iy = 563 cm^4
b = 150 mm	Wx = 219 cm^3
tb = 7 mm	Wy = 75,1 cm^3
ts = 10 mm	ix = 6,39 cm
As = 40,14 cm^2	iy = 3,75 cm

Pembebanan:

• berat sendiri dinding batako	= 300 kg/m^2 × 2 m
	= 600 kg/m'
• berat sendiri profil WF	= 31,5 kg/m'
	q = 631,5 kg/m'

Kontrol tegangan:

V max = ½ × q × l

= ½ × 631,5 × 3,14

= 991,46 kg

Mmax = 1/8 × 631,5 × $(3,14)^2$

= 778,292 kgm

$$\sigma \text{ max} = \frac{77829,2}{219} = 355,38 < \overline{\sigma}$$

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PERHITUNGAN

Kontrol Lendutan:

$\bar{f} = \frac{3140}{250} = 12{,}56mm$

$f = \frac{5 \times 6{,}315 \times 314}{384 \times 2{,}1.10 \times 1640} = 0{,}232 \text{ cm} \sim 2{,}32 \text{ mm}$

f yang terjadi 2,32 mm < $\bar{f}$ = 12,56 mm...**(OK)**

Perhitungan Vertikal Grid

Dimensi WF 150.150.7.10

q = 31,5 kg/m'	Ix = 1640 cm^4
h = 150 mm	Iy = 563 cm^4
b = 150 mm	Wx = 219 cm^3
tb = 7 mm	Wy = 75,1 cm^3
ts = 10 mm	ix = 6,38 cm
As = 40,14 cm^2	iy = 13,75 cm

Lk = L = 4 m

N = q × L + V horisontal grid

= 31,5 × 4 + 1982,91

= 2108,91 kg

Beban Angin

q angin = 0,9 × 25 × [4×3.14 / 2]

= 141,3 kg/m'

M = 1/8 × 11,3 × 4^2

= 282,6 kgm

= 28260 kgcm

$\sigma max = \frac{N}{A} + \frac{M}{W}$

$= \frac{2108{,}91}{40{,}14} + \frac{282{,}6}{219}$

= 52,54 + 1,29

= 53,83 kg/cm^2 < $\bar{\sigma}$

PERHITUNGAN

$$\frac{h}{tb} = \frac{150}{7} = 21{,}43 < 75$$

$$\frac{L}{h} = \frac{6000}{150} = 40 > 1{,}25\frac{b}{ts} = 1{,}25 \times \frac{150}{10} = 18{,}75$$

maka penampang tidak berubah bentuk

$$C1 = \frac{L.h}{b.ts} = \frac{4000 \times 150}{150 \times 10} = 400$$

$C2 = 0{,}63 \times (E \div \bar{\sigma}) = 0{,}63 \times (2{,}1.10^6 \div 1600)$

$= 826{,}875$

untuk C2 > C1 didapat:

$$\bar{\sigma}\ kip = \bar{\sigma} - \frac{C1 - 250}{C2 - 250} \times 0{,}2.\sigma$$

$$= 1600 - \frac{400 - 250}{826{,}875 - 250} \times 0{,}3 \times 1600$$

1475,19 kg/cm²

Syarat bila statis tertentu dan tidakada pengaku samping:

$0{,}042 \times C2 \times C1 \times [tb/h]^3 > \bar{\sigma}\ kip$

$0{,}042 \times 826{,}875 \times 400 \times [7/150]^3 = 2285{,}87 > \bar{\sigma}\ kip$

Kontrol Interaksi:

$$\theta = \frac{5 \times \bar{\sigma}}{\bar{\sigma}kip\left(8 - 3\frac{Mx1}{Mx2}\right)} = \frac{5 \times 1600}{810(8 - 3 \times 0)}$$

$= 1{,}23$

$\lambda x = Lkx/ix = 400/6{,}39 = 62{,}59 \approx 63 \ldots\ldots \sigma_{EX} = 5222$

$nx = (A.\ \sigma_{EX}) / N$

$= (40{,}14 \times 5222) / 3064{,}46 = 68{,}4$

$$\frac{nx}{nx - 1} = \frac{68{,}4}{68{,}4 - 1} = 1{,}015$$

$\lambda y = Lky/iy = 400/3{,}75 = 106{,}7 \ldots\ldots \omega max = 5{,}3626$

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PERHITUNGAN

$$\omega\frac{N}{A}+\theta\frac{nx}{nx-1}\frac{\beta x.Mx2+Mdx}{Wx}<\bar{\sigma}$$

$$= 5{,}3626\frac{2108{,}91}{40{,}14}+1{,}23\times1{,}034\frac{0+95378}{213}$$

$$= 281{,}76 + 553{,}9$$

$$= 835{,}66\ \text{kg/cm}^2 < \bar{\sigma} = 1600$$

jadi dimensi dapat dipergunakan dan aman

TIE BEAM

3359,42 kg → ——————————— ← 3359,42 kg

WF 150.100.6.9

W = 21,1 kg/m'	Ix = 1020 cm^4
h = 148 mm	Iy = 151 cm^4
b = 100 mm	ix = 26,17 cm
tb = 6 mm	iy = 2,37 cm
ts = 9 mm	Wx = 128 cm^3
A = 26,84 cm^2	Wy = 30,1 cm^3

M akibat berat sendiri $= 1/8 \times 21{,}1 \times 6^2$

$= 94{,}95$ kgm

Lendutan:

$\tilde{f} = l/250 = 600/250 = 2{,}4$ cm

$$f = \frac{5\times q\times Lx}{384\times E\times Ix}$$

$$= \frac{5\times 2110\times(600)}{384\times 2{,}1.10\times 1020} = 0{,}17 \text{ cm}$$

$f < \tilde{f}$

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PERHITUNGAN

Stabilitas terhadap kip:

$$\frac{h}{tb} = \frac{148}{6} = 24{,}67 < 75$$

$$\frac{L}{h} = \frac{6000}{148} = 40{,}54 > 1{,}25\frac{b}{ts} = 1{,}25 \times \frac{100}{9} = 13{,}89$$

maka penampang tidak berubah bentuk

$$C1 = \frac{L.h}{b.ts} = \frac{600 \times 148}{10 \times 0{,}9} = 986{,}7$$

$C2 = 0{,}63 \times (E \div \bar{\sigma}) = 0{,}63 \times (2{,}1.10^6 \div 1600)$

$= 826{,}875$

untuk C1 > C2 didapat:

$$\bar{\sigma}\ \text{kip} = \bar{\sigma} - \frac{C1-250}{C2-250} \times 0{,}3.\sigma$$

$$= 1600 - \frac{400-250}{826{,}875-250} \times 0{,}3 \times 1600$$

$= 1475{,}19\ \text{kg/cm}^2$

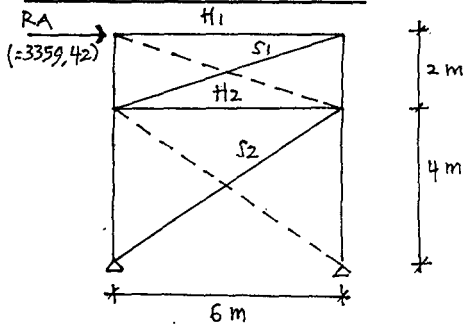
Syarat bila statis tertentu dan tidakada pengaku samping:

$0{,}042 \times C2 \times C1 \times [tb/h]^3 \times \sigma > \bar{\sigma}$ kip

$0{,}042 \times 986{,}7 \times 826{,}875 \times [0{,}6/14{,}8]^3 \times 1600 > \bar{\sigma}$ kip

$3653{,}11 > 1475{,}19\ \text{kg/cm}^2$

IKATAN ANGIN DINDING



n = 1

q = 40,81 kg/m'

L = 2×11,1 = 22,2 m

dk = 6 m

Q = n × q × L × dk

= 1 × 40,81 × 22,2 × 6

= 5435,9 kg

Q' = 0,0025 × Q

= 0,0025 × 5435,9 = 13,59 kg

PERHITUNGAN

$H1 = R_A + Q'$

$= 3358,42 + 13,59 = 3373,01$ kg

• $tg\,\alpha = 2/6 = 0,33$

$\alpha = 18,26^o$

• $S1 = H1/\cos\alpha = 3374,01/\cos 18,26^o = 3352,92$ kg

$A = S1/\sigma = 3352,92/1600 == 2,22$ cm²

$A = ¼\,\pi\,d^2$

$$d = \sqrt{\frac{A \times 4}{\pi}} = \sqrt{\frac{2,22 \times 4}{3,14}} = 1,68 \text{ cm} = 16,8 \text{ mm}$$

• Syarat kelangsingan:

$d\ min \geq 1/500 \times Lv/\cos\alpha$

$\geq 1/500 \times 6000/\cos 18,26^o$

$\geq 12,64$ mm

dipakai besi beton ø 5/8" = 15,87 mm

$$\sigma max = \frac{N}{A} + \frac{Mx}{Wx}$$

$$= \frac{3359,42}{138} + \frac{9495}{26,84}$$

$= 68,8 + 125,16$

$= 193,96$ kg/cm² < $\bar{\sigma}kip = 3653,11$ kg/cm²

Interaksi

$$\theta = \frac{5 \times \bar{\sigma}}{\sigma kip\left(8 - 3\frac{Mx1}{Mx2}\right)} = \frac{5 \times 1600}{3653,11(8 - 3 \times 0)}$$

$= 0,27$

$\lambda x = Lkx/ix = 600/6,17 = 97,24 \rightarrow \omega x = 1,965 \ldots\ldots \bar{\sigma}_{EX} = 2169$ kg/cm²

$nx = (A.\ \sigma_{EX}) / N$

$= (26,84 \times 2169) / 3359,42 = 17,33$

$$\frac{nx}{nx - 1} = \frac{17,33}{17,33 - 1} = 1,06$$

$\lambda y = Lky/iy = 600/2,37 = 253,16 \ldots\ldots \omega y = 7,72$

$M_{Dx} = 9495$

PERHITUNGAN

$$\omega\frac{N}{A}+\theta\frac{nx}{nx-1}\frac{|\beta x.Mx2+Mdx|}{Wx}+\frac{ny}{ny-1}\frac{|\beta y.My2+MDy|}{Wy}<\bar{\sigma}$$

$$= 7{,}72\frac{3359{,}42}{26{,}84}+0{,}27\times 1{,}06\frac{9495}{138}+0$$

$$= 985{,}96 \text{ kg/cm}^2 < \bar{\sigma} = 1600 \text{ kg/cm}^2$$

RAFTER

Direncanakan rafter dengan profil WF 300.200.9.14

q = 65,4 kg/m'	Ix = 13300 cm^4
h = 298 mm	Iy = 1900 cm^4
b = 201 mm	ix = 12,6 cm
tb = 9 mm	iy = 4,77 cm
ts = 4 mm	Wx = 893 cm^3
A = 83,36 cm^2	Wy = 189 cm^3

Kontrol Lentur:

Beban tetap

$$\sigma max = \frac{N}{A}+\frac{M\,max}{Wx}$$

$$= \frac{914580}{893}+\frac{1855{,}5}{83{,}36}$$

$$= 1046{,}42 \text{ kg/cm}^2 < \bar{\sigma} = 1600 \text{ kg/cm}^2$$

Beban sementara

$$\sigma max = \frac{N}{A}+\frac{M\,max}{Wx}$$

$$= \frac{1033500}{893}+\frac{2034{,}4}{83{,}36}$$

$$= 1181{,}74 \text{ kg/cm}^2 < 1{,}3\times\bar{\sigma} = 2080 \text{ kg/cm}^2$$

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

Kontrol Geser:

Beban tetap

$$\tau max = \frac{D\,max}{Aprofil} = \frac{2716,6}{83,36} = 32,59\ kg/cm^2 < \bar{\tau} = 928\ kg/cm^2$$

Beban sementara

$$\tau\ max = \frac{D\,max}{Aprofil} = \frac{2034,4}{83,36} = 24,4\ kg/cm^2 < \bar{\tau} = 928\ kg/cm^2$$

Kontrol KIP:

$$\frac{h}{b} = \frac{298}{9} = 33,11 < 75$$

$$\frac{L}{h} = \frac{1580}{298} = 5,3 < 1,25\times(201\div4) = 62,81$$

Jadi termasuk penampang berubah bentuk

Tegangan kip yang terjadi:

A' = A sayap + 1/6 A sayap

= 201,4 + 1/6 × 9 (298-2,4)

= 1239 mm² ~ 12,39 cm²

$$\text{iy tepi} = \sqrt{\frac{1/2.Iy}{A'}} = \sqrt{\frac{1/2\times1900}{83,36}} = 3,38\,cm$$

λy = Lky ÷ iy tepi = 158 ÷ 3,38 = 46,7

ωy = 1,2023

$\bar{\sigma}kip$ = 1600/1,2023 = 1330,78 kg/cm²

$$\sigma max = \frac{N}{A} + \frac{M\,max}{Wx}$$

$$= \frac{1855,5}{83,36} + \frac{914580}{893}$$

= 1046,42 kg/cm² < $\bar{\sigma}$kip = 1330,78 kg/cm²...**(OK)**

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

Kontrol Lendutan:

$\bar{f} = L/90 = 158/90 = 1{,}76$ cm

Kontrol Tegangan:

Kombinasi tegangan (ideal)

$\sigma i = \sqrt{\sigma^2 + 3\tau^2} < \sigma$

$= \sqrt{1046{,}42^2 + 3 \times 32{,}59^2}$

$= 1047{,}94 \text{ kg/cm}^2 < \bar{\sigma} = 1600 \text{ kg/cm}^2$

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

KOLOM

Dimensi kolom WF 300.200.9.14

Faktor Kip

L = Lky = 2000 mm

$$\frac{h}{tb} = \frac{298}{9} = 33{,}11 < 75$$

$$\frac{L}{h} = \frac{2000}{298} 6{,}71$$

1,25×(b/ts) = 1,25(201/14) = 17,95 > L/h = 6,71 →maka kolom berubah bentuk

Tegangan kip yang terjadi

A' = A sayap + 1/6 A badan

= 201 + 14 + 1/6×9(298-2,14)

= 3219 mm² = 32,19 cm²

$i_{A'}$ = Lk/ $i_{A'}$

= 2000/54,3 = 36,83 → $\omega_{A'}$ = 1,1176

$\bar{\sigma}kip = \sigma/\omega_{A'}$

= 1600/1,1176 = 1431,64 kg/cm²

$$\sigma max = \frac{8828300}{893} + \frac{7901{,}92}{83{,}36} = 1038{,}4 \text{ kg/cm}^2 < \bar{\sigma}kip = 1431{,}64 \text{ kg/cm}^2$$

Mx1 = 1471,4 × 2 = 2942,8 kgm

Mx2 = 8828,3 kgm

$$\theta = \frac{5 \times \bar{\sigma}}{\sigma kip\left(8 - 3\frac{Mx1}{Mx2}\right)} = \frac{5 \times 1600}{1056\left(8 - 3 \times \frac{2942{,}8}{8828{,}3}\right)}$$

= 1,082

Kontrol Lipat

• sayap tekan

$$\frac{b}{ts} = \frac{201}{14} = 14{,}36$$

$$10\sqrt{\frac{\sigma r}{\sigma d}} = 10\sqrt{\frac{3267}{1047{,}35}} = 17{,}66$$

17,66 > 14,36 ...**(OK)**

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

- badan

h' = 298 - 2×14 = 270 mm

$\frac{h'}{tb} = \frac{270}{9} = 30 < 60 \rightarrow$ tidak perlu diperiksa lipat

N total = $N_{MICROFEAP} + N_{TIE\ BEAM} + N_{HORISONTAL\ GRID}$

= 3911 + 3359,42 + 631,5

= 7901,92 KG

N max = 8828,3 kgm = 882830 kgcm

Faktor β* portal bergoyang → β* = 0,85

G_A = sendi = 10

$G_B = \frac{Ic/n}{Ib/2m} = \frac{13300/6000}{13300/2 \times 11100} = \frac{2,22}{0,6} = 3,7$

Dari G_A = 10, dan GB = 3,7 didapat k = 2,5

Lkx = k×Lx

= 2,5 × 600

= 1500

$\lambda x = \frac{Lkx}{ix} = \frac{1500}{12,6} = 119 \rightarrow \sigma_{EX}$ = 1464 kg/cm²

nx = (A. σ_{EX}) / N

= (83,36 × 1464) / 7509,52 = 16,25

$\frac{nx}{nx-1} = \frac{16,25}{16,25-1} = 1,066$

λy = Lky/iy = 201/4,77 = 42,14.....ωmax = 2,733

λy < λx = 119

$$\omega \max \frac{N}{A} + 0,85.\theta \frac{nx}{nx-1} \frac{|\beta x.Mx2 + Mdx|}{Wx} + \frac{ny}{ny-1} \frac{|\beta y.My2 + MDy|}{Wy} < \bar{\sigma}$$

$$= 2,733 \frac{7901,92}{83,36} + 0,85 \times 1,082 \times 1,066 \frac{9495}{893} + 0$$

= 269,5 kg/cm² < $\bar{\sigma}$ = 1600 kg/cm²

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

$$\frac{N}{A} + \theta \frac{Mx}{Wx} \leq \bar{\sigma}$$

$$\frac{7901,92}{83,36} + 1,082 \times \frac{8828,3}{893} \leq \bar{\sigma}$$

$94,79 + 10,7 \leq \bar{\sigma}$

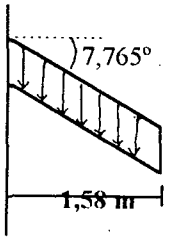
$105,49 \text{ kg.cm}^2 \leq \bar{\sigma} = 1600 \text{ kg/cm}^2$

$\therefore$ dimensi kolom dapat dipakai

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

KANTILEVER



Pembebanan:

- Beban terpusat
  - beban gording = 2×q×L = 2×40,81×6 = 489,72 kg
  - beban talang = 0,25×0,3×1000×6 = 450 kg
  - beban orang = = 100 kg

  Total = 1039,72 kg
- Beban terbagi rata
  - berat sendiri kantilever = 40,2 /cos 7,765° = 40,572 kg/m'
  - berat alat penyambung = 10%×40,572 = 4,0572 kg/m'

  Total = 44,63 kg/m'

Mmax = ½ ×q × L½ + P × L

= ½ × 44,63 × (3,14)² + 1039,72 × 3,14

= 3704,75 kgm

Dmax = q × L + P

= 44,63 × 3,14 + 1039,72

= 1179,86 kg

M = 3704,75 kgm

D = 1179,86 cos 7,765° = 1169,04 kg

N = 1179,86 sin 7,765° = 159,41 kg

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

Kontrol KIP:

jarak gording = 1,58 m

$$\frac{h}{b} = \frac{600}{8} = 75 = 75$$

$$\frac{L}{h} = \frac{1580}{600} = 2{,}633 < 1{,}25\times(175\div 11) = 19{,}89$$

Jadi termasuk penampang berubah bentuk

Tegangan kip yang terjadi:

A' = b × ts + 1/6 × tb (h - 2ts)

= 175×11 + 1/6 × 7,5 (175-2×11)

= 2116,25 mm² ~ 21,2 cm²

$$\text{iy tepi} = \sqrt{\frac{1/2.Iy}{A'}} = \sqrt{\frac{492}{21{,}12}} = 4{,}82 \text{ cm}$$

λy = Lky ÷ iy tepi = 158 ÷ 4,82 = 32,78

ω = 1,0685

σkip = 1600/1,0685 = 1472,62 kg/cm²

$$\sigma\text{max} = \frac{N}{A} + \frac{M\,\text{max}}{Wx}$$

$$= \frac{159{,}41}{51{,}21} + \frac{370475}{330}$$

= 1125,76 kg/cm² < $\bar{\sigma}$kip = 1330,78 kg/cm² ...**(OK)**

Kontrol Lipat

- sayap tekan

$$\frac{b}{ts} = \frac{87{,}5}{11} = 7{,}95$$

$$10\sqrt{\frac{\sigma r}{\sigma d}} = 10\sqrt{\frac{3267}{1047{,}35}} = 17{,}66$$

17,66 > 7,95 ...**(OK)**

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

- badan

h' = 175 - 2×11 = 153 mm

$\frac{h'}{tb} = \frac{153}{7,5} = 20,4 < 60 \rightarrow$ tidak perlu diperiksa terhadap bahaya lipat ,sesuai PPBBI hal 47

$$\theta = \frac{5 \times \sigma}{\sigma kip\left(8 - 3\frac{Mx1}{Mx2}\right)} = \frac{5 \times 1600}{1056(8 - 3 \times 0)}$$

$= 0,68$

$$\frac{N}{A} + \theta \frac{Mx}{Wx} \leq \bar{\sigma}$$

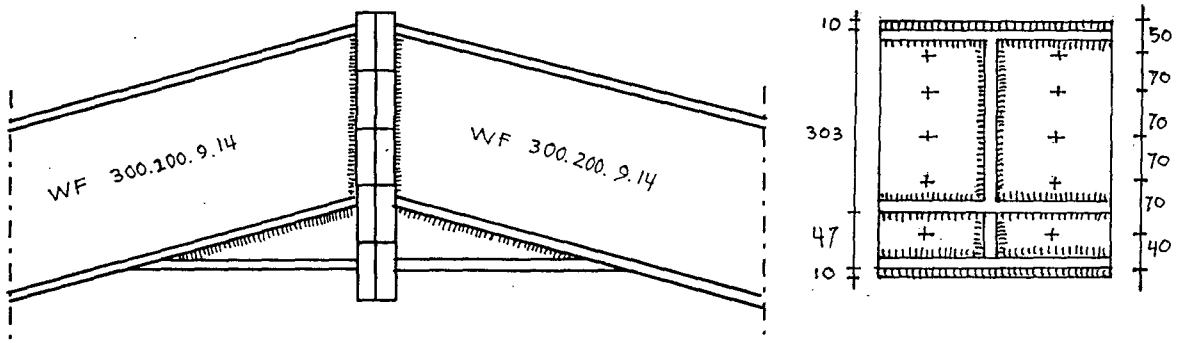
$$\frac{159,41}{51,21} + 0,68 \times \frac{370475}{330} = 766,52 \leq \bar{\sigma} = 1600 \text{ kg/cm}^2 \ldots \textbf{(OK)}$$

∴ dimensi kantilever dapat dipakai

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

SAMBUNGAN RAFTER-RAFTER



Beban yang bekerja:

D = 203,01 kg

N = 1458,5 kg

M = 5789 kgm

ø baut = 1¼" = 31,75 mm

ø teras (d_1) = 27,1 mm

A teras = 5,77 cm²

Perhitungan sambungan:

1. Bout

$$Tmax = \frac{M \times h\,max}{2 \times \Sigma h^2}$$

$$= \frac{578900 \times 28}{2(7^2+14^2+21^2+28^2)} = 5513{,}33 \text{ kg}$$

σtarik = Tmax/A teras = 5513,33 / 5,77 = 955,52 kg/cm² < 0,7σ = 1120 kg/cm² **(OK)**

$$\tau = \frac{D}{n.A} = \frac{203{,}01}{10 \times 5{,}77} = 3{,}52 \text{ kg/cm}^2 < 0{,}6\sigma = 960 \text{ kg/cm}^2 \textbf{ (OK)}$$

$$\sigma i = \sqrt{\sigma^2 + 3\tau^2} = \sqrt{955{,}52^2 + 3 \times (3{,}52^2)}$$

$$= 955{,}54 \text{ kg/cm}^2 < \sigma = 1600 \text{ kg/cm}^2 \textbf{ (OK)}$$

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

2. Las

a. Sayap

- a max = ½ × 14 × √2 = 9,9 mm
- Ln = L brutto - 3.a

  = (200 - 3.9,9) + (200 - 9 -2.3.9,9) = 301,9 mm
- Panjang las maksimum = 200 - 3.9,9 = 170,3 mm
- Lmin = 40 mm
- Lmax = 40.a = 40.9,9 = 396 mm

Akibat momen:

$$P = \frac{M}{h} = \frac{578900}{35} = 16540\,\text{kg}$$

$$\sigma t = \tau\perp = \frac{0{,}353 \times P}{a \times Ln} = \frac{0{,}353 \times 16540}{0{,}99 \times 30{,}2} = 195{,}3\ \text{kg/cm}^2$$

$$\sigma i = \sqrt{\sigma t^2 + 3\tau\perp^2} = \sqrt{195{,}3^2 + 3 \times (195{,}3^2)}$$

$$= 390{,}6\ \text{kg/cm}^2 < \bar{\sigma} = 1600\ \text{kg/cm}^2 \quad \textbf{(OK)}$$

b. Badan

- a max = ½ × 9√2 = 6,36 mm ≈ 6,4 mm
- Ln = Lbrutto - 3.a

  = (350 - 3.14 - 2.3.64) = 269,6 mm
- Lnmin = 40 mm
- Lnmax = 40.a = 40.6,4 = 256 mm

Akibat D (lintang)

$$\tau = \sqrt{\tau_{//}^2 + \tau_{\perp}^2}$$

$$= \sqrt{12{,}39^2 + 62{,}89^2} = 64{,}1\ \text{kg/cm}^2 < \bar{\tau} = 0{,}58.\bar{\sigma} = 928\ \text{kg/cm}^2 \quad \textbf{(OK)}$$

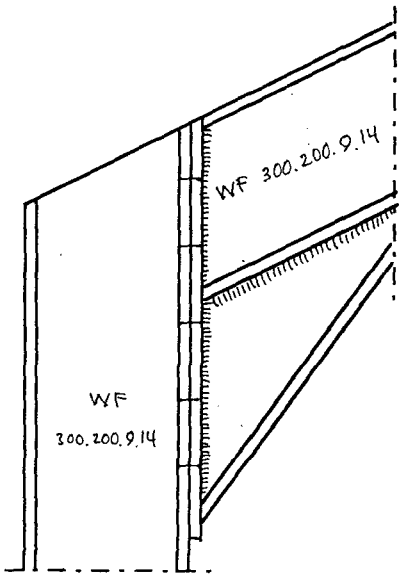
$$\sigma i = \sqrt{\sigma^2 + 3\tau^2} = \sqrt{62{,}89^2 + 3 \times (64{,}1^2)}$$

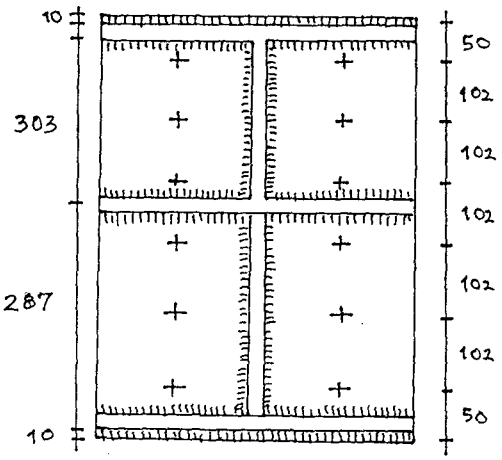
$$= 127{,}6\ \text{kg/cm}^2 < \bar{\sigma} = 1600\ \text{kg/cm}^2 \quad \textbf{(OK)}$$

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

SAMBUNGAN KOLOM - RAFTER





Beban yang bekerja : M = 9147,2 kgm

D = 2716,6 kg

N = 3911 kg

ø baut 1¼" = 31,75 mm

ø teras (d1) = 27,1 mm

A teras = 5,77 cm²

Perhitungan sambungan:

1. Bout

$$Tmax = \frac{M \times h\,max}{2 \times \Sigma h^2}$$

$$= \frac{314720 \times 51}{2(10,2^2 + 20,4^2 + 30,6^2 + 40,8^2 + 50^2)} = 4149,53\,kg$$

$\sigma tarik$ = Tmax/A teras = 4149,53 / 5,77 = 719,16 kg/cm² < 0,7$\bar{\sigma}$ = 1120 kg/cm² **(OK)**

$$\tau = \frac{D}{n.A} = \frac{2716,6}{12 \times 5,77} = 39,23\,kg/cm^2 < 0,6\bar{\sigma} = 960\ kg/cm^2$$ **(OK)**

$$\sigma i = \sqrt{\sigma^2 + 3\tau^2} = \sqrt{719,16^2 + 3 \times (39,23^2)}$$

$$= 722,36\ kg/cm^2 < \bar{\sigma} = 1600\ kg/cm^2$$ **(OK)**

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

2. Las

a. Sayap

- a max = ½ × 14 × √2 = 9,9 mm
- Ln = L brutto - 3.a

  = (200 - 3.9,9) + (200 - 9 -2.3.9,9) = 301,9 mm
- Panjang las maksimum = 200 - 3.9,9 = 170,3 mm
- Lmin = 40 mm
- Lmax = 40.a = 40.9,9 = 396 mm

Akibat momen:

$$P = \frac{M}{h} = \frac{914720}{59} = 15503{,}73 \text{ kg}$$

$$\sigma t = \tau\perp = \frac{0{,}353 \times P}{a \times Ln} = \frac{0{,}353 \times 15503{,}73}{0{,}99 \times 30{,}19} = 183{,}11 \text{ kg/cm}^2 < \bar{\sigma} = 1600 \text{ kg/cm}^2 \textbf{ (OK)}$$

$$\sigma i = \sqrt{\sigma t^2 + 3\tau\perp^2} = \sqrt{183{,}11^2 + 3 \times (183{,}11^2)}$$

$$= 366{,}22 \text{ kg/cm}^2 < \bar{\sigma} = 1600 \text{ kg/cm}^2 \textbf{ (OK)}$$

b. Badan

- a max = ½ × 9√2 = 6,36 mm ≈ 6,4 mm
- Ln = Lbrutto - 3.a

  = (350 - 3.14 - 2.3.64) = 269,6 mm
- Lnmin = 40 mm
- Lnmax = 40.a = 40.6,4 = 256 mm

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

Akibat D (lintang)

$$\tau_{//} = \frac{D}{a.\,Ln} = \frac{2716,6}{0,64 \times 25,6} = 165,81 \text{ kg/cm}^2$$

Akibat N

$$\sigma t = \tau\perp = \frac{0,707 \times N}{a \times Ln} = \frac{0,707 \times 3911}{0,64 \times 25,6} = 168,77 \text{ kg/cm}^2$$

Kontrol

$\tau = \sqrt{\tau_{//}^2 + \tau_{\perp}^2}$

$= \sqrt{165,81^2 + 168,77^2} = 236,59 \text{ kg/cm}^2 < \tau = 0,58.\sigma = 928 \text{ kg/cm}^2$ **(OK)**

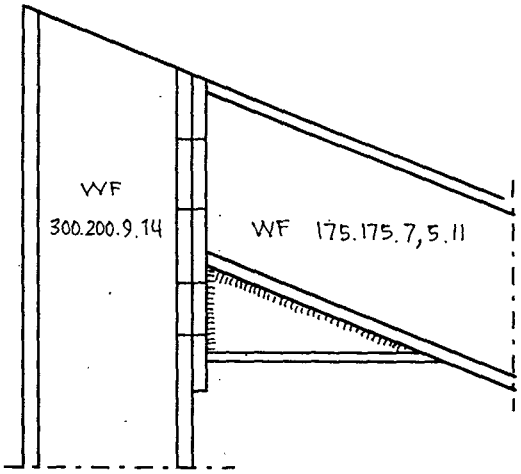
$\sigma i = \sqrt{\sigma^2 + 3\tau^2} = \sqrt{168,77^2 + 3 \times (168,77^2)}$

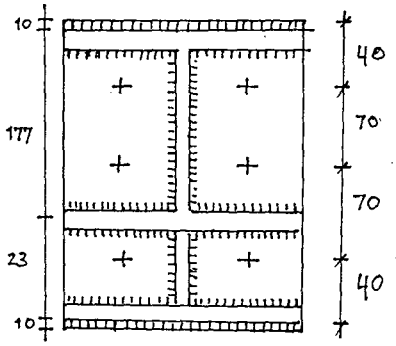
$= 337,54 \text{ kg/cm}^2 < \sigma = 1600 \text{ kg/cm}^2$ **(OK)**

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

SAMBUNGAN KANTILEVER - KOLOM





Beban yang bekerja : M = 317,52 kgm
D = 571,07 kg

ø baut ¾" = 19,05 mm
ø teras (d1) = 15,08 mm
A teras = 1,96 cm²

Perhitungan sambungan:

1. Bout

$$Tmax = \frac{M \times h\,max}{2 \times \Sigma h^2}$$

$$= \frac{317520 \times 14}{2(7^2+14^2)} = 907{,}2 \text{ kg}$$

σtarik = Tmax/A teras = 907,2 / 1,96 = 462,86 kg/cm² < 0,7$\bar{\sigma}$ = 1120 kg/cm² **(OK)**

$$\tau = \frac{D}{n.A} = \frac{571{,}07}{6 \times 1{,}96} = 48{,}56 \text{ kg/cm}^2 < 0{,}6\bar{\sigma} = 960 \text{ kg/cm}^2 \textbf{ (OK)}$$

$$\sigma i = \sqrt{\sigma^2 + 3\tau^2} = \sqrt{463{,}86^2 + 3 \times (48{,}56^2)}$$

$$= 470{,}44 \text{ kg/cm}^2 < \bar{\sigma} = 1600 \text{ kg/cm}^2 \textbf{ (OK)}$$

PERHITUNGAN

2. Las

a. Sayap

- a max = ½ × 11 × √2 = 7,78 mm ≈ 7 mm
- Ln = L brutto - 3.a

  = (175 - 3.7) + (175 - 7,5 -2.3.7) = 279,5 mm
- Panjang las maksimum = 175 - 3.7 = 154 mm
- Lmin = 40 mm
- Lmax = 40.a = 40.7 = 280 mm

Akibat momen:

$$P = \frac{M}{h} = \frac{31752}{20} = 1587{,}6 \text{ kg}$$

$$\sigma t = \tau\perp = \frac{0{,}353 \times P}{a \times Ln} = \frac{0{,}353 \times 1587{,}6}{0{,}7 \times 279{,}5} = 286 \text{ kg/cm}^2 < \bar{\sigma} = 1600 \text{ kg/cm}^2 \textbf{ (OK)}$$

$$\sigma i = \sqrt{\sigma t^2 + 3\tau\perp^2} = \sqrt{286^2 + 3 \times (286^2)}$$

$$= 572 \text{ kg/cm}^2 < \bar{\sigma} = 1600 \text{ kg/cm}^2 \textbf{ (OK)}$$

b. Badan

- a max = ½ × 7,5√2 = 5,3 mm
- Ln = Lbrutto - 3.a

  = (200 - 3.11 - 2.3.5,3) = 135,2 mm
- Lnmin = 40 mm
- Lnmax = 40.a = 40.5,3 = 212 mm

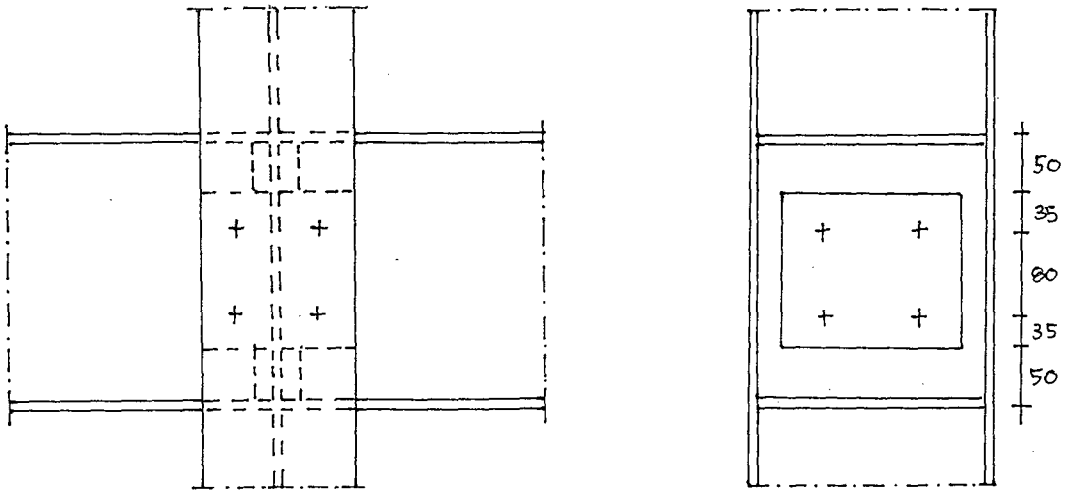
Akibat D (lintang)

$$\tau_{//} = \frac{D}{a.Ln} = \frac{571{,}07}{0{,}53 \times 135{,}2} = 8 \text{ kg/cm}^2$$

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

SAMBUNGAN GRID VERTIKAL dan GRID GORISONTAL



• ⌋⌊ 50.50.6

Baut : ø 3/8" = 9,52 mm

ø teras = 7,49 mm

• Beban yang bekerja

V = ½ (berat dinding + berat profil) × L

= ½ (2×300 + 31,5) × 3,14 = 991,5 kg

R = koef. angin tekanan tiup × Luas bidang tekan

= 0,9 × 25 × ½ × 6 × 3,14 = 211,95 kg

• Perhitungan sambungan antara ⌋⌊ 50.50.6 dengan Horisontal Grid

• sambungan irisan kembar :

$P = 2 \times \frac{1}{2}\pi \times d^2 \times \tau = 2 \times \frac{1}{2} \times 3{,}14 \times (0{,}952)^2 \times 0{,}6 \times 1600 = 2732$ kg

$P = \delta \times d \times \sigma_{tu} = 0{,}6 \times 0{,}952 \times 1{,}5 \times 1600 = 1371$ kg

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

• kontrol tegangan baut

$$\sigma tarik = \frac{211{,}95}{2\left(\frac{1}{4}\times\pi\times d^2\right)} = \frac{211{,}95}{2\left(\frac{1}{4}\times 3{,}14\times 0{,}952^2\right)} = 148{,}96 \text{ kg/cm}^2 < 0{,}7\bar{\sigma} = 1120 \text{ kg/cm}^2 \textbf{ (OK)}$$

$$\tau = \frac{V}{2\left(\frac{1}{4}\times\pi\times d^2\right)} = \frac{991{,}5}{2\left(\frac{1}{4}\times 3{,}14\times 0{,}952^2\right)} = 348{,}41 \text{ kg/cm}^2 < 0{,}58\bar{\sigma} = 928 \text{ kg/cm}^2 \textbf{ (OK)}$$

$$\sigma i = \sqrt{\sigma^2 + 3\tau^2} = \sqrt{148{,}96^2 + 3\times(348{,}41^2)}$$

$$= 621{,}58 \text{ kg/cm}^2 < \bar{\sigma} = 1600 \text{ kg/cm}^2 \textbf{ (OK)}$$

• kontrol sambungan antara ⌋⌊ 50.50.6 dengan Vertikal Grid

• sambungan irisan kembar ditinjau dari 1 sisi

$P = ½\times(½\pi\times d^2\times\tau) = ½\times(½\times 3{,}14\times(0{,}952)^2\times 0{,}6\times 1600) = 683{,}33$ kg

$P = ½\times(\delta\times d\times\sigma_{tu}) = ½\times 0{,}6\times 0{,}952\times 1{,}5\times 1600 = 652{,}5358$ kg

P diambil = 652,5358 kg ≈ 652,54 kg

Jumlah baut yang diperlukan:

n = V/P = 991,5/652,54 = 1,52 ≈ 2 buah baut

P = V/n = 991,5/2 = 495,75 kg

• Geser

$$\tau_\perp = \frac{P}{A} = \frac{495{,}75}{\frac{1}{4}\times\pi\times 0{,}952^2} = 697 \text{ kg/cm}^2$$

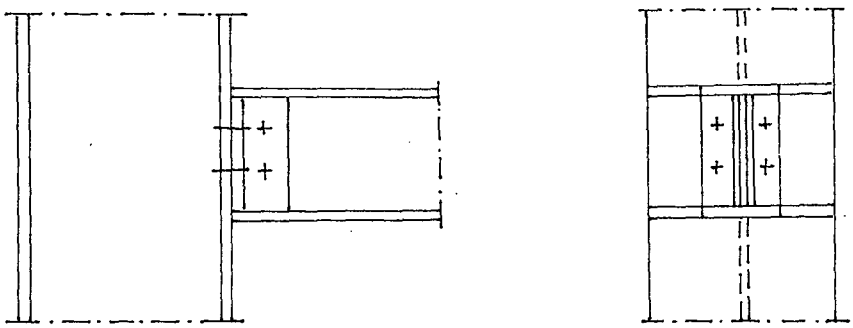
$$\tau_{//} = \frac{R}{n.A} = \frac{211{,}95}{2\times\frac{1}{4}\times\pi\times 0{,}952^2} = 149 \text{ kg/cm}^2$$

$\tau = \sqrt{(697^2) + (149^2)} = 712{,}75$ kg/cm² < $\tau = 0{,}6\,\bar{\sigma} = 960$ kg/cm² **(OK)**

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

SAMBUNGAN KOLOM dan HORISONTAL GRID



Baut : ø 3/8" = 9,52 mm

ø teras = 7,49 mm

Beban yang bekerja : V = 991,5 kg

R = 211,95 kg

• Sambungan

• kolom dengan plat siku

sambungan irisan tunggal

1. $P = \frac{1}{4}\pi \times d^2 \times \tau = \frac{1}{4} \times 3,14 \times (0,952)^2 \times 0,6 \times 1600 = 683$ kg

2. $P = \delta \times d \times \sigma_{tu} = 0,6 \times 0,952 \times 1,5 \times 1600 = 1370,88$ kg

$P = V/n = 991,5/c = 495,75$ kg $< \bar{P} = 689$ kg **(OK)**

Cek tegangan baut

• Geser

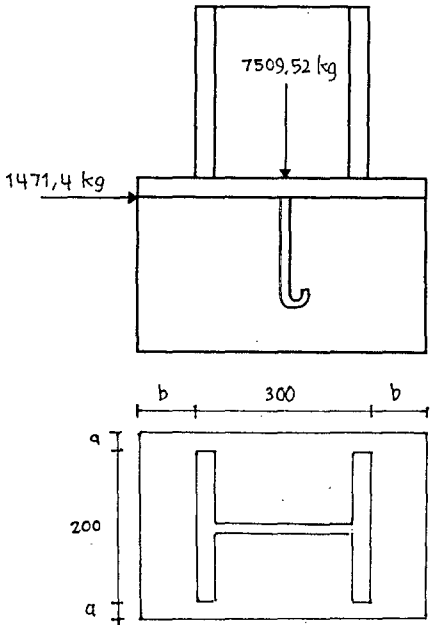
$$\tau_{\perp} = \frac{P}{A} = \frac{495,75}{\frac{1}{4} \times \pi \times 0,952^2} = 697 \text{ kg/cm}^2$$

$$\tau_{//} = \frac{R}{n.A} = \frac{211,95}{2 \times \frac{1}{4} \times \pi \times 0,952^2} = 149 \text{ kg/cm}^2$$

$\tau = \sqrt{(697^2) + (149^2)} = 712,75$ kg/cm² $< \tau = 0,6\ \bar{\sigma} = 960$ kg/cm² **(OK)**

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN



Berat profil = 65,4 kg/cm'

Berat sendiri kolom = 65,4 ×6 = 392,4 kg

N total = 392,4 + 7509,52 = 7901,92 kg

$q = 7901,92 / (35\times25) = 9,031$ kg/cm² < σd = 25 kg/cm²

$M = ½\times q\times B\times b^2$

$= ½\times9,031\times25\times(2,5^2) = 705,55$ kgcm

$W = 1/6\times S^2\times1$

$\sigma = M/W$

$1600 = 705,55 / (1/6.S^2.1)$

S = 1,63 cm → dibuat 18 mm

Angker

H = 1471,4 kg

$$\tau = \frac{H}{A} = \frac{1471,4}{1/4\times\pi\times d^2}$$

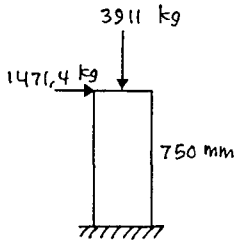
$$0,6\times1600 = \frac{H}{A} = \frac{1471,4}{1/4\times\pi\times d^2} \rightarrow d = 1,4 \text{ cm}$$

∴ Angker yang dipakai ø5/8" = 15,87 mm

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

KOLOM PENDEK



Pu = 1,4.P

= 1,4 (3911+0,25×0,35×0,75×2400) = 5696 kg

= 56,96 kN

Mu = 1,4 (1471,4×0,75)

= 1544,97 kgm = 15,45 kNm

$$\frac{Pu}{\phi.Agr.0{,}85.fc'} = \frac{56960}{0{,}65\times 350\times 250\times 0{,}85\times 25} = 0{,}047 < 0{,}1$$

$$= \frac{56960}{0{,}8\times 350\times 250\times 0{,}85\times 25} = 0{,}038$$

et = Mu/Pu = 15,45 / 56,96 = 0,27 = 270 mm

et/h = 250/600 = 0,42

$$\frac{Pu}{\phi.Agr.0{,}85.fc'}\times\frac{et}{h} = 0{,}038\times 0{,}42 = 0{,}016$$

d' = 70 + 8 + ½.20 = 88 mm

d = 600 - 88 = 512 mm

D'/d = 0,17

didapat r = 0,008 ; $\beta = 1 \rightarrow \rho = 0{,}008$

As tot = 0,008 × 250 × 350 = 700 mm²

As ki = As kn = 350 mm² (2ø16)

Geser

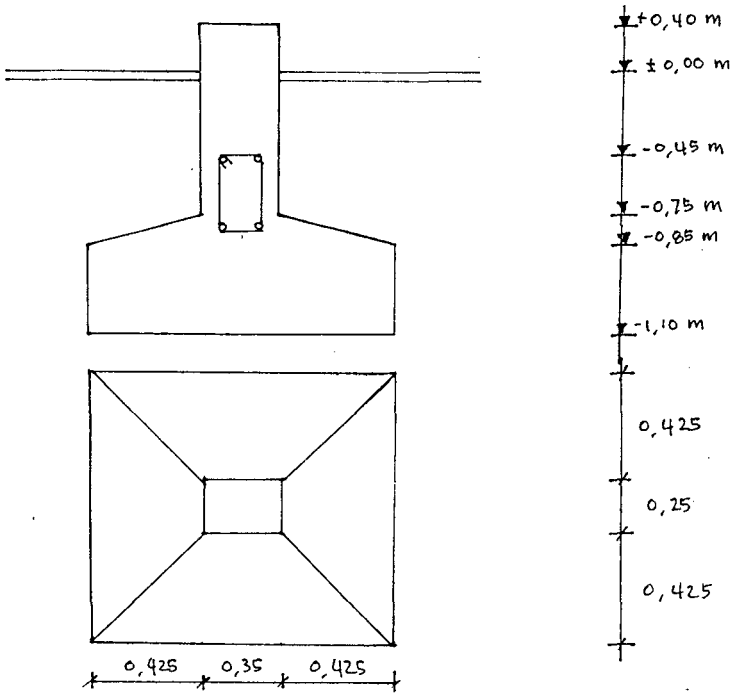
$$\text{ø Vc} = 0{,}6\left[2\times\left(1+\frac{5696}{14(250\times 350)}\right)\right]\times\left(\frac{\sqrt{25}}{6}\right)\times 250\times 512 = 128595{,}17N$$

Vumax = 1471,4 N < ø Vc →sengkang praktis ø8 - 250

FAKULTAS TEKNIK SIPIL UNIVERSITAS KRISTEN PETRA	TUGAS KONSTRUKSI BAJA	DIBUAT OLEH :
	BAGIAN STRUKTUR : NO. GAMBAR:	NRP :

PERHITUNGAN

PONDASI



Pembebanan

• Berat Kolom	= 3911 kg	= 3911 kg
• Berat kolom pendek	= 0,25×0,35×0,75×2400	= 157,5 kg
• Berat dinding batako	= 2×1,1×300	= 660 kg
• Berat sloof	= 0,2×0,3×1,1×2400	= 144 kg
• Berat sendiri pondasi	= 0,21×2400	= 504 kg
• Berat tanah urug	= (1,1×1,2×1,1) - (0,21×0,25×0,35×0,75)× 1800	= 777 kg
	$\sum Q$	= 6153,5 kg

M = 1471,4×1,1 = 1618,54 kgm

q all = 60/60×[1,1 + 1,1/1,2]×1,1 = 2,11 kg/cm²

$$\sigma = \frac{1618,54}{110 \times 120} + \frac{1471,4 \times 110}{1/6 \times 110 \times 120} = 0,123 + 0,613 = 0,736 < 2,11 \text{ kg/cm}^2 \quad \textbf{(OK)}$$

Penulangan Plat Pondasi

q = (3911+0,25×0,35×0,75×2400) ÷ (1,1×1,2) = 3082,2 kg/m²

Wu = 1,4×3082,2 = 4315,08 kg/m²

Mu = ½×4315,08×(0,425²) = 389,71 kgm = 3,8971 kNm

d' = 70 + 8 + ½.16 = 86 mm

d = 250 - 86 = 164 mm

$$\frac{Mu}{b.d} = \frac{3,8971}{1 \times 0,164} = 23,76 \rightarrow \rho < \rho min = 0,0058$$

As = ρmin.b.d

= 0,0058×100×16,4 = 951,2 mm² (ø16 - 200)

Sloof

Pembebanan:

• Berat Kolom =	=	3911 kg
• Berat kolom pendek = 0,25×0,35×0,75×2400	=	157,5 kg
q total	=	4068,5 kg

Jarak antara Vertikal Grid = 3,14 m

q = 4068,5 ÷ 3,14 = 1295,7 kg/m'

Mlap = 1/8 ×1295,7×3,14 = 1596,89 kgm

Mtump = 1/24×1295,7×3,14 = 532,3 kgm

STRUCTURE DATA

COORDINATE DATA (M) **BOUNDARY DATA**

NODE	1-COOR	2-COOR	1-B	2-B	3-B
1	0.00	0.00	L	L	F
2	-1.57	5.79			
3	0.00	6.00			
4	11.00	7.50			
5	22.00	6.00			
6	23.57	5.79			
7	22.00	0.00	L	L	F

ELEMENT DATA

LEM	1-NODE	2-NODE	HINGE	MATERIAL
1	1	3		1
2	2	3		2
3	3	4		1
4	4	5		1
5	5	6		2
6	5	7		1

MATERIAL DATA

ATE	E-MODULUS (KG/M^2)	AXIAL-AREA (M^2)	INERTIA (M^4)
1	2.100D+10	8.336D-03	1.330D-04
2	2.100D+10	5.121D-03	2.880D-05

OAD CASE #1 : BEBAN RAFTER

UNIFORM LOAD DATA

LEM	1-UNIFORM (KG/M)	2-UNIFORM (KG/M)
2	0.000D+00	-4.057D+01
3	0.000D+00	-6.600D+01
4	0.000D+00	-6.600D+01
5	0.000D+00	-4.057D+01

OAD CASE #2 : BEBAN MATI

*CONCENTRATED LOAD DATA**

LEM	1-POINT L. (KG)	2-POINT L. (KG)	DISTANCE (M)

LOAD CASE #2 : BEBAN MATI
CONCENTRATED LOAD DATA

ELEM	1-POINT L. (KG)	2-POINT L. (KG)	DISTANCE (M)
2	0.000D+00	-1.708D+02	0.000D+00
2	0.000D+00	-1.708D+02	1.580D+00
3	0.000D+00	-3.416D+02	1.580D+00
3	0.000D+00	-3.416D+02	3.160D+00
3	0.000D+00	-3.416D+02	4.740D+00
3	0.000D+00	-3.416D+02	6.320D+00
3	0.000D+00	-3.416D+02	7.900D+00
3	0.000D+00	-3.416D+02	9.480D+00
3	0.000D+00	-1.708D+02	1.106D+01
4	0.000D+00	-3.416D+02	1.580D+00
4	0.000D+00	-1.708D+02	0.000D+00
4	0.000D+00	-3.416D+02	3.160D+00
4	0.000D+00	-3.416D+02	4.740D+00
4	0.000D+00	-3.416D+02	6.320D+00
4	0.000D+00	-3.416D+02	7.900D+00
4	0.000D+00	-3.416D+02	9.480D+00
5	0.000D+00	-1.708D+02	1.580D+00
5	0.000D+00	-3.416D+02	0.000D+00

LOAD CASE #3 : BEBAN KOLOM
CONCENTRATED LOAD DATA

ELEM	1-POINT L. (KG)	2-POINT L. (KG)	DISTANCE (M)
1	0.000D+00	-3.924D+02	0.000D+00
6	0.000D+00	-3.924D+02	6.000D+00

LOAD CASE #4 : BEBAN ANGIN
UNIFORM LOAD DATA

ELEM	1-UNIFORM (KG/M)	2-UNIFORM (KG/M)
1	1.350D+02	0.000D+00
2	-9.580D+00	1.306D+00
3	-9.580D+00	1.306D+00
4	9.908D+00	1.350D+00
5	9.908D+00	1.350D+00
6	1.000D+01	0.000D+00

****
* *
* COMBINATION *
* *
****

STRESS COMBINATION <2D-FRAME SYSTEM>
LOAD FACTOR : 1/1/1/0

ELEM	MA	HINGE	SECTION (M)	AXIAL F. (KG)	SHEAR (KG)	MOMENT (KG-M)
1	1		0.00	-3.7486D+03	-1.4714D+03	0.0000D+00
			1.50	-3.3562D+03	-1.4714D+03	-2.2071D+03
			3.00	-3.3562D+03	-1.4714D+03	-4.4142D+03
			4.50	-3.3562D+03	-1.4714D+03	-6.6212D+03
			6.00	-3.3562D+03	-1.4714D+03	-8.8283D+03
2	2		0.00	-2.5156D-02	1.7615D-03	9.7157D-05
			0.40	2.4733D+01	-1.8509D+02	-7.0171D+01
			0.79	2.6844D+01	-2.0088D+02	-1.4659D+02
			1.19	2.8955D+01	-2.1666D+02	-2.2926D+02
			1.58	5.3713D+01	-4.0176D+02	-3.1886D+02
3	1		0.00	-1.8566D+03	2.7250D+03	-9.1472D+03
			2.78	-1.7859D+03	2.2067D+03	-2.2382D+03
			5.55	-1.6691D+03	1.3498D+03	2.5530D+03
			8.33	-1.5522D+03	4.9299D+02	5.2264D+03
			11.10	-1.4585D+03	-1.9460D+02	5.7890D+03
4	1		0.00	-1.4573D+03	2.0301D+02	5.7890D+03
			2.78	-1.5511D+03	-4.8459D+02	5.2285D+03
			5.55	-1.6679D+03	-1.3414D+03	2.5501D+03
			8.33	-1.7848D+03	-2.1983D+03	-2.2460D+03
			11.10	-1.8555D+03	-2.7166D+03	-9.1458D+03
5	2		0.00	7.6397D+01	5.7107D+02	-3.1752D+02
			0.40	2.8992D+01	2.1666D+02	-2.2859D+02
			0.79	2.6881D+01	2.0088D+02	-1.4592D+02
			1.19	2.4770D+01	1.8510D+02	-6.9499D+01
			1.58	1.2051D-02	2.7008D-03	-3.1275D-04
6	1		0.00	-3.5186D+03	1.4714D+03	-8.8283D+03
			1.50	-3.5186D+03	1.4714D+03	-6.6212D+03
			3.00	-3.5186D+03	1.4714D+03	-4.4142D+03
			4.50	-3.5186D+03	1.4714D+03	-2.2071D+03
			6.00	-3.9110D+03	1.4714D+03	9.7656D-04

SUPPORT REACTIONS <2D-FRAME SYSTEM>
LOAD FACTOR : 1/1/1/0

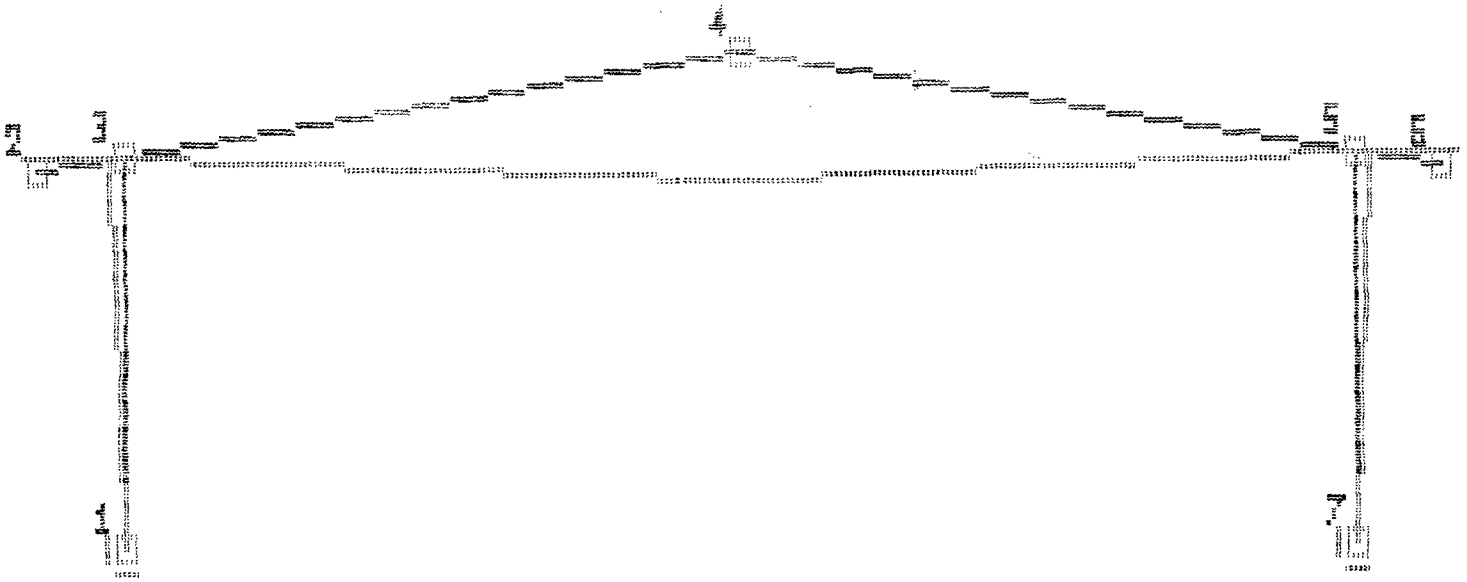
NODE	1-REACTION (KG)	2-REACTION (KG)	3-REACTION (KG-M)

SUPPORT REACTIONS <2D-FRAME SYSTEM>
LOAD FACTOR : 1/1/1/0

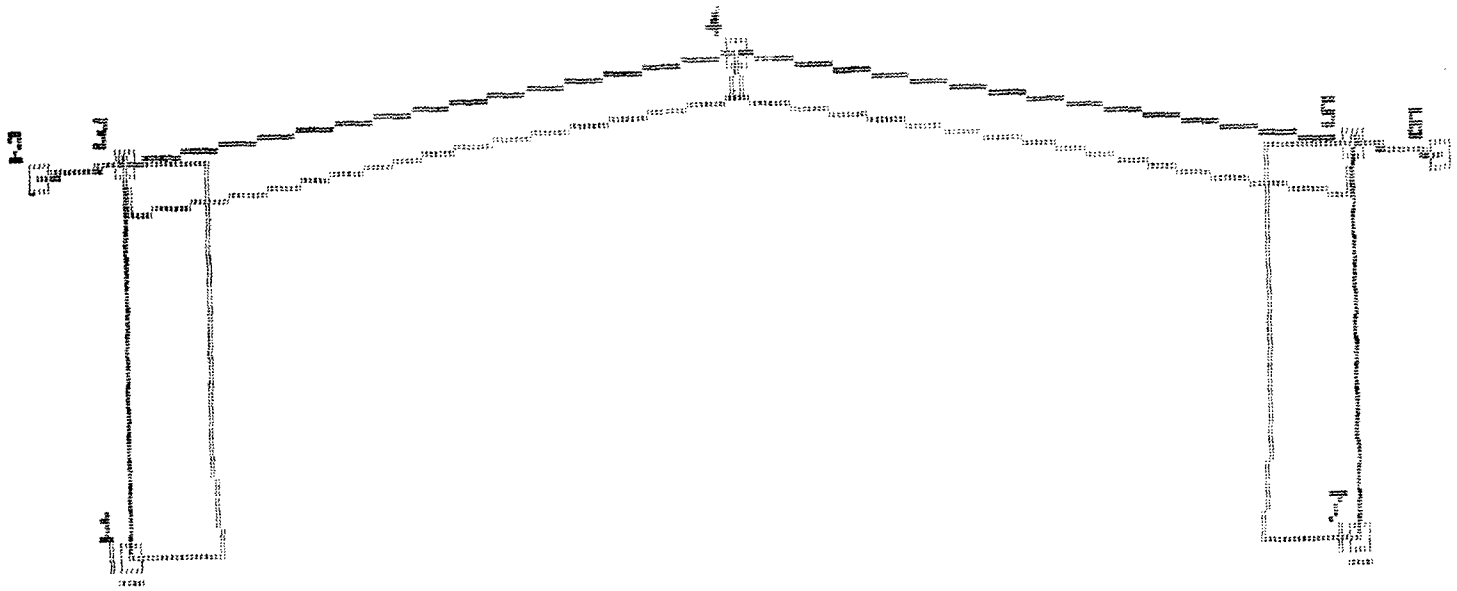
NODE	1-REACTION (KG)	2-REACTION (KG)	3-REACTION (KG-M)
1	1.4714D+03	3.7486D+03	0.0000D+00
7	-1.4714D+03	3.9110D+03	0.0000D+00

DISPLACEMENT COMBINATION <2D-FRAME SYSTEM>
LOAD FACTOR : 1/1/1/0

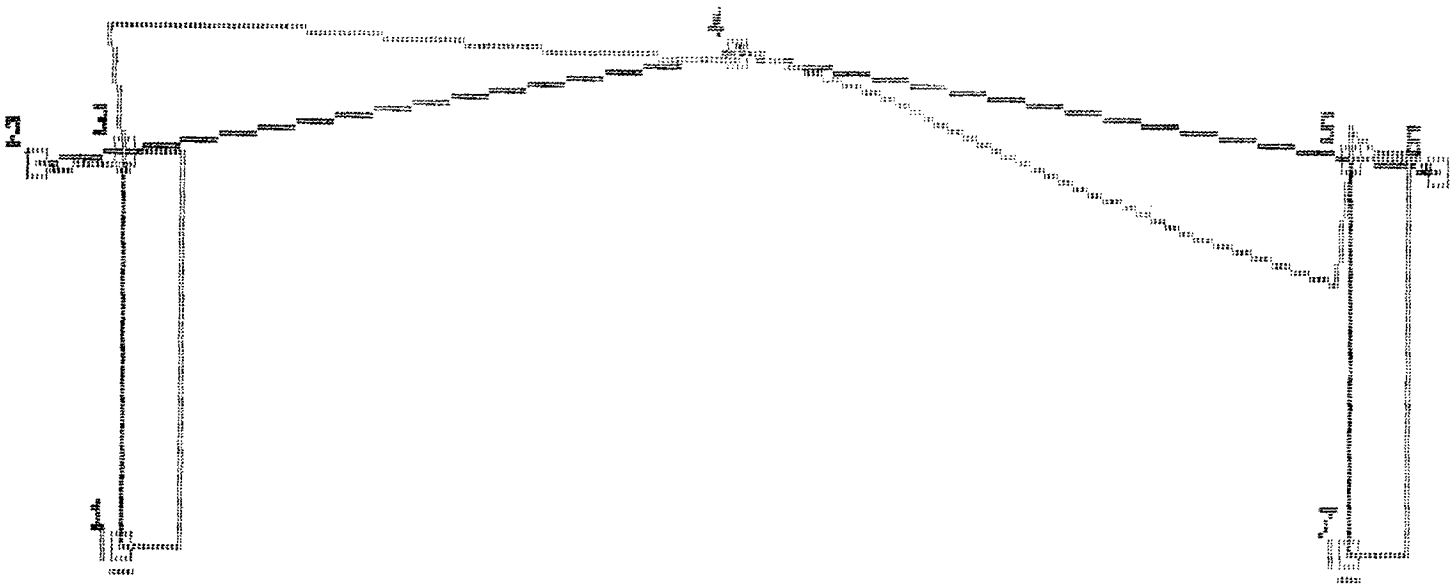
NODE	1-DISP (M)	2-DISP (M)	3-DISP (Rad)
1	0.0000D+00	0.0000D+00	4.9436D-03
2	-1.1594D-02	6.5921D-03	-4.1441D-03
3	-1.0697D-02	-1.1503D-04	-4.5390D-03
4	2.2894D-05	-7.9508D-02	1.9163D-06
5	1.0742D-02	-1.2060D-04	4.5315D-03
6	1.1638D-02	6.5761D-03	4.1384D-03
7	0.0000D+00	0.0000D+00	-4.9511D-03



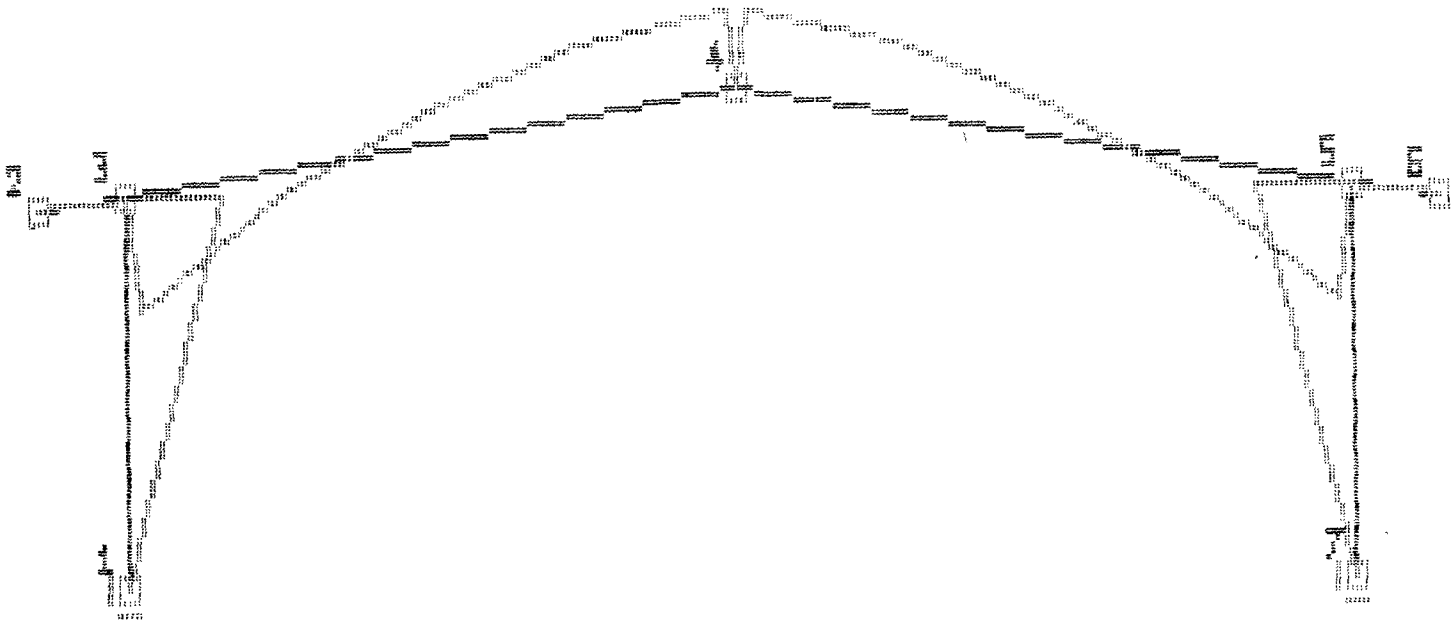
DISP.COM (⊥ = 5.63E-02)



NORMAL FORCE(1 = 3.07E+03)



SHEAR FORCE(⊥ = 1.92E+03)



MOMENT (1 = 6.94E+03)

STRUCTURE DATA

COORDINATE DATA (M)

NODE	1-COOR	2-COOR	**BOUNDARY DATA** 1-B	2-B	3-B
1	0.00	0.00	L	L	F
2	-1.57	5.79			
3	0.00	6.00			
4	11.00	7.50			
5	22.00	6.00			
6	23.57	5.79			
7	22.00	0.00	L	L	F

ELEMENT DATA

ELEM	1-NODE	2-NODE	HINGE	MATERIAL
1	1	3		1
2	2	3		2
3	3	4		1
4	4	5		1
5	5	6		2
6	5	7		1

MATERIAL DATA

MATE	E-MODULUS (KG/M^2)	AXIAL-AREA (M^2)	INERTIA (M^4)
1	2.100D+10	8.336D-03	1.330D-04
2	2.100D+10	5.121D-03	2.880D-05

LOAD CASE #1 : BEBAN RAFTER

UNIFORM LOAD DATA

ELEM	1-UNIFORM (KG/M)	2-UNIFORM (KG/M)
2	0.000D+00	-4.057D+01
3	0.000D+00	-6.600D+01
4	0.000D+00	-6.600D+01
5	0.000D+00	-4.057D+01

LOAD CASE #2 : BEBAN MATI

CONCENTRATED LOAD DATA

ELEM	1-POINT L. (KG)	2-POINT L. (KG)	DISTANCE (M)

LOAD CASE #2 : BEBAN MATI
CONCENTRATED LOAD DATA

ELEM	1-POINT L. (KG)	2-POINT L. (KG)	DISTANCE (M)
2	0.000D+00	-1.70SD+02	0.000D+00
2	0.000D+00	-1.708D+02	1.580D+00
3	0.000D+00	-3.416D+02	1.580D+00
3	0.000D+00	-3.416D+02	3.160D+00
3	0.000D+00	-3.416D+02	4.740D+00
3	0.000D+00	-3.416D+02	6.320D+00
3	0.000D+00	-3.416D+02	7.900D+00
3	0.000D+00	-3.416D+02	9.480D+00
3	0.000D+00	-1.70SD+02	1.106D+01
4	0.000D+00	-3.416D+02	1.580D+00
4	0.000D+00	-1.70SD+02	0.000D+00
4	0.000D+00	-3.416D+02	3.160D+00
4	0.000D+00	-3.416D+02	4.740D+00
4	0.000D+00	-3.416D+02	6.320D+00
4	0.000D+00	-3.416D+02	7.900D+00
4	0.000D+00	-3.416D+02	9.480D+00
5	0.000D+00	-1.70SD+02	1.58OD+00
5	0.000D+00	-3.416D+02	0.000D+00

LOAD CASE #3 : BEBAN KOLOM
CONCENTRATED LOAD DATA

ELEM	1-POINT L. (KG)	2-POINT L. (KG)	DISTANCE (M)
1	0.000D+00	-3.924D+02	0.000D+00
6	0.000D+00	-3.924D+02	6.000D+00

LOAD CASE #4 : BEBAN ANGIN
UNIFORM LOAD DATA

ELEM	1-UNIFORM (KG/M)	2-UNIFORM (KG/M)
1	1.350D+02	0.000D+00
2	-9.580D+00	1.306D+00
3	-9.580D+00	1.306D+00
4	9.908D+00	1.350D+00
5	9.908D+00	1.350D+00
6	1.000D+01	0.000D+00

****
* *
* COMBINATION *
* *
****

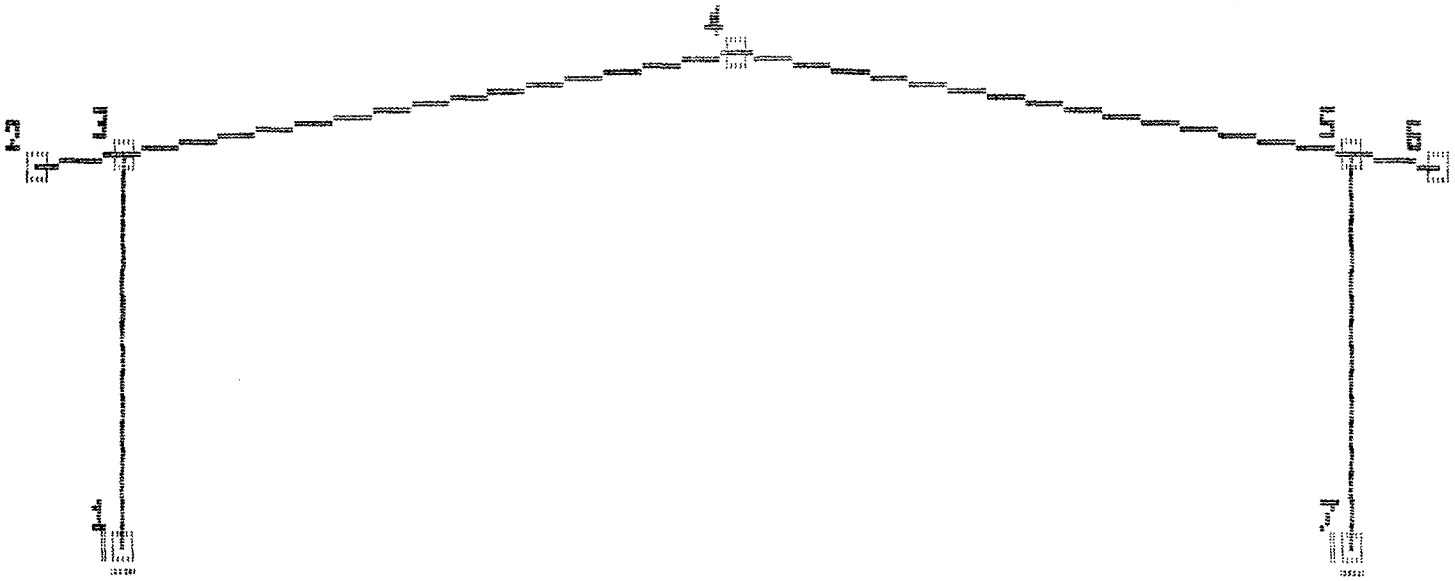
STRESS COMBINATION <2D-FRAME SYSTEM>
LOAD FACTOR : 1/1/1/1

ELEM	MA	HINGE	SECTION (M)	AXIAL F. (KG)	SHEAR (KG)	MOMENT (KG-M)
1	1		0.00	-3.6133D+03	-8.2936D+02	0.0000D+00
			1.50	-3.2209D+03	-1.0319D+03	-1.3959D+03
			3.00	-3.2209D+03	-1.2344D+03	-3.0956D+03
			4.50	-3.2209D+03	-1.4369D+03	-5.0990D+03
			6.00	-3.2209D+03	-1.6394D+03	-7.4062D+03
2	2		0.00	1.5904D-02	2.6326D-03	5.8845D-04
			0.40	2.5204D+01	-1.8452D+02	-7.0057D+01
			0.79	2.7746D+01	-1.9973D+02	-1.4614D+02
			1.19	3.0288D+01	-2.1493D+02	-2.2824D+02
			1.58	5.5476D+01	-3.9946D+02	-3.1704D+02
3	1		0.00	-2.0031D+03	2.5705D+03	-7.7232D+03
			2.78	-1.9293D+03	2.0562D+03	-1.2374D+03
			5.55	-1.8094D+03	1.2034D+03	3.1418D+03
			8.33	-1.6895D+03	3.5063D+02	5.4145D+03
			11.10	-1.5926D+03	-3.3292D+02	5.5876D+03
4	1		0.00	-1.6236D+03	1.0566D+02	5.5876D+03
			2.78	-1.7205D+03	-5.7776D+02	4.7627D+03
			5.55	-1.8406D+03	-1.4304D+03	1.8315D+03
			8.33	-1.9606D+03	-2.2831D+03	-3.2058D+03
			11.10	-2.0344D+03	-2.7973D+03	-1.0335D+04
5	2		0.00	7.8180D+01	5.6869D+02	-3.1563D+02
			0.40	3.0330D+01	2.1488D+02	-2.2753D+02
			0.79	2.7774D+01	1.9969D+02	-1.4545D+02
			1.19	2.5217D+01	1.8450D+02	-6.9380D+01
			1.58	1.3971D-02	1.5682D-03	1.6788D-04
6	1		0.00	-3.6205D+03	1.6399D+03	-1.0020D+04
			1.50	-3.6205D+03	1.6549D+03	-7.5484D+03
			3.00	-3.6205D+03	1.6699D+03	-5.0548D+03
			4.50	-3.6205D+03	1.6849D+03	-2.5386D+03
			6.00	-4.0129D+03	1.6999D+03	0.0000D+00

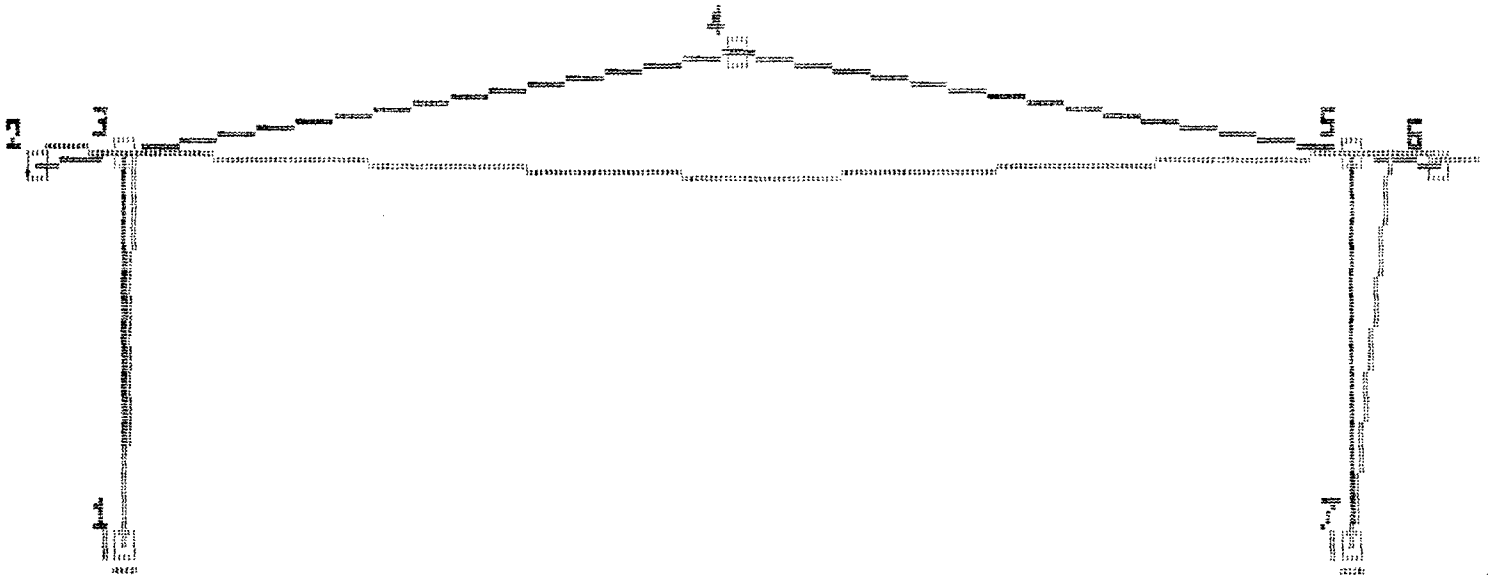
SU CTIONS <2D-FRAME SYSTEM>
LO : 1/1/1/1
NOD EACTION 2-REACTION 3-REACTION
(KG) (KG) (KG-M)

SUPPORT REACTIONS <2D-FRAME SYSTEM>
LOAD FACTOR : 1/1/1/1

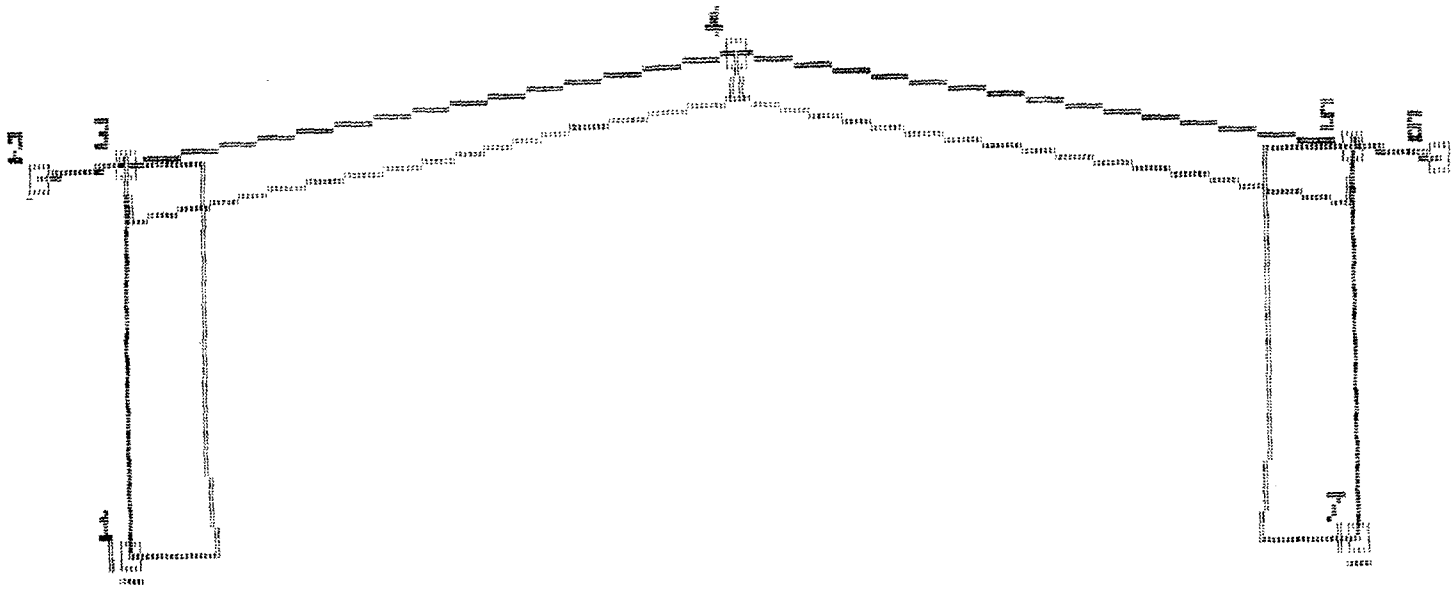
NODE	1-REACTION (KG)	2-REACTION (KG)	3-REACTION (KG-M)
1	8.2936D+02	3.6133D+03	0.0000D+00
7	-1.6999D+03	4.0129D+03	0.0000D+00



GEOMETRY (1 = 1.36E+00)

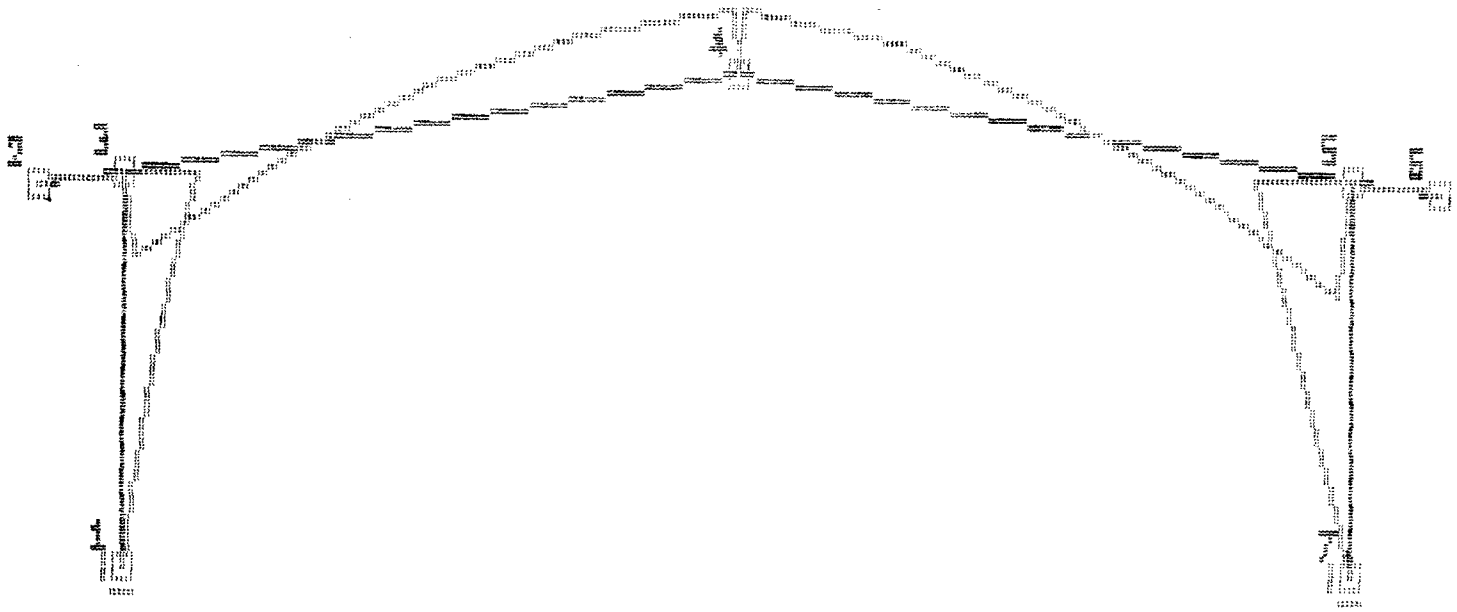


DISP.COM (⊥ = 5.46E-02)



NORMAL FORCE(⊥ = 3.15E+03)

SHEAR FORCE(1 = 1.97E+03)



MOMENT (↓ = 7.88E+03)

PROJECT

GROUND SURFACE LEVEL :
GROUND WATER LEVEL

BORING DEPTH : - 30 m

Depth (m)	Soil Description	S.P.T. (10 20 30 40 50 60 70)	Wp – Wn – Wl (20 40 60 80)	∂	Gs	e	S	Strength Test: Type	c	φ	qu
1.00	Chemical Waste	2	32	1.72	2.61	1.0	83	D.S	0.05	37°	-
2.00	Light Grey Clay		45 53 132	1.63	2.69	1.69	100	U.C.	0.47	0°	0.94
3.00		5									
4.00	Grayish Brown Sand, Silty	9	48	1.76	2.76	1.32	100	DS	0.07	40°	-
5.00											
6.00	silty		35 51 100	1.72	2.73	1.39	100	UC	0.33	0	0.66
7.00		10									
8.00	Light Brown Clay		40 52 130	1.71	2.71	1.41	100	UC	0.57	0°	1.14
9.00											
10.00		10	54	1.70	2.73	1.47	100	UC	0.14	0°	0.28
11.00		14									
12.00		15									
13.00	silty	13	54	1.71	2.76	1.49	120	DS	0.08	38°	-
14.00											
15.00	Light Brown to Dark Grey Sand	11	55	1.70	2.75	1.51	100	DS	0	40°	-
16.00			48	1.75	2.73	1.31	100	DS	0	40°	-
17.00		22									
18.00		17									
19.00		29	51	1.73	2.76	1.41	100	DS	0	34°	-
20.00											
21.00		19	35 50 120	1.72	2.70	1.35	100	-	-	-	-
22.00			38 47 64	1.75	2.70	1.27	100	UC	0.91	0°	1.82
23.00	Dark Grey Clay, Silty	25									
24.00		21									
25.00			34 47 104	1.75	2.72	1.33	100	-	-	-	-
26.00		40									
27.00	Sandy	29									
28.00											
29.00	Sandy	36									
30.00		50									
31.00	END OF BORING										
32.00											
33.00											
34.00											
35.00											
36.00											
37.00											
38.00											
39.00											
40.00											

NOTATION

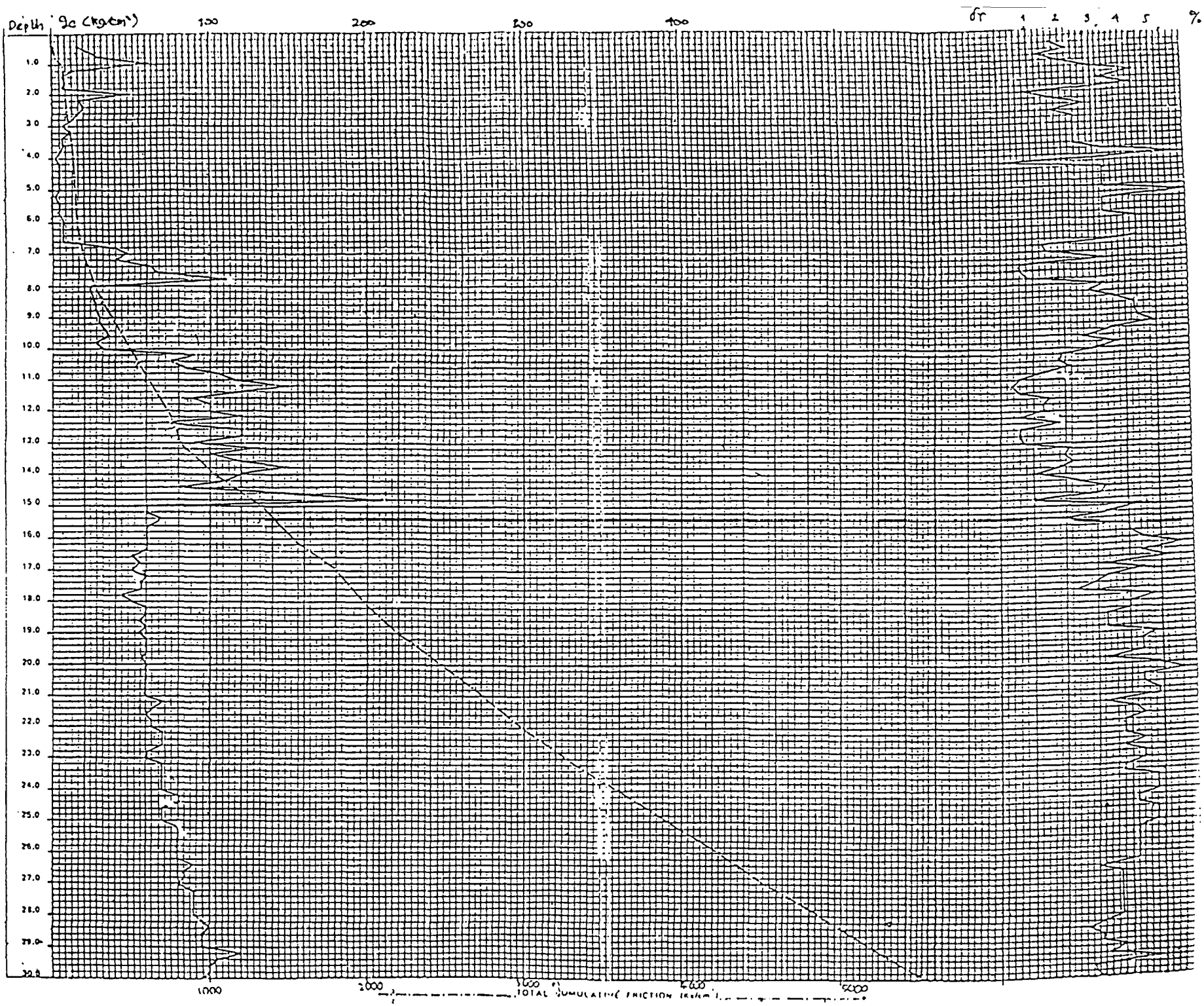
- S.P.T. = Standard Penetration Test (Blows/ft)
- Wp = Plastic Limit (%)
- Wn = Natural Water Content (%)
- Wl = Liquid Limit (%)
- ∂ = Bulk Unit Weight (t/m³)
- Gs = Specific Gravity
- e = Void Ratio
- S = Degree of Saturation (%)
- UU = Unconsolidated Undrained Test
- UC = Unconfined Compression Test
- DS = Direct Shear Test
- c = Cohesion (Kg/cm²)
- φ = Angle of Internal Friction
- qu = Unconfined Compressive Strength (Kg/cm²)

Boring no. B 3

Thin Wall S.P.T. Coring

LABORATORIUM MEKANIKA TANAH
UNIVERSITAS KRISTEN PETRA

SHEET NO.


Depth
qc (kg/cm²)
100
200
300
400
fr
1
2
3
4
5
%
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
18.0
19.0
20.0
21.0
22.0
23.0
24.0
25.0
26.0
27.0
28.0
29.0
30.0
1000
2000
3000
4000
5000
TOTAL CUMULATIVE FRICTION (kg/cm)