PERHITUNGAN ATAP :

(ATAP BANGUNAN MULTIPURPOSE)

Kuda - kuda atap : WF Cas 600 x 200 x 8 x 13	Kuda - kuda atap : WF 25
Pembebanan :	**Pembebanan :**
Beban pada atap Q = 57 kg/m2	Beban pada atap Q = 57
Jarak Kuda - kuda = 2.5 m Jarak Kuda - kuda = 2 m	Jarak Gording = 1.5 Jarak Kuda - kuda = 2.5
Beban pada Kuda - kuda WF :	**Beban pada Kuda - kuda WF :**
Beban terbagi rata q = Q x L = 57 x 2,5	Beban terbagi rata q = Q x L =
q = 142.5 kg/m'	q = 85.5 kg/m'
Beban terpusat P1 = (57 x 2,5) x (4 + 3,25)	Beban terpusat P1 = (57 x 2,5) x
P1 = 1033.125 kg	P1 = 1033.125 kg
Beban terpusat P2 = (57 x 2,0) x (3,25 + 2,75)	
P2 = 684 kg	

Kuda - kuda atap : WF 200 x 100 x 5,5 x 7	Kuda - kuda atap : WF 35
Pembebanan :	**Pembebanan :**
Beban pada atap Q = 57 kg/m2	Beban pada atap Q = 57
Jarak Kuda - kuda = 2.5 m	Jarak Kuda - kuda = 3.3
Beban pada Kuda - kuda WF :	**Beban pada Kuda - kuda WF :**
Beban terbagi rata q = Q x L = 57 x 2,5	Beban terbagi rata q = Q x L =
q = 142.5 kg/m'	q = 188.1 kg/m'

0 x 125 x 6 x 9

kg/m2

m
m

57 x 1,5

x (4 + 3,25)

0 x 175 x 7 x 11

kg/m2

m

57 x 3,3

PERHITUNGAN IKATAN ANGIN ATAP

β = arc tan (5.75 / 6) = 43.76 0

PEMBEBANAN

A. Beban Tetap (N) = N/cos β = 1175.46 /cos 43.76 = 1628.09
B. Beban Sementara (N) = N/cos β = 1944.60 /cos 43.76 = 2693.39

PERHITUNGAN BATANG TARIK

ϕ > L/500 = 600 / cos 43.76 / 500 = 1.66208 cm

A. Beban Tetap
A = N/σ = 1628.09 / 1600 = 1.02 cm^2
d = (4*A/3.14)^0.5 = 1.14 cm

B. Beban Sementara
A = N/s = 2693.39 / 2080 = 1.29 cm^2
d = (4*A/3.14)^0.5 = 1.28 cm

Jadi dipakai besi beton ϕ 16 mm

KONTROL TERHADAP SYARAT PPBBI (pasal 7.4.2)

h/L >= (0.25*Q/(E*Atepi))^0.5
h = 6 m
L = (40 + 2* 1.5) / cos 15 = 44.5181 m
Q = n*q*L*dk = 2 * 30.33 * 44.5181 * 6 = 16200.3111 kg
Atepi = b * ts = 125 * 9 = 1125 mm^2 = 11.25 cm^2
6 / 44.5181 >= (0.25* 16200.3111 / (2.1*10^6* 11.25))^0.5
0.13 >= 0.01 .... OK

9 kg
9 kg

PERHITUNGAN GORDING

DATA :

GORDING : C 125.50.20.2,3

KEMIRINGAN ATAP	(α)	=	15	0		h	=	125	mm	ts =	2.3 mm
JARAK GORDING	(Lg)	=	1.5	m		b	=	50	mm	tb =	2.3 mm
JARAK SAGROD	(Ls)	=	2	m		A	=	5.747	cm^2	ix =	4.88 cm
JARAK KAP	(L)	=	6	m		W	=	4.51	kg/m	iy =	1.89 cm
BERAT ATAP		=	7	kg/m^2		Ix	=	137	cm^4	Wx =	21.9 cm³
LEBAR BENTANG		=	40	m		Iy	=	20.6	cm^4	Wy =	6.22 cm³
JARAK GRID VERTIKAL PERTAMA	(KANOPI)				(L1)		=	1.5	m		
JARAK VERTIKAL KEDUA					(L2)		=	5.75	m		
JARAK ANTAR GRID VERTIKAL					(L3)		=	5.75	m		
JUMLAH GORDING PADA L1							=	2	buah		
JUMLAH GODING PADA L2							=	5	buah		
JUMLAH GORDING PADA L3							=	5	buah		
TINGGI KOLOM					(hk)		=	6	m		

PEMBEBANAN :

A. Beban Mati :

- Beban Atap = 7 * 1.5 = 10.5 kg/m
- Berat Sendiri Gording = = 4.51 kg/m
- Berat Alat Penyambung = 0.1*(10.5 + 4.51) = 1.50 kg/m +

Qm = 16.51 kg/m

B. Beban Hidup

- Beban Air Hujan (Qh) = 40-0.8* α = 28 kg/m^2 ..harus<=20

= 20 * 1.5 * cos α = 28.98 kg/m

- Beban Terpusat (P) = = 100 kg

C. Beban Angin

Angin dari sampin kiri = kanan

- Di pihak angin = (0.02*a-0.4) * 25 * Lg = -3.75 kg/m
- Di belakang angin = - 0.4 * 25 * Lg = -15 kg/m

Angin dari depan = - 0.4 * 25 * Lg = -15 kg/m

PERHITUNGAN MOMEN

A. Akibat Beban Mati

Mmx = 1/8 * Qm * cosα * L^2 = 71.77 kg m

Mmy = 1/8 * Qm * sinα * Ls^2 = 2.14 kg m

B. Akibat Beban Hidup

- Beban Air Hujan

Mhhx = 1/8 * Qh * cosα * L^2 = 125.95 kg m

Mhhy = 1/8 * Qh * sinα * Ls^2 = 3.75 kg m

- Beban Pekerja

Mhpx = 1/4 * P * cos α * L = 144.88 kg m

Mhpy = 1/4 * P * sin α * Ls = 12.95 kg m

C. Akibat Beban Angin

- Di Pihak Angin : Max = 1/8 * Qa * L^2 = -16.875 kg m
- Di Belakang Angin : Max = 1/8 * Qa * L^2 = -67.5 kg m
- Angin dari depan : Max = 1/8 * Qa * L^2 = -67.5 kg m

Kombinasi Pembebanan :

A. Pembebanan Tetap (Beban Mati + Hidup)

Mx = 71.77 + 144.88 = 216.65 kg m

My = 2.14 + 12.95 = 15.0875 kg m

B. Pembebanan Sementara (Beban Tetap + Angin Samping)

Mx = 71.77 + 0 = 71.77 kg m

My = 2.14 + 0 = 2.14 kg m

c. Pembebanan Sementara (Beban Tetap + Angin Depan)

Mx = 71.77 + -67.5 = 4.27 kg m

My = 2.14 + 0 = 2.14 kg m

Kontrol Tegangan :

σmax = Mx/Wx + My/ Wy = 1231.81 kg/cm^2 ... Harus <= 1600 kg/cm^2

Kontrol Lendutan :

- Akibat Beban Terpusat terhadap Sumbu Y

  f = 3.3 cm

  fy = Py*Ls^3/(48*E*Iy) = 0.0098 cm .... < 3.3 cm

- Akibat Beban Mati + Hidup

  f = 1/180 * L = 3.33 cm

  - Beban Mati + Air Hujan

    fx = 5*Qx*L^4/(384*E*Ix) = 2.668 cm .... < 3.33 cm

    fy = 5*Qy*Ls^4/(384*E*Iy) = 0.561 cm .... < 3.33 cm

  - Beban Mati + Pekerja

    fx = 5*Qx*L^4/(384*E*Ix) + Px*L^3/(48*E*Ix) = 2.45 cm .... < 3.33

    fy = 5*Qy*Ls^4/(384*E*Iy) + Py*Ls^3/(48*E*Iy) = 0.12 cm .... < 3.33

PERHITUNGAN GAYA NORMAL TEKAN PADA GORDING

Hubungan Gording dengan Rafter

Direncanakan rafter CASTELLA 375.125

h = 375 mm tb = 6 mm

b = 125 mm ts = 9 mm

Pkuda-kuda = Asayap *σ = (b*ts)*1600 = 18000 kg

P' = 0.01*Pkuda-kuda = 180 kg

Hubungan Gording dengan Ikatan Angin

P" = P'+0.005*n*dk*dq*q .... q = 16.51 / 1.5 + 20 * cos 15 = 30.33 kg/

= 180 + 0.005*2* 6 * 1.5 * 30.33

= 182.73 kg

Pengaruh Angin Pada Gording

R1' = 0 kg

R2' = 0.5*0.5*L2/2*(2*hk+L2/2*tanα)*0.9*25

= 206.53 kg

R3' = 0.5*0.5*(L2+L3)/2*(2*hk+L2/2*tanα+(L2+L3/2)*tanα)*0.9*25

= 487.83 kg

R4' = 0.5*0.5*L3/2*(2*hk+(L2+L3/2)*tanα+(L2+L3)tanα)*0.9*25

= 281.31 kg

Kombinasi Pembebanan

- Akibat Beban Tetap

R1 = P' = 180.00 kg

R2 = 1.5 * P' + P" = 452.73 kg

R3 = 3 * P' + P" = 722.73 kg

R4 = 1.5 * P' + P" = 452.73 kg +

RA = 1808.19 kg

Gaya batang maximum (N) = RA-R1-R2 = 1175.46 kg

- Akibat Beban Sementara

R1 = R1 + R1' = 180.00 kg

R2 = R2 + R2' = 659.26 kg

R3 = R3 + R3' = 1210.56 kg

R4 = R4 + R4' = 734.04 kg +

RA = 2783.85

Gaya batang maximum (N) = RA-R1-R2 = 1944.60 kg

PERSAMAAN INTERAKSI

h/tb = 54.35 < 75 ...Penampang

L/h = 16.00 < 1.25 * b/ts = 27.17 berubah bentuk

A' = Asayap + 1/6 Abadan = 1.62 cm^2

λiy tepi = (Iy/(2*A')^(1/2) = 2.52 cm

λy = Lky/λiytepi = 79.33 ... wy = 1.6046

σkip = σ/wy = 997.13 kg/cm^2

θ = 5*σ/(σkip*(8-3*Mx1/Mx2)) = 1.00 .... harus >=1. Jadi θ = 1

λx = Lkx/ix = 600 / 4.88 = 122.951 .... σEx = 1371.2 kg/cm^2 wmax = 2.

λy = Lky/iy = 200 / 1.89 = 105.82 .... σEy = 1851.3 kg/cm^2

- Untuk Beban Tetap

nx = A*σEx/N = 5.747 * 1371.2 / 1175.46 = 6.70

ny = A*σEy/N = 5.747 * 1851.3 / 1175.46 = 9.05

wmax*N/A+θ*nx/(nx-1)*βx*Mx/Wx+βy*ny/(ny-1)*My/Wy = 861.22 kg/cm^2 .... har

1600 kg/

N/A+θ*Mx/Wx+My/Wy = 904.12 kg/cm^2 .... harus <= 1600 kg/cm^2

- Untuk Beban Sementara

nx = A*σEx/N = 5.747 * 1371.2 / 1944.60 = 4.05

ny = A*σEy/N = 5.747 * 1851.3 / 1944.60 = 5.47

wmax*N/A+θ*nx/(nx-1)*βx*Mx/Wx+βy*ny/(ny-1)*My/Wy = 966.09 kg/cm^2 .... har

2080 kg/

N/A+θ*Mx/Wx+My/Wy = 1231.81 kg/cm^2 .... harus <= 2080 kg/cm^2

Jadi profil gording CNP 125.50.20.2,3 Aman digunakan

`3
`3

kg/m^2

′m^2

.9177

ous <=
cm^2

ous <=
cm^2

PERHITUNGAN SAGROD

PEMBEBANAN

A Beban Mati = Rx1 = Qm * sin α * Ls = 16.51 * sin 1

B Beban Hidup

- Beban Air Hujan = Rx2 = 29.0 * sin α * Ls = 29.0 * sin 1
- Beban Terpusat = Rx3 = P* sin α = 100 * sin 15

Pada satu sisi ada 17 gording dan dianggap ada 3 pekerja

Rx = 17 * (8.55 + 15.01) = 400.44 kg Rx max =

Rx = 17 * 8.55 + 3 * 25.89 = 223.03 kg

PERHITUNGAN BATANG TARIK

ϕ > Lg/500 .... ϕ > 150 / 500 = 0.30 cm

Ateras = F/σ = 554.84 / 1600 = 0.35 cm^2

d = (4*A/3.14)^0.5 = 0.66 cm .... dipakai besi beton polos ϕ

PEMERIKSAAN GORDING PADA PUNCAK RAFTER AKIBAT SAGROD

Beban

Py = Rx * tan α = 554.84 * tan 15 = 148.73 kg

Msagrod x = 148.73 * 2 = 297.46 kg m

Kombinasi Beban

A. Beban Tetap

Mx = 21664.58 + 29746.319 = 51410.90 kg cm

My = 15.0875209 kg cm

Nt =

B. Beban Sementara

Mx =

My =

Nt =

Kontrol Tegangan

A. Terhadap Beban Tetap

nx = A*σEx/N = #REF! * 0 / 0.00 = #REF!

ny = A*σEy/N = #REF! * 0 / 0.00 = #REF!

wmax*N/A+θ*nx/(nx-1)*βx*Mx/Wx+βy*ny/(ny-1)*My/Wy = #VALUE! kg/cm

N/A+θ*Mx/Wx+My/Wy = ### kg/cm^2 .... harus <= 1600 kg/cm^2

B. Terhadap Beban Sementara

nx = A*σEx/N = 5.747 * 1371.2 / 0.00 = #DIV/0!

ny = A*σEy/N = 5.747 * 1851.3 / 0.00 = #DIV/0!

wmax*N/A+θ*nx/(nx-1)*βx*Mx/Wx+βy*ny/(ny-1)*My/Wy = #VALUE! kg/cm

N/A+θ*Mx/Wx+My/Wy = ### kg/cm^2 .... harus <= 1600 kg/cm^2

5 * 2 = 8.55 kg

5 * 2 = 15.01 kg
= 25.89 kg

554.84 kg

8 mm

^2 .... harus <=
1600 kg/cm^2

^2 .... harus <=
1600 kg/cm^2

PERHITUNGAN BAUT

TRUSS10

Nomor Batang	Gaya Normal N, (kg)		Profil Terpakai	Jumlah baut	ϕ baut cm	P geser baut kg
16	+	5	H70~0.55	3.00	0.40	904.3
17	+	202	H70~0.55	3.00	0.40	904.3
18	-	270	H70~0.55	3.00	0.40	904.3
19	+	36	H70~0.55	3.00	0.40	904.3
20	-	36	H70~0.55	3.00	0.40	904.3

σ ijin baut = 4000 kg/cm2

P geser baut = 0.6 x A x σ x n

A = Luas baut

n = jumlah baut

N < P ges baut
ok ok ok ok ok

DESAIN KEKUATAN SAMBUNGAN

Mutu Baja : Fe 360 — Ty = 2400 kg/cm²
Tijin 1600 kg/cm²
Mutu Baut : Fe 360 — Ttarik 1120 kg/cm²
Tshear 960 kg/cm²

Kode	Profil Sambungan	Geser	Momen Lentur	Baut		jarak baut[cm]											Total	Teg. geser
	BALOK	[kg]	[kgcm]	ϕ baut	jumlah	d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d²	(T shear)
PORTAL :																		
B223	WF 346X174X6X9	9720	1250000	16	12	55.2	43.9	32.6	20.6	10.3	0.0	0.0	0.0	0.0	0.0	0.0	13134.92	403.065
B110	WF 250X125X6X9	4870	470000	16	6	36.0	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3170.00	403.895
B157	WF 396X199X7X11	13620	2152100	16	12	65.2	51.4	37.6	26.6	12.8	0.0	0.0	0.0	0.0	0.0	0.0	18356.32	564.789
B222	WF 298X149X5,5X8	8730	834100	16	10	45.6	36.7	27.8	15.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8897.46	434.415
B333	WF 582X300X12X17	33398	5291700	16	18	102.2	90.7	79.2	67.7	56.2	44.0	33.0	22.0	0.0	0.0	0.0	72389.40	923.290
B170	WF 446X199X8X12	15711	2302100	16	16	75.1	64.3	53.5	42.7	30.6	20.4	10.2	0.0	0.0	0.0	0.0	31833.20	488.623
B200	WF 500X200X10X16	17571	3876100	16	18	86.0	76.5	67.0	57.5	48.0	36.0	24.0	12.0	0.0	0.0	0.0	50727.00	485.752
B184	WF 600X200X11X17	22845	4232200	16	20	106.0	94.0	82.0	70.0	58.0	46.0	34.5	23.0	11.5	0.0	0.0	78055.00	568.397

Teg.tarik (T tarik)	Teg.idiil	KET
3734.34	3799	
3794.32	3858	
5433.96	5521	
3038.85	3131	
5310.84	5546	
3860.79	3952	
4671.39	4747	
4085.67	4203	

PERHITUNGAN SAMBUNGAN

SAMBUNGAN RAFTER DAN KOLOM

M = -797646 kg cm
D = -1893.05 kg
N = -893.05 kg
V = D*cosα + N*sinα = -2059.7235 kg
H = D*sinα + N*cosα = -1352.7458 kg
Dipakai diameter baut ϕ 18 mm .... A = 2.5434 cm^2
Jumlah baut yang digunakan (n) = 12 buah
Jarak antar baut : 2.5 d <= s <= 7 d
2.5 * 18 <= s <= 7 * 18
45 mm <= s <= 126 mm
Jarak antar baut = 100 mm
h1^2 = 100 cm^2
h2^2 = 400 cm^2
h3^2 = 900 cm^2
h4^2 = 1600 cm^2
h5^2 = 2500 cm^2 +
Σh^2 = 5500 cm^2
Tmax = M*h5/(2*Σh^2) = -3625.66 kg
σmax = Tmax/A = -1425.52 kg/cm^2
τ = D/(n*A) = -62.02 kg/cm^2
σi = (σmax^2+3*τ^2)^0.5 = 1429.56 kg/cm^2 .... <= 1600 kg/cm^2..

SAMBUNGAN PUNCAK RAFTER

M = -797646 kg cm
D = -1893.05 kg
N = -893.05 kg
V = D*cosα + N*sinα = -2059.7235 kg
H = D*sinα + N*cosα = -1352.7458 kg
Dipakai diameter baut ϕ 18 mm .... A = 2.5434 cm^2
Jumlah baut yang digunakan (n) = 12 buah
Jarak antar baut : 2.5 d <= s <= 7 d
2.5 * 18 <= s <= 7 * 18
45 mm <= s <= 126 mm
Jarak antar baut = 100 mm
h1^2 = 100 cm^2
h2^2 = 400 cm^2
h3^2 = 900 cm^2
h4^2 = 1600 cm^2
h5^2 = 2500 cm^2 +
Σh^2 = 5500 cm^2
Tmax = M*h5/(2*Σh^2) = -3625.66 kg
σmax = Tmax/A = -1425.52 kg/cm^2
τ = D/(n*A) = -62.02 kg/cm^2
σi = (σmax^2+3*τ^2)^0.5 = 1429.56 kg/cm^2 .... <= 1600 kg/cm^2..

SAMBUNGAN KOLOM DAN CRANE

M = -797646 kg cm
D = -1893.05 kg
N = -893.05 kg
V = D*cosα + N*sinα = -2059.7235 kg
H = D*sinα + N*cosα = -1352.7458 kg
Dipakai diameter baut ϕ 18 mm .... A = 2.5434 cm^2
Jumlah baut yang digunakan (n) = 12 buah
Jarak antar baut : 2.5 d <= s <= 7 d
2.5 * 18 <= s <= 7 * 18
45 mm <= s <= 126 mm
Jarak antar baut = 100 mm
h1^2 = 100 cm^2
h2^2 = 400 cm^2
h3^2 = 900 cm^2
h4^2 = 1600 cm^2
h5^2 = 2500 cm^2 +
Σh^2 = 5500 cm^2
Tmax = M*h5/(2*Σh^2) = -3625.66 kg
σmax = Tmax/A = -1425.52 kg/cm^2
τ = D/(n*A) = -62.02 kg/cm^2
σi = (σmax^2+3*τ^2)^0.5 = 1429.56 kg/cm^2 .... <= 1600 kg/cm^2..

SAMBUNGAN ANTAR RAFTER

M = -797646 kg cm
D = -1893.05 kg
N = -893.05 kg
V = D*cosα + N*sinα = -2059.7235 kg
H = D*sinα + N*cosα = -1352.7458 kg
Dipakai diameter baut ϕ 18 mm .... A = 2.5434 cm^2
Jumlah baut yang digunakan (n) = 12 buah
Jarak antar baut : 2.5 d <= s <= 7 d
2.5 * 18 <= s <= 7 * 18
45 mm <= s <= 126 mm
Jarak antar baut = 100 mm
h1^2 = 100 cm^2
h2^2 = 400 cm^2
h3^2 = 900 cm^2
h4^2 = 1600 cm^2
h5^2 = 2500 cm^2 +
Σh^2 = 5500 cm^2
Tmax = M*h5/(2*Σh^2) = -3625.66 kg
σmax = Tmax/A = -1425.52 kg/cm^2
τ = D/(n*A) = -62.02 kg/cm^2
σi = (σmax^2+3*τ^2)^0.5 = 1429.56 kg/cm^2 .... <= 1600 kg/cm^2..

. OK

. OK

. OK

. OK

PERHITUNGAN SAMBUNGAN

SAMBUNGAN RAFTER DAN KOLOM

(c10 dengan b11

M = 68829 kg cm
D = 602 kg
N = 151 kg
V = D*cosα + N*sinα = 614 kg
H = D*sinα + N*cosα = 210 kg
Dipakai diameter baut ϕ 16 mm .... A = 2.0096 cm²
Jumlah baut yang digunakan (n) = 10 buah
Jarak antar baut : 2.5 d <= s <= 7 d
2.5 * 16 <= s <= 7 * 16
40 mm <= s <= 112 mm
Jarak antar baut = 90 mm
h1^2 = 81 cm^2
h2^2 = 324 cm^2
h3^2 = 729 cm^2
h4^2 = 1296 cm^2 +
Σh^2 = 2430 cm^2
Tmax = M*h5/(2*Σh^2) = 637.31 kg
σmax = Tmax/A = 317.13 kg/cm^2
τ = D/(n*A) = 29.96 kg/cm^2
σi = (σmax^2+3*τ^2)^0.5 = 321.35 kg/cm^2 ...

SAMBUNGAN BADAN RAFTER

(B 11)

M = 68800 kg cm
D = 602 kg
Dipakai diameter baut ϕ 16 mm .... A = 2.0096 cm²
Jumlah baut yang digunakan (n) = 9 buah
Jarak antar baut : 2.5 d <= s <= 7 d
2.5 * 16 <= s <= 7 * 16
40 mm <= s <= 112 mm
Jarak antar baut = 70 mm

no	x cm	y cm	x2 cm2	y2 cm2
1	0	0	0	0
2	7	0	49	0
3	0	7	0	49
4	7	7	49	49
			98	**98**

Σ(x2+y2) = 4(98+98) = 784 cm2

$$Kx = \frac{M \times y_{max}}{\Sigma(x2+y2)} = \frac{68800 \times 7}{784} = 614 \text{ kg}$$

$$Ky1 = \frac{M \times x_{max}}{\Sigma(x2+y2)} = \frac{68800 \times 7}{784} = 614 \text{ kg}$$

$$Ky2 = \frac{D}{n\ baut} = \frac{602}{9} = 66.9\ kg$$

$$Ky = Ky1 + Ky2 = 614 + 66.9 = 681\ kg$$

$$K = (Kx2 + Ky2)^{0.5} = (614^2 + 681^2)^{0.5} = 917\ kg < 2329\ k$$

$$ng = 0.25 \times 3.14 \times d^2 \times 0.6 \times 1600$$
$$= 2573\ kg$$

$$ns = t \times d \times 1{,}4 \times 1600$$
$$= 2329\ kg \quad (\text{menentukan})$$

)

`2

.. <= 1600 kg/cm^2... OK

`2

‹g

PERHITUNGAN SAMBUNGAN BAUT (PIN JOINT)

σijin= 5000 kg/cm2 (HTB)

No	Type Balok	Profil	Gaya geser (kg)	Dia Baut (cm)	Jumlah	Luas (cm2)	τ (kg/cm2)
1	SB1	WF 250.125	4350	1.9	2	5.67	767.51
2	SB2	WF 300.150	5566	2.2	3	11.40	488.32
3	SB3	WF 450.200	7164	2.2	4	15.20	471.39
4	SB4	WF 350.175	3670	2.2	3	11.40	321.98
5	SB5	WF 400.200	4274	2.2	3	11.40	374.97

τ ijin 0.6* σijin (kg/cm2)	KET
3000	ok
3000	ok
3000	ok
3000	ok
3000	ok

PERHITUNGAN RAFTER

Dipakai profil : WF 400.200.8.13

A = 84.1 cm2
Zx = 1190 cm3
ix = 16.8 cm

Gaya Dalam (Output SAP'90)

M = 1550600 kgcm
N = 6469 kg

Tegangan Rafter

σ = **w.N/A + M/Zx**

Lk = 18.5 m
λ = Lk/ ix 110.119048 ^----------> w = 2.34

σ = **1483.0188** kg/cm2 < **1600 kg/cm2** **(ok)**

PERHITUNGAN KOLOM BAJA

Dipakai profil : WF 400.200.8.13

A = 84.1 cm2
Zx = 1190 cm3
ix = 16.8 cm

Gaya Dalam (Output SAP'90)

M = 1703200 kgcm

N = 5102 kg

Tegangan Rafter

σ = w.N/A + M/Zx

Lk = 6 m
λ = Lk/ ix 35.7142857 ^----------> w = 1.11

σ = **1498.5996** kg/cm2 < **1600 kg/cm2** **(ok)**

PERHITUNGAN ANGKER PERLETAKAN KOLOM

direncanakan plat baja : 500 x 300 x 10

σ = **N/A + M/W**

σ **max** = **N/A + M/W**
= 5102/(50x30) + 1703200x6/(30x50^2)
= 139 kg

σ **min** = **N/A + M/W**
= 5102/(50x30) - 1703200x6/(30x50^2)
= -132 kg

Tegangan minimum harus dipikul angker

x / 45 - x = 132 / 139

x = 24.3 cm

I = 24.3 x 30 x 132 x 0.5

= 48144 kg

F = I / σ

48144/1600 = 30 cm2

Dipakai 8 ϕ 22 (F = 30.4 cm2)

PERHITUNGAN PONDASI

Direncanakan dengan 2 macam pondasi, yaitu :

1. Pondasi Footing (pondasi dangkal) :
2. Pondasi Srauss (pondasi dalam) :

Kondisi tanah dianggap cukup baik

Direncanakan :

1. Strauss ϕ 30 cm , L = - 13.5 m

   P allow = 10 ton

1. Pondasi Footing

   Tegangan ijin tanah = 2500 kg/m2

Beban yang bekerja diterima oleh pondasi dangkal sampai tegangan 2500kg/m2 sisanya diterima strauss

PERHITUNGAN KOLOM

WF 250 X 125 X 6 X 9

h =	25.0	cm		tb =	0.60
b =	12.5	cm		ts =	0.90
A =	37.66	cm2		iy =	2.79
Ix =	4050.00	cm4		Zx =	324.00
Iy =	294.00	cm4		Zy =	47.00
ix =	10.40	cm		σ =	1600

KIP :

L = 900 cm

h/tb < 75 ---------- h/tb =

L/h > 1.25 b/ts ---------- L/h =

1.25 b/ts =

Penampang berubah bentuk ? --------- ya

A' = A sayap + 1/6 A badan

A' = 13.570 cm2

iA' = (1/2 Iy)/A = 3.291 cm

λ = Lky/iA' --------> Lky = 500 cm

λ = 151.92 ----------> ω = 1.35

kip = σ /ω = 1184.3 kg/cm2

mx1 = 0 kgm

mx2 = 4104 kgm

θ = 0.84 --> 1.00

λx = Lkx / ix = ^----------> Lkx = 500

λx = 48.08 ^---------- ωX = 1.07

σEX = 23029

λy = Lky / iy

λy = 179.2 ^---------- ωy = 1.45

σEy = 4353

nx = (A .σEX)/ N ----------> N = 8867

nx = 97.81

nx / (nx - 1) = 1.010

β = 0.60

ny = (A .σEy)/ N ----------> N = 8867

ny = 18.49

ny / (ny - 1) = 1.057

Mx = 4104 kgm

1109.5 kg/cm2 < σ

WF 350 X 175 X 7 X 11

h =	35.0	cm	tb =	0.70	
b =	17.5	cm	ts =	1.10	
A =	63.14	cm2	iy =	3.95	
Ix =	13600.00	cm4	Zx =	775.00	
Iy =	984.00	cm4	Zy =	112.00	
ix =	14.70	cm	σ =	1600	

KIP :

L = 600 cm

h/tb < 75 ---------- h/tb =

L/h > 1.25 b/ts ---------- L/h = 1.25 b/ts = ya

Penampang berubah bentuk ? ------

A' = A sayap + 1/6 A badan

A' = 23.077 cm2

iA' = (1/2 Iy)/A = 4.617 cm

λ = Lky/iA' --------> Lky = 600 cm

λ = 129.94 ----------> ω = 3.26

kip = σ /ω = 490.5 kg/cm2

mx1 = 8639 kgm

mx2 = -11575 kgm

θ = 1.59 iambil 1.59

Faktor tekuk :

Gb = 1 (jepit)

Ga = (Ic/Lc) / (Ib/Lb)

Lb = 3000 cm

Ga = 5.000

k = 1.70

λx = Lkx / ix = --------> Lkx = 600

λx = 40.82 --- ωX = 1.15

-----> ωy = 4.46

λy = Lky / iy

-----> σEX = 12330

λy = 151.9 --- σEy = 897

nx = (A .σEX)/ N ---> N = 3836

nx = 202.95

nx / (nx - 1) = 1.005

β = 0.85

ny = (A .σEy)/ N ---> N = 3836

ny = 14.76

ny / (ny - 1) = 1.073

Mx = 11575 kgm

My = 0 kgm

2299.4 kg/cm2 < σ = 1600 kg/cm2

cm
cm
cm
cm3
cm3
kg/cm2

41.67
36.00
17.36

cm

kg/cm2

kg/cm2
kg

kg

cm
cm
cm
cm3
cm3

kg/cm2

50.00
17.14
19.89

cm

kg/cm2
kg/cm2
kg

kg

office area

COLUMN		B2 - 1ST	2ND - 5TH	6TH - 9TH	10TH - 13TH	14TH - 17TH	18TH - 21TH	22TH - 28TH	
C1		1200 X 1200	1100 X 1100	1000 X 1000	900 X 900	800 X 800	700 X 700	600 X 600	
C2		1000 X 1000	900 X 900	850 X 850	800 X 800	750 X 750	700 X 700	600 X 600	
C3		800 X 800	700 X 700	600 X 600	-	-	-	-	
C4		700 x 700	-	-	-	-	-	-	
C5		2(300 X 1200)	-	-	-	-	-	-	
C6		700 X 700	600 X 600	-	-	-	-	-	

apartment area

COLUMN		B2 - 1ST	2ND - 5TH	6TH - 9TH	10TH - 13TH	14TH - 17TH	18TH - 20TH	21TH - 22TH	
C7		1000 X 1000	900 X 900	850 X 850	800 X 800	750 X 750	700 X 700	600 X 600	
C8		1200 X 1200	1100 X 1100	1000 X 1000	900 X 900	800 X 800	700 X 700	600 X 600	
C9		1000 X 1000	900 X 900	850 X 850	800 X 800	750 X 750	700 X 700	600 X 600	
C10		900 x 900	850 x 850	800 x 800	750 x 750	700 x 700	650 x 650	600 X 600	
C11		700 X 700	-	-	-	-	-	-	
C12		350 X 600	-	-	-	-	-	-	

hotel area

COLUMN		B2 - 1ST	2ND - 4TH	5TH -7TH	8TH - 10TH	11TH - 13TH	14TH - 16TH	
C13		1000 X 1000	900 X 900	850 X 850	800 X 800	700 x 700	600 x 600	
C14		300 X 1200	300 X 1100	300 X 1000	300 X 950	300 X 900	300 X 850	
C14A		300 X 800	300 X 800	300 X 750	300 X 700	300 X 650	300 X 600	
C15		900 x 900	850 x 850	800 x 800	750 X 750	700 X 700	600 X 600	
C16		400 X 1200	400 X 1100	400 X 1000	400 X 950	400 X 900	400 X 850	
C16A		400 X 800	400 X 800	400 X 750	400 X 700	400 X 650	400 X 600	
C16B		(400X800)+(400X1200)	400 X 1100	400 X 1000	400 X 950	400 X 900	400 X 850	
C17		200 X 1200	200 X 1100	-	-	-	-	
C18		700 X700	600 X 600	-	-	-	-	
C19		700 X700	-	-	-	-	-	

swimming,driveway,gymnasium area

COLUMN		B2 - 1ST	2ND - 5TH	
C20		800 X 800	600 x 600	

C21	□	700 x 700	-	

PERHITUNGAN KOLOM BAJA

SC

Profil = WF 300150.6,5.9

Zx =	481	cm3
A =	46.78	cm2
I =	3.29	cm
Lk =	400	cm

Momen =	495	kgm	(elemen 48)
P =	10245	kg	(elemen 48)

σ M/Zx + ω.P/A

λ Lk/I = 121.5805 >>>>> ω = 2.8126

σ 718.88 < 1600 kg/cm2 **(OK)**

TABEL PERHITUNGAN TEGANGAN KOLOM BAJA

gen-hou as C,D,E

Element	Profil	A cm2	ix cm	wx cm3	Lk cm	λ	ω	σEx	M kgcm	N kg	nx	nx-1	nx/nx-1	βx	σ1 kg/cm2	σ2 kg/cm2	σ3 kg/cm2
1	WF 350.175.7.11	63.14	14.7	775	650	44	1.178	10706	132100	3610	187	186	1.005	0.6	170	67	228

CALCULATION OF STEEL COLUMN

generator house

Element	Profil	A cm2	ix cm	wx cm3	Lk cm	λ	ω	σEx	M kgcm	N kg	nx	nx-1	nx/nx-1	βx	σ1 kg/cm2	σ2 kg/cm2	σ3 kg/cm2
C1(3)	WF 350.175.7.11	63.14	14.7	775	350	24	1.024	35983	415200	18416	123	122	1.008	0.6	623	299	827
C2 (11)	WF 200.100.5.5.8	27.16	8.24	184	350	42	1.161	11750	298200	200	1596	1595	1.001	0.6	982	9	1628

σ kg/cm2
1600

σ kg/cm2
1600 1600

TEGANGAN BALOK BAJA

Tegangan ijin = 1.30*1600= 2080 kg/cm2 (beban sementara)

Lt. 2

No Element	Profil	Zx cm3	Momen kgcm	Tegangan kg/cm2	Ket
2&3	WF.300.150.6.5.9	481	652800	1357	OK
4&5	WF.300.150.6.5.9	481	700700	1457	OK
6&7	WF.300.150.6.5.9	481	735000	1528	OK
8&9	WF.300.150.6.5.9	481	738300	1535	OK
10&11	WF.400.150.6.5.9	625	975000	1560	OK
12&13	WF.400.150.6.5.9	625	722900	1157	OK
14&15	WF.400.150.6.5.9	625	813100	1301	OK
16&17	WF.400.150.6.5.9	625	856600	1371	OK
18	WF.300.150.6.5.9	481	436700	908	OK
19&20	WF.400.150.6.5.9	625	832600	1332	OK
21&22	WF.400.150.6.5.9	625	898700	1438	OK
23,24,25	WF.450.200.9.14	1490	1732500	1163	OK
26,27,28	WF.450.200.9.14	1490	1369400	919	OK
29	WF.400.200.8.13	1190	1523600	1280	OK
30,31,32	WF.450.200.9.14	1490	1611000	1081	OK
33	WF.300.150.6.5.9	481	180200	375	OK
34	WF.400.200.8.13	1190	1247000	1048	OK
35	WF.400.200.8.13	1190	1737600	1460	OK
37	WF.300.150.6.5.9	625	749900	1200	OK
38	WF.400.200.8.13	1190	979500	823	OK
40	WF.300.150.6.5.9	481	515200	1071	OK
41	WF.450.200.9.14	1490	2138600	1435	OK
42	WF.400.200.8.13	1190	1768800	1486	OK
44	WF.300.150.6.5.9	481	515200	1071	OK
45	WF.450.200.9.14	1490	2206400	1481	OK
46	WF.400.200.8.13	1190	1832400	1540	OK
48	WF.300.150.6.5.9	481	525300	1092	OK
49	WF.400.150.6.5.9	625	793100	1269	OK
50	WF.450.200.9.14	1490	2240300	1504	OK
51	WF.400.200.8.13	1190	1936000	1627	OK
52	WF.400.200.8.13	1190	1163300	978	OK
53	WF.400.200.8.13	1190	1156100	972	OK
55	WF.300.150.6.5.9	481	525300	1092	OK
56	WF.400.150.6.5.9	625	844900	1352	OK
57	WF.400.200.8.13	1190	1227800	1032	OK
58	WF.400.150.6.5.9	625	1011200	1618	OK
59	WF.400.150.6.5.9	625	700000	1120	OK
60	WF.300.150.6.5.9	481	646800	1345	OK
61	WF.400.200.8.13	1190	2348800	1974	OK

note : Untuk tumpuan " rigid joint " hounc belum diperhitungkan.

PERHITUNGAN RAFTER

PROYEK : RIKEN ASAHI PLASTICS INDONESIA

SUBYEK : WARE HOUSE

RAFTER : SB1 (elemen 4-10, file : ASAHI2.F3F)

PROFIL PAKAI : WF 375 X 125 X 6 X 9

DATA PROFIL

tinggi tampang (h)	=	37.5	cm	tebal badan (tb)	=
lebar sayap (b)	=	12.5	cm	tebal sayap (ts)	=
luas tampang (A)	=	28.92	cm2	jari² inertia sb.y (iy)	=
momen inertia sb. x (Ix)	=	9030.26	cm4	modulus tampang sb.x (Zx)	=
momen inertia sb. y (Iy)	=	293.16	cm4	modulus tampang sb.y (Zy)	=
jari² inertia sb x (ix)	=	17.67	cm	tegangan dasar baja BJ37 (σ)	=

PERSYARATAN KIP (PPBB1 5.1.1) :

panjang penjepitan (L) = 150 cm

h/tb < 75 ----------

L/h > 1.25 b/ts ----------

Penampang berubah bentuk ? ---------

A' = A sayap + 1/6 A badan

A' = 14.820 cm2

iA' = (1/2 Iy)/A = 3.145 cm

λ = Lky/iA' --------> Lky = 150 cm : (panjang tekuk arah tegak lurus sb y)

λ = 47.70 ----------> faktor tekuk Fe 360 (ω) =

tegangan kip = σ /ω = 1311.5 kg/cm2

Mx1 = 2105 kgm : (mx1 & mx2 = momen pada ujung kolom)

Mx2 = 6498 kgm : (syarat : | Mx1| < | Mx2 |)

θ = 0.87 --> diambil ---------->

λx = Lkx / ix = ^---> pj. tekuk tegak lurus sb.x (Lkx) =

λx = 67.91 ^------> faktor tekuk Fe 360 (ωx) =

tegangan Euler (σEx) =

λy = Lky / iy

λy = 47.2 ^-----> faktor tekuk Fe 360 (ωy) =

tegangan Euler (σEy) =

nx = (A .σEx)/ N --> gaya aksial (N) =

nx = 54.05

nx / (nx - 1) = 1.019

βx = 0.60 βy =

ny = (A .σEy)/ N --> gaya aksial (N) =

ny = 113.16

ny / (ny - 1) = 1.009

Mx= 6498 kgm

My= 0 kgm

$\sigma 1 = \omega max.N/A + \beta x.\theta.nx/(nx-1).Mx/Zx + \beta y.ny/(ny-1).My/Zy$ ……PPBBI 4.8.4 (31

= 925.1 kg/cm2 < σ

$\sigma 2 = N/A + \theta.Mx/Zx + My/Zy$……PPBBI 4.8.4 (31b)

= 1432.1 kg/cm2 < σ

0.60 cm
0.90 cm
3.18 cm
481.61 cm3
46.91 cm3
1600 kg/cm2

h/tb = 62.50
L/h = 4.00
1.25 b/ts = 17.36
ya

1.22

1.00

1200 cm
1.44
4482 kg/cm2

1.21
9383 kg/cm2
2398 kg

0.6
2398 kg

.a)

TABEL PERHITUNGAN TEGANGAN BAJA

BALOK BAJA

σ ijin = 1600 kg/cm2

Nomor Batang	Momen (kg cm)	Profil Terpakai	Luas A, (cm²)	M. Tampang Z, (cm3)	σ (kg/cm²)
1,2	561000	WF.350.175.7.11	63.14	775	723.87
39,40	1026400	WF.350.175.7.11	63.14	775	1324.39
68,69	1110100	WF.350.175.7.11	63.14	775	1432.39
66,67	845100	WF.350.175.7.11	63.14	775	1090.45
61,62,63	942700	WF.400.200.8.13	84.12	1190	792.18
64,65	854200	WF.350.175.7.11	63.14	775	1102.19
52,53,54	1620300	WF.400.200.8.13	84.12	1190	1361.60
55,56	1047700	WF.350.175.7.11	63.14	775	1351.87
72,73,100,101	1156700	WF.400.200.8.13	84.12	1190	972.02
102,103	610300	WF.350.175.7.11	63.14	775	787.48
74,75	1034100	WF.400.200.8.13	84.12	1190	868.99
76,77	442500	WF.350.175.7.11	63.14	775	570.97
82,83	1240200	WF.400.200.8.13	84.12	1190	1042.18
84,85	731700	WF.350.175.7.11	63.14	775	944.13
87,88	710700	WF.400.200.8.13	84.12	1190	597.23
89,90	490300	WF.350.175.7.11	63.14	775	632.65
4	656300	WF.375.125.6.9	30.16	502	1307.37
5,6,7	400100	WF.375.125.6.9	30.16	502	797.01
129,8	314100	WF.375.125.6.9	30.16	502	625.70
19	650700	WF.375.125.6.9	30.16	502	1296.22
20,128	650700	WF.375.125.6.9	30.16	502	1296.22
22,107	647400	WF.375.125.6.9	30.16	502	944.13
23	547700	WF.375.125.6.9	30.16	502	917.03
130,48	647700	WF.375.125.6.9	30.16	502	632.65
131,26	656300	WF.375.125.6.9	30.16	502	1307.37
24,25	692400	WF.375.125.6.9	30.16	502	944.13
50,51	681200	WF.375.125.6.9	30.16	502	917.03
12,125	529400	WF.375.125.6.9	30.16	502	632.65
104,124	647700	WF.375.125.6.9	30.16	502	1290.24
30,10	656300	WF.375.125.6.9	30.16	502	632.65
94	415100	WF.375.125.6.9	30.16	502	826.89
112	415100	WF.375.125.6.9	30.16	502	826.89

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Keterangan
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PERHITUNGAN TEGANGAN STRUKTUR BALOK CRANE

(DISAIN AWAL)

Posisi Beban	No elemen	Momen kgm	Profil	Zx cm3	Tegangan kg/cm2
1 (titik 16)	11& 12	6405	WF 350.175.7.11	775	826
2 (titik 24)	13 & 29	6280	WF 350.175.7.11	775	810
3 (titik 25)	14 & 30	6325	WF 350.175.7.11	775	816

σ ijin = 1600 kg/cm2

keterangan
OK
OK
OK

PERHITUNGAN DEFLEKSI STRUKTUR BALOK CRANE

(DISAIN AWAL)

Posisi Beban	Bentang cm	Defleksi cm	Profil	Zx cm3	defleksi ijin (cm)
1 (titik 16)	250	1.4	WF 350.175.7.11	775	2.00
2 (titik 24)	600	0.69	WF 350.175.7.11	775	2.40
3 (titik 25)	600	0.72	WF 350.175.7.11	775	2.40

Syarat Lendutan tsb Berdasarkan Peraturan Perencanaan Bangunan Baja Untuk Gedung 1987
Bab XV Psl. 15.1

Keterangan
2xL/250 (cantilever)
L/250
L/250

KONTROL LENDUTAN

Joint	Bentang (m)	defleksi m	ratio
52	4.375	0.00397	1/ 1102.0
53	4.375	0.00645	1/ 678.3
77	6.000	0.01231	1/ 487.4
78	6.000	0.01203	1/ 498.8
79	6.000	0.01203	1/ 498.8
80	6.000	0.01034	1/ 580.3
81	6.000	0.01375	1/ 436.4
82	6.000	0.01271	1/ 472.1
83	6.000	0.00618	1/ 970.9
84	6.000	0.01333	1/ 450.1
85	6.000	0.01237	1/ 485.0
65	4.150	0.00668	1/ 621.3
66	4.150	0.00504	1/ 823.4
39	5.475	0.00701	1/ 781.0

defleksi ijin = 1/250 L

PERHITUNGAN ELEMEN TRUSS

PROYEK : SUMI RUBBER INDONESIA

SUBYEK : GOLFBALL FACTORY

TRUSS : as X7 (elemen 29)

PROFIL PAKAI : **2L 60 X 60 X 6**

DATA PROFIL

luas tampang (A)	=	11.80	cm2
jari² inertia sb x (ix)	=	1.82	cm
tegangan dasar baja BJ37 (σ)	=	1600	kg/cm2
gaya aksial (N)	=	10500	kg (tekan)
panjang span (L)	=	150.00	cm
λ	=	L / ix	
	=	82.4	^--------> faktor tekuk (ω) = 1.65 (PPBBI)
σ		N.ω / A	
	=		

TABEL PERHITUNGAN TEGANGAN KONSTRUKSI ATAP

Nomor Batang	Panjang (cm)	Gaya Normal N, (kg)	Momen (kg cm)	Profil Terpakai	Luas A, (cm²)	M. Tampa Z, (cm3)	Jari² Giras i, (cm)	λ	ω	N.ω/ A (kg/cm²)
TRUSS										
506X	100	- 28894	0	T(149.299.9.14)	55.40	0	3.59	27.9	1.05	547.63
506Y	300	- 28894	0	T(149.299.9.14)	55.40	0	7.51	39.9	1.14	594.57
547	100	+ 3836	0	T(149.299.9.14)	55.40	0	0.00	0.0	0.00	69.24
596X	100	- 3661	0	T(149.299.9.14)	55.40	0	3.59	27.9	1.05	69.39
596Y	300	- 3661	0	T(149.299.9.14)	55.40	0	7.51	39.9	1.14	75.33
615X	100	- 37675	0	T(149.299.9.14)	55.40	0	3.59	27.9	1.05	714.06
615Y	300	- 37675	0	T(149.299.9.14)	55.40	0	7.51	39.9	1.14	775.26
682X	100	- 25523	0	T(149.299.9.14)	55.40	0	3.59	27.9	1.05	483.74
682Y	300	- 25523	0	T(149.299.9.14)	55.40	0	7.51	39.9	1.14	525.20
700X	100	- 23957	0	T(149.299.9.14)	55.40	0	3.59	27.9	1.05	454.06
700Y	300	- 23957	0	T(149.299.9.14)	55.40	0	7.51	39.9	1.14	492.98
528	200	+ 22400	0	T(150.150.6,5.9)	23.39	0	0.00	0.0	0.00	957.67
525X	100	- 11993	0	T(147.200.8.12)	36.19	0	3.97	25.2	1.03	341.33
525Y	300	- 11933	0	T(147.200.8.12)	36.19	0	4.71	63.7	1.39	458.33
619X	100	- 7278	0	T(147.200.8.12)	36.19	0	3.97	25.2	1.03	207.14
619Y	300	- 7278	0	T(147.200.8.12)	36.19	0	4.71	63.7	1.39	279.54
637	200	+ 32447	0	T(150.150.6,5.9)	23.39	0	0.00	0.0	0.00	1387.22
707	200	+ 19577	0	T(150.150.6,5.9)	23.39	0	0.00	0.0	0.00	836.98
726	200	+ 18095	0	T(150.150.6,5.9)	23.39	0	0.00	0.0	0.00	773.62
630X	200	- 4091	0	T(147.200.8.12)	36.19	0	3.97	50.4	1.23	139.04
630Y	300	- 4091	0	T(147.200.8.12)	36.19	0	4.71	63.7	1.39	157.13
601	200	+ 14714	0	T(150.150.6,5.9)	23.39	0	0.00	0.0	0.00	629.07
690	200	+ 15937	0	T(150.150.6,5.9)	23.39	0	0.00	0.0	0.00	681.36
717X	100	- 6498	0	T(147.200.8.12)	36.19	0	3.97	25.2	1.03	184.94
717Y	200	- 6498	0	T(147.200.8.12)	36.19	0	4.71	42.5	1.17	210.08
516	200	+ 16453	0	T(150.150.6,5.9)	23.39	0	0.00	0.0	0.00	703.42
538X	100	- 18088	0	T(147.200.8.12)	36.19	0	3.97	25.2	1.03	514.80
538Y	200	- 18088	0	T(147.200.8.12)	36.19	0	4.71	42.5	1.17	584.77

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TABEL PERHITUNGAN TEGANGAN ATAP

TR-14

Nomor Batang	Panjang (cm)	Gaya Normal N, (kg)		Profil Terpakai	Luas A, (cm²)	Jari² Girasi i, (cm)	λ	ω	σ (kg/cm²)
1	127.5	-	498	U75~0.55	1.10	2.78	45.9	1.20	541.5
2	127.5	-	79	U75~0.55	1.10	2.78	45.9	1.20	85.9
3	127.5	+	292	U75~0.55	1.10	2.78	0.0	1.00	265.5
4	127.5	+	460	U75~0.55	1.10	2.78	0.0	1.00	418.2
9	79.4	+	18	U75~0.55	1.10	2.78	0.0	1.00	16.4
10	70.5	-	908	U75~0.55	1.10	2.78	25.4	1.03	851.0
11	70.5	-	868	U75~0.55	1.10	2.78	25.4	1.03	813.6
12	80	-	797	U75~0.55	1.10	2.78	28.8	1.06	767.3
13	127.5	-	1333	U75~0.55	1.10	2.78	45.9	1.20	1449.3
14	127.5	-	1600	U75~0.55	1.10	2.78	45.9	1.20	1739.6
15	127.5	-	1669	U75~0.55	1.10	2.78	45.9	1.20	1814.7
22	77	-	16	H70~0.55	1.20	2.40	32.0	1.08	14.4
23	86.6	+	432	H70~0.55	1.20	2.40	0.0	1.00	360.0
24	96.9	-	551	H70~0.55	1.20	2.40	40.3	1.14	525.3
25	99.4	+	292	H70~0.55	1.20	2.40	0.0	1.00	243.3
26	99.4	-	296	H70~0.55	1.20	2.40	41.3	1.15	284.2
27	99.4	+	129	H70~0.55	1.20	2.40	0.0	1.00	107.5
28	99.4	-	136	H70~0.55	1.20	2.40	41.3	1.15	130.3
29	99.4	-	26	H70~0.55	1.20	2.40	41.3	1.15	24.9

σ ijin = 6000 kg/cm2

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TABEL PERHITUNGAN TEGANGAN TRUSS

Akibat Beban Tambahan M/E

Nomor Batang	Panjang (cm)	Gaya Normal N, (kg)	Profil Terpakai	Luas A, (cm^2)	Jari² Girasi i, (cm)	λ	ω	σ = N.ω/ A (kg/cm^2)
73	150	- 34891	T 100.200.8.12	31.77	2.41	62.2	1.363	1496.90
74	150	- 37697	T 100.200.8.12	31.77	2.41	62.2	1.363	1617.28
75	150	- 39529	T 100.200.8.12	31.77	2.41	62.2	1.363	1695.88
76	150	- 39452	T 100.200.8.12	31.77	2.41	62.2	1.363	1692.57
77	150	- 40083	T 100.200.8.12	31.77	2.41	62.2	1.363	1719.65
78	150	- 39664	T 100.200.8.12	31.77	2.41	62.2	1.363	1701.67
79	150	- 37969	T 100.200.8.12	31.77	2.41	62.2	1.363	1628.95

catatan :

OK = σ < σ ijin
NOT OK = σ > σ ijin

σ ijin = σ leleh / SF

σ ijin = 2400/1.5

σ ijin = 1600 kg/m2

Keterangan
OK
NOT OK
NOT OK
NOT OK
NOT OK
NOT OK
NOT OK

PERHITUNGAN TEGANGAN TRUSS ATAP TR1

Nomer Batang : 23
Profil : T 75X150X7X10
L : 140 cm

Data Profil :

h =	7.5	cm	tb =	0.70	cm
b =	15.0	cm	ts =	1.00	cm
A =	15.75	cm2	iy =	3.75	cm
Ix =	66.00	cm4	Zx =	10.80	cm3
Iy =	282.00	cm4	Zy =	37.60	cm3
ix =	1.81	cm	σ =	1600	kg/cm2

Lkx = 140 cm
N = 1631 kg (tarik)
M = 47 kgm
λ L / ix = 0.0 ----------> dari tabel PPBBI --->

σ = ω.N/A = 103.56 kg/cm2

Nomer Batang : 35
Profil : T 75X150X7X10
L : 140 cm

Data Profil :

h =	7.5	cm	tb =	0.70	cm
b =	15.0	cm	ts =	1.00	cm
A =	15.75	cm2	iy =	3.75	cm
Ix =	66.00	cm4	Zx =	10.80	cm3
Iy =	282.00	cm4	Zy =	37.60	cm3
ix =	1.81	cm	σ =	1600	kg/cm2

Lkx = 140 cm
N = 10313 kg (tekan)
M = 24 kgm
λ L / iy = 37.3 ----------> dari tabel PPBBI --->

σ = ω.N/A = 732.71 kg/cm2

Nomer Batang : 29
Profil : T 75X150X7X10
L : 140 cm

Data Profil :

h =	7.5	cm	tb =	0.70	cm
b =	15.0	cm	ts =	1.00	cm
A =	15.75	cm2	iy =	3.75	cm
Ix =	66.00	cm4	Zx =	10.80	cm3

Iy =	282.00	cm4	Zy =	37.60	cm3
ix =	1.81	cm	σ =	1600	kg/cm2

Lkx =		140	cm
N =		14022	kg (tekan)
M =		25	kgm
λ	L / iy =	37.3	----------> dari tabel PPBBI --->

σ = ω.N/A = 996.23 kg/cm2

Nomer Batang : 6
Profil : T 75X150X7X10
L : 140 cm

Data Profil :

h =	7.5	cm	tb =	0.70	cm
b =	15.0	cm	ts =	1.00	cm
A =	15.75	cm2	iy =	3.75	cm
Ix =	66.00	cm4	Zx =	10.80	cm3
Iy =	282.00	cm4	Zy =	37.60	cm3
ix =	1.81	cm	σ =	1600	kg/cm2

Lkx =		140	cm
N =		7221	kg (tekan)
M =		39	kgm
λ	L / iy =	37.3	----------> dari tabel PPBBI --->

σ = ω.N/A = 513.03 kg/cm2

Nomer Batang : 12
Profil : T 75X150X7X10
L : 140 cm

Data Profil :

h =	7.5	cm	tb =	0.70	cm
b =	15.0	cm	ts =	1.00	cm
A =	15.75	cm2	iy =	3.75	cm
Ix =	66.00	cm4	Zx =	10.80	cm3
Iy =	282.00	cm4	Zy =	37.60	cm3
ix =	1.81	cm	σ =	1600	kg/cm2

Lkx =		140	cm
N =		12885	kg (tarik)
M =		1033	kgm
λ	L / iy =	0.0	----------> dari tabel PPBBI --->

σ = ω.N/A = **818.10 kg/cm2**

Nomer Batang : 18
Profil : T 75X150X7X10
L : 140 cm

Data Profil :

h =	7.5	cm	tb =	0.70	cm
b =	15.0	cm	ts =	1.00	cm
A =	15.75	cm2	iy =	3.75	cm
Ix =	66.00	cm4	Zx =	10.80	cm3
Iy =	282.00	cm4	Zy =	37.60	cm3
ix =	1.81	cm	σ =	1600	kg/cm2

Lkx = 140 cm
N = 6989 kg (tarik)
M = 1066 kgm
λ L / iy = 0.0 ----------> dari tabel PPBBI --->

σ = ω.N/A = **443.75 kg/cm2**

Nomer Batang : 44
Profil : 2L 50.50.5
L : 120 cm

Data Profil :

h =	5.0	cm	tb =	0.50	cm
b =	5.0	cm	ts =	0.50	cm
A =	4.80	cm2	iy =	1.51	cm
Ix =	11.00	cm4	Zx =	3.05	cm3
Iy =	11.00	cm4	Zy =	3.05	cm3
ix =	1.51	cm	σ =	1600	kg/cm2

Lkx = 120 cm
N = 3558 kg (tekan)
M = 0 kgm
λ L / iy = 39.7 ----------> dari tabel PPBBI --->

σ = ω.N/A = **420.66 kg/cm2**

Nomer Batang : 61
Profil : 2L 50.50.5
L : 170 cm

Data Profil :

h =	5.0	cm	tb =	0.50	cm

b =	5.0	cm	ts =	0.50	cm
A =	4.80	cm2	iy =	1.51	cm
Ix =	11.00	cm4	Zx =	3.05	cm3
Iy =	11.00	cm4	Zy =	3.05	cm3
ix =	1.51	cm	σ =	1600	kg/cm2

Lkx	=	170	cm
N	=	5009	kg (tarik)
M	=	0	kgm
λ	L / iy =	0.0	----------> dari tabel PPBBI --->

σ = ω.N/A = 521.77 kg/cm2

ω 1 (tarik)

ω 1.119

ω 1.119

ω 1.119

ω 1 (tarik)

ω 1

ω 1.135

ω 1

TABEL PIPA

(Pipa Baja Hitam & Pipa Baja Digalvanis merk SIO)

Diameter Lubang Nominal		Diameter Luar	Tebal	Diameter Bersih	A	Berat	Ix
inch	mm	mm	mm	mm	cm3	Kg/m	cm4
1/2"	15	21.4	2.00	17.40	1.22	0.957	0.58
3/4"	20	26.9	2.00	22.90	1.57	1.228	1.22
1	25	34.1	2.00	30.10	2.02	1.583	2.61
1 1/4	32	42.5	2.00	38.50	2.55	1.997	5.23
1 1/2	40	48.4	2.00	44.40	2.92	2.288	7.86
2	50	60.8	2.00	56.80	3.70	2.900	15.99
2 1/2	65	76.0	2.00	72.00	4.65	3.650	31.86
3	80	88.7	2.90	82.90	7.82	6.136	72.04
4	100	113.9	2.90	108.10	10.12	7.938	155.92
5	125	140.6	2.90	134.80	12.55	9.847	297.60
6	150	166.1	2.90	160.30	14.87	11.671	495.37
8	200	219.1	5.00	209.10	33.64	26.399	1928.82
10	250	273.0	5.00	263.00	42.11	33.044	3782.34
12	300	323.8	6.35	311.10	63.35	49.710	7983.77
14	355	355.6	6.35	342.90	69.70	54.689	10630.68
16	400	406.4	6.35	393.70	79.84	62.644	15975.73
18	400	457.4	9.00	439.40	126.83	62.644	31889.59

Note :

$Ix = \pi/64.D^4$

$Zx = \pi/32.D^3$

Zx cm3
0.54
0.91
1.53
2.46
3.25
5.26
8.38
16.24
27.38
42.33
59.65
176.07
277.09
493.13
597.90
786.21
1394.39