E.2 PLAT DAN JUMLAH ALAT SAMBUNG

Kontrol Profil

Data-data

P	**18,297**	kg	Bj. 33/37/41/44/50//52 ?
diameter alat sambung (d)	**1**	cm	σ (ijin)

*Dicoba Profil **L70.70.7*** *F(cm2) =* ***9.4*** *> 5.71788575 cm2 (O*

Fperlu = 18297.2344 / 1600 = 11.435772 cm2 (untuk 2 penampang p

F perlu untuk 1 profil = 11.435772 / 2

= 5.72 cm2

F netto profil = 9.4 - 2 x 0.7 x 1

= 8.00 cm2 > 5.72 cm2 (Aman)

Perhitungan Plat Penyambung

Data-data

P	**18,297**	kg	Bj. 33/37/41/44/50//52 ?
diameter alat sambung (d)	**1**	cm	σ (ijin)

Tebal Plat Penyambung *L(cm) =* **50.00**

Fperlu = 18297.2344 / 1600 = 11.436 cm2 (untuk 2 penampang p

δ = 11.436 / (50-1)

= 0.23 cm ~ 0.30

Perhitungan baut

Data-data

P	**18,297**	kg	Bj. 33/37/41/44/50//52 ?
tebal plat sambung (δ)	**1.00**	cm	σ (ijin)
diameter alat sambung (d)	**1.6**	cm	- *sambungan iris* ***ganda***

σ (tp) = 1.5 x 1600 = 2400 kg/cm2

τ (baut) = 0.58 x 1600 = 928 kg/cm2

σ (t) = 0.7 x 1600 = 1120 kg/cm2

Jumlah baut

Ngs = 2x0.25x3.14x1.6^2x928 = 3730 kg

Ntp = 1.6 x 1 x 2400 = 3840 kg

Nmax = 3840 kg

n = 18297.2344 / 3840 = 5.96 buah ~~~ 6

37
1600

k)
rofil)

37
1600

rofil)

cm

37
1600

buah

PENGARUH LUBANG BAUT

Dasar-Dasar Peraturan Perencanaan

- *Peraturan Perencanaan Bangunan Baja Indonesia (PPBBI)*, Penerbit Yayasan Lembaga Penyelidikan Masalah Bangunan, Bandung, 1984
- Ir. Oengtoeng, *Konstruksi Baja*, LPPM Universitas Kristen PETRA Surabaya, Penerbit Ansi Yogyakarta, 1999
- Teguh Santoso, *Catatan Kuliah*, Universitas Negeri Malang, Malang, 1992-1998
- Teguh Santoso SPd, *Perhitungan Struktur OPTIMALISASI KEBUN-KEBUN BENIH DI BBI HORTIKULTURA SE - JAWA TIMUR* Desa Jebeen Kec Jaboan Kab Sampang, Desa Kincang Wetan Kec Jiwan Kab Madiun, Desa Lebo Kec Pudjon Kab Malang, Surabaya, Februari 2008

Pengaruh Penempatan Lubang Terhadap Luas Netto

Menurut PPBBI pasal 3.3.1 :

" Tegangan rata-rata pada batang tarik didapat dari gaya tarik yang bekerja diba luas penampang bersih. Tegangan tersebut harus tidak boleh lebih besar dari teg dasar untuk penampang tidak berlubang, dan *tidak boleh lebih besar dari 0,75 k tegangan dasa*r untuk penampang berlubang."

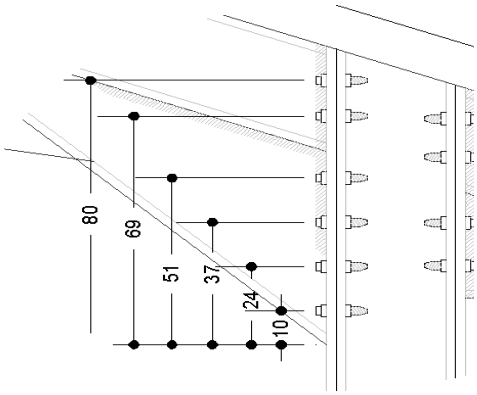
Kontrol Tegangan Sambungan Baut

a. ***Data-data 1***

- Lokasi Desa Kincang Wetan Kec Jiwan Madiun
- Type Kuda-kuda A (Rev)
- Nilai D, N, M diambil dari hasil perhitungan software SAP2000 NonLinier Versi 9.0.3

M	=	**932.00** kgm
D	=	**1711.53** kg
N	=	**243.16** kg
α	=	**20** derajat

Dipakai D19



Moment Inersia

- h dihitung dari tepi plat

diameter alat sambung (d) **1.9** cm

	h	*h^2*
h1	**1.1** cm	1.21 cm2
h2	**2.4** cm	5.76 cm2
h3	**4.3** cm	18.49 cm2
h4	**4.3** cm	18.49 cm2
h5	**4.3** cm	18.49 cm2
h6	**5.3** cm	28.09 cm2
htot =	21.7 cm	A = 90.53 cm2

F = 1/4 x 3.14 x 1.9^2 = 2.83 cm2

penguranga tegangan kar adanya lubang

Tegangan tarik max untuk satu baut

$$N = \frac{93200 \times 5.3}{2 \times 90.53} = 2728.16 \text{ kg}$$

$$\sigma = \frac{2728}{2.83} = 962.70 \text{ kg/cm2} < 0.75 \times 1600 = 1200 \text{ kg/c}$$

(OK)

Akibat gaya lintang dan gaya normal

N = 243.16 kg α = 20

Q = 1711.53 kg
D = 1,711.53 x cos 20 + 243.16 sin 20
= 1691.48 kg

$\tau = \frac{D}{\text{jml baut x } F}$

$= \frac{1691.48}{12 \text{ x } 2.83} =$ 49.74 kg/cm2

Tegangan Idiil
σ (ijin) = 1600 kg/cm2 *(PPBBI Tabel 1)*

$\sigma i = \sqrt{\sigma + 1{,}56 \cdot \tau}$ *(PPBBI pasal 8.2.1)*

= sqrt(962.70^2 + 1.56 x 49.74^2)
= 964.71 kg/cm2 < 1600 kg/cm2 **(OK)**

b. *Data-data 2*
- Lokasi Desa Lebo Kec Pudjon Kab Malang
- Type Kuda-kuda B
- Nilai D, N, M diambil dari hasil perhitungan software SAP2000 NonLinier Versi 9.0.3

M = **188.00** kgm
D = **715.32** kg
N = **239.99** kg
α = **15** derajat
Dipakai D16

Moment Inersia
- h dihitung dari tepi plat
diameter alat sambung (d) **1.6** cm

	h		*h^2*	
h1	**0.7**	cm	0.49	cm2
h2	**1.6**	cm	2.56	cm2
h3	**2.6**	cm	6.76	cm2
h4	**3.8**	cm	14.44	cm2
h5	**4.7**	cm	22.09	cm2
h6	**5.6**	cm	31.36	cm2
htot =	19	cm	A = 77.7	cm2

F = 1/4 x 3.14 x 1.6^2 = 2.01 cm2

penguranga
tegangan kar
adanya lubang

Tegangan tarik max untuk satu baut
N = $\frac{18800 \text{ x } 5.6}{2 \text{ x } 77.7}$ = 677.48 kg

$\sigma = \frac{677}{2.01} =$ 337.12 kg/cm2 < 0.75 x 1600 = 1200 kg/c
(OK)

Akibat gaya lintang dan gaya normal
N = 239.99 kg α = 15
Q = 715.32 kg
D = 715.32 x cos 15 + 239.99 sin 15
= 753.06 kg

$\tau = \frac{D}{\text{jml baut x } F}$

$= \frac{753.06}{} =$ 31.23 kg/cm2

12 x 2.01

Tegangan Idiil

σ (ijin) = 1600 kg/cm2 *(PPBBI Tabel 1)*

σi = $\sqrt{\sigma^2 + 1{,}56 \cdot \tau^2}$ *(PPBBI pasal 8.2.1)*

= sqrt(337.12^2 + 1.56 x 31.23^2)

= 339.37 kg/cm2 < 1600 kg/cm2 **(OK)**

c. *Data-data 3*

- Lokasi Desa Lebo Kec Pudjon Kab Malang
- Type Kuda-kuda B
- Nilai D, N, M diambil dari hasil perhitungan software SAP2000 NonLinier Versi 9.0.3

M = **36.77** kgm
D = **181.73** kg
N = **130** kg
α = **15** derajat
Dipakai D16

Moment Inersia

- h dihitung dari tepi plat

diameter alat sambung (d) **1.6** cm

	h	*h^2*
h1	**0.7** cm	0.49 cm2
h2	**1.8** cm	3.24 cm2
h3	**3** cm	9 cm2
h4	**4.6** cm	21.16 cm2
h5	**5.5** cm	30.25 cm2
htot =	15.6 cm	A = 64.14 cm2

F = 1/4 x 3.14 x 1.6^2 = 2.01 cm2

penguranga
tegangan kar
adanya lubang

Tegangan tarik max untuk satu baut

$N = \frac{3677 \times 5.5}{2 \times 64.14} = 157.65$ kg

$\sigma = \frac{158}{2.01} = 78.45$ kg/cm2 < 0.75 x 1600 = 1200 kg/c

(OK)

Akibat gaya lintang dan gaya normal

N = 130.00 kg α = 15
Q = 181.73 kg
D = 181.73 x cos 15 + 130.00 sin 15
= 209.18 kg

$\tau = \frac{D}{\text{jml baut} \times F}$

$= \frac{209.18}{10 \times 2.01} = 10.41$ kg/cm2

Tegangan Idiil

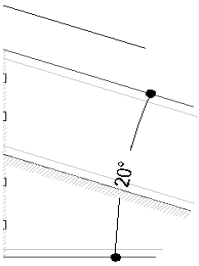
σ (ijin) = 1600 kg/cm2 *(PPBBI Tabel 1)*

σi = $\sqrt{\sigma^2 + 1{,}56 \cdot \tau^2}$ *(PPBBI pasal 8.2.1)*

= sqrt(78.45^2 + 1.56 x 10.41^2)

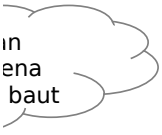
= 79.52 kg/cm2 < 1600 kg/cm2 **(OK)**

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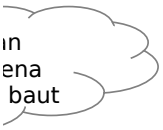


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m2
(PPBBI pasal 3.3.1)



m2
(PPBBI pasal 3.3.1)



m2
(PPBBI pasal 3.3.1)

E. KONSOL WF I 150.75.5,7 (L = 1.15 M)

E.1. Perhitungan Dimensi Konsol

Data-data

- Jarak kuda-kuda max	=	**300**	cm		
- Bentang konsol (Ls)	=	**115**	cm		
- Berat penutup atap	=	**75**	kg/m2		
- Berat angin	=	**30**	kg/m2		
- Kemiringan kuda-kuda	=	**30**	derajat		
- Direncanakan gording	**C.150.65.20.3,2**				
g	=	**7.51**	kg/m'		
- Direncanakan konsol	**WF I 150.75.5,7**				
Wx	**88.8**	cm3	h	**15**	cm
Wy	**13.2**	cm3	b	**7.5**	cm
Ix	**666**	cm4	ts	**0.7**	cm
Iy	**49.5**	cm4	tb	**0.5**	cm
A	**17.85**	cm2			
g	**14**	kg/m'			

Kesimpulan :

- Tegangan ***(OK)***
- KIP ***(OK)***
- Geser ***(OK)***
- Lipat ***(OK)***

Pembebanan

- Bs. Konsol	=	14 kg/m'
- Bs. Gording = (5 x 7.51 x 3)/6.7	=	16.81 kg/m'
- Bs. Atap = 75 x 3	=	225 kg/m'
- Bs. Orang = (5 x 100)/6.7	=	74.63 kg/m'
- Bs. Plafond+penggantung = 18 x 3		
	=	54 kg/m'
		384.44 kg/m'
lain-lain 10%		38.44 kg/m'
q total		422.88 kg/m'

Moment

q	=	422.88	kg/m'	α =	30
Ls	=	1.15	m		
MA	=	1/2 x 422.88 x 1.0 x 1.15			
	=	243.16	kgm		
VA	=	422.88 x 1.15	=	486.32	kg
NA	=	486.32 x sin 30	=	243.16	kg
DA	=	486.32 x cos 30	=	421.16	kg

Akibat angin

		30	kg/m2		
- Lkd	=	3	m		
- Ls	=	1.15	m		
wt	=	0.2 x 30 x 3	=	18	kg/m'
N	=	1/2 x 18 x 1.15^2	=	11.90	kgm'
D	=	18 x 1.15	=	20.7	kg

Kombinasi Pembebanan

Mmax	=	243.16 + 11.90	=	255.06	kgm
Nmax	=		=	243.16	kg
Dmax	=	421.16 + 20.70	=	441.86	kg

Kontrol Tegangan

Wx	=	88.8	cm3	Bj. 33/37/41/44/50//52 ?		**37**
A	=	17.85	cm3	σ (ijin)	1600	kg/cm2
N	=	243	kgcm			
M	=	25506	kgcm			

σ = 243 / 17.85 + 25,506 / 88.8
= 300.85 kg/cm2 < 1600kg/cm2 **(OK)**

Kontrol Stabilitas KIP

h	**15** cm	b	**7.5** cm
tb	**0.5** cm	ts	**0.7** cm
Ls	**115** cm	Iy	**49.5** cm4

Fe 310/360/430/510 ? **360**
σ (ijin) 1600 kg/cm2

$\frac{150}{5}$ = 30.00 <= 75

$\frac{1150}{150}$ = 7.67 < $\frac{1.25 \times 75}{7}$ = 13.39 **berubah**

Balok berubah bentuk (KIP)

h	**15** cm	b	**7.5** cm
tb	**0.5** cm	ts	**0.7** cm
Ls	**115** cm	Iy	**49.5** cm4

Fe 310/360/430/510 ? **360**
σ (ijin) 1600 kg/cm2

A' = (15 x 0.7) + (1/6 x 13.6 x 0.5) = 11.63 cm2
iy = sqrt(0.5 x 49.5/11.63) = 1.459
λ y = $\frac{115}{1.459}$ = 78.84 ===> ω y =

σ kip = $\frac{1600}{1.599}$ = 1000.63 kg/cm2

Balok tidak berubah bentuk (KIP)
- Badan balok diberi pengkau samping
- Statis tertentu

h	**24.8** cm	b	**12.4** cm
tb	**0.5** cm	ts	**0.8** cm
Ls	**640** cm	Iy	**49.5** cm4

Fe 310/360/430/510 ? **360**
σ (ijin) 1600 kg/cm2

C1 = $\frac{640 \times 24.8}{12.4 \times 0.8}$ = 1600

C2 = $\frac{0.63 \times 2100000}{1600}$ = 826.88

1600 =< 250

σ kip = 1600 kg/cm2

250 < 1600 < 826.88

σ kip = 1600 - ((1600 - 250) / (826.875 - 250) x 0.3 x 1600
= 476.71 kg/cm2

1600 > 826.88

σ kip = $\frac{826.88 \times 0.7 \times 1600}{1600}$ = 578.81 kg/cm2

Jadi

σ kip = *578.81* kg/cm2 < 1600 kg/cm2 **(OK)**

- Badan balok tidak diberi pengkau samping

σ kip = 0.042 x 1600 x 826.88 x (0.5 / 24.8)^3 x 1600

= 728.59 kg/cm2 > 578.81 kg/cm2 **(OK)**

Balok tidak berubah bentuk (KIP)

- Badan balok diberi pengkau samping

- Statis tak tertentu

h	**24.8** cm	b	**12.4** cm	Mki	**1250**
tb	**0.5** cm	ts	**0.8** cm	Mka	**1325**
Ls	**640** cm	Iy	**0** cm4	Mjep	**1122**

Fe 310/360/430/510 ? **360**

σ (ijin) 1600 kg/cm2

$$C1 = \frac{640 \times 24.8}{12.4 \times 0.8} = 1600$$

$$C3 = \frac{0.21(1+2.30)(3 - 2 \times 2.30) \times 210000}{1600} = 640.26$$

$$\beta\star = \frac{(1250 + 1325)}{2 \times 1122} = 2.30$$

1600 =< 250

σ kip = 1600 kg/cm2

250 < 1600 < 640.26

σ kip = 1600 - ((1600 - 250) / (640.26 - 250) x 0.3 x 1600

= -60.42 kg/cm2

1600 > 640.26

$$\sigma \text{ kip} = \frac{640.26 \times 0.7 \times 1600}{1600} = 448.18 \text{ kg/cm2}$$

Jadi

σ kip = *448.18* kg/cm2 < 1600 kg/cm2 **(OK)**

- Badan balok tidak diberi pengkau samping

σ kip = 0.042 x 1600 x 640.26 x (0.5 / 24.8)^3 x 1600

= 564.16 kg/cm2 > 448.18 kg/cm2 **(OK)**

Kontrol Geser

h	**15** cm	b	**7.5** cm
tb	**0.5** cm	ts	**0.7** cm
Ls	**115** cm	Ix	**666** cm4

Fe 310/360/430/510 ? **360**

σ (ijin) 1600 kg/cm2

δ x = (7.5 x 0.7){0.5 x (15-0.7)} + (0.5 x 6.8) x 3.4

= 49.10 cm3

D = **441.86** kg

$$\tau = \frac{(441.86 \times 49.10)}{0.5 \times 666} = 65.15 \text{ kg/cm2} < 0.5 \times 1600 = 928 \text{ kg/cm2}$$

Kontrol Lipat

σ r	=	3267	kg/cm2	bp =	3.75	cm
σ d	=	**1000.63**	kg/cm2	tp =	0.7	cm

$\frac{3.75}{0.7}$ = 5.357 < 10 x sqrt(3267/1,000.63) = 18.07 **(OK)**

E.2. Perhitungan Sambungan

Data-data

M = **255.06** kgm
Dipakai D16
Fe 310/360/430/510 ? **360**
σ (ijin) 1600 kg/cm2

Moment Inersia

- h dihitung dari jarak alat sambung pertama (h0)
diameter alat sambung (d) **1.6** cm

	h		*h^2*	
h1	**25**	cm	625	cm2
h2	**14**	cm	196	cm2
h3	**3**	cm	9	cm2
htot =	42	cm	A = 830	cm2

F = 1/4 x 3.14 x 1.6^2 = 2.01 cm2
Ix = 2 x 2.01 x 830 = 3335.936 cm4

Tegangan tarik max untuk satu baut

N = $\frac{25506 \times 25}{2 \times 830}$ = 384.13 kg

σ = $\frac{384}{2.01}$ = 191.15 kg/cm2 < 0.7 x 1600 = 1120 kg/cm **(OK)**

Akibat gaya lintang dan gaya normal

N = **243.16** kg α = **30**
Q = **441.86** kg
D = 441.86 x cos 30 + 243.16 sin 30
= 504.24 kg

τ = $\frac{504.24}{6 \times 2.01}$ = 41.82 kg/cm2

Tegangan Idiil

Fe 310/360/430/510 ? **360**
σ (ijin) 1600 kg/cm2

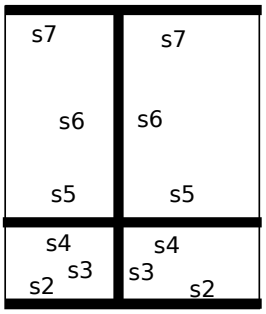
σi = sqrt(191.15^2 + 1.56 x 41.82^2)
= 198.15 kg/cm2 < 1600 kg/cm2 **(OK)**

Perhitungan Kekuatan Las

- Tebal plat	**0.6** cm	- b	**7.5** cm
- ts	**0.7** cm	- h	**15** cm
- tb	**0.5** cm	α	**30**

Tebal las badan = 1/2 x sqrt(2) x 0.5 = 0.35 cm
Tebal las sayab = 1/2 x sqrt(2) x 0.7 = 0.49 cm

s8



Statis Moment

las terhadap las bagian bawah

s2 =	2(3.5x0.49)1.4	=	4.71	cm3
s3 =	2(9.3x0.35)5.8	=	38.44	cm3
s4 =	2(3.5x0.49)10.2	=	35.22	cm3
s5 =	2(3.5x0.49)11.4	=	39.36	cm3
s6 =	2(15.2x0.35)18.7	=	201.29	cm3
s7 =	2(3.5x0.49)26.3	=	90.95	cm3
s8 =	(7.5x0.49)27.3	=	101.27	cm3
			511.24	cm3

A = 3.71 + 3.46 + 6.58 + 3.46 + 3.46 + 10.76 + 3.46 + 3.71

= 38.62 cm2

Yb = 511.24/38.62 = 13.24 cm

Ya = 28.02 - 13.24 = 14.78 cm

Inersia Las

Ix1 =	(1/12 x 7.5 x 0.49^3) + (3.71 x 12.91^2) =	618.51	cm4
Ix2 =	2(1/12 x 3.5 x 0.49^3) + (3.46 x 11.88^2) =	488.83	cm4
Ix3 =	2(1/12 x 0.35 x 9.30^3) + (6.58 x 7.19^2) =	387.07	cm4
Ix4 =	2(1/12 x 3.50 x 0.49^3) + (3.46 x 2.91^2) =	29.35	cm4
Ix5 =	2(1/12 x 3.50 x 0.49^3) + (3.46 x 1.88^2) =	12.28	cm4
Ix6 =	2(1/12 x 0.35 x 15.22^3) + (10.76 x 5.33^2) =	513.91	cm4
Ix7 =	2(1/12 x 3.50 x 0.49^3) + (3.46 x 13.42^2) =	624.41	cm4
Ix8 =	(1/12 x 7.5 x 0.49^3) + (3.71 x 14.45^2) =	775.60	cm4
	Ix =	3449.95	cm4

Momen Tahanan

Ix	=	3449.95	cm4
ya	=	14.78	cm
yb	=	13.24	cm

$$Wb = \frac{3449.95}{13.24} = 260.63$$

$$Wa = \frac{3449.95}{14.78} = 233.36$$

Kontrol Tegangan

M	=	**255**	kgcm	Bj. 33/37/41/44/50//52 ?		**37**
W	=	**233.36**	cm3	σ (ijin)	1600	kg/cm2
P(N)	=	**243**	kg			
F	=	**38.62**	cm2			
D	=	**442**	kg			

σ a	=	255 / 233.36				
	=	1.09 kg/cm2				
σ n	=	243 / 38.62				
	=	6.30 kg/cm2				
τ	=	442 / 38.62				
	=	11.44 kg/cm2				
σ b	=	6.30 + 11.44				
	=	17.74 kg/cm2				
σ i	=	sqrt(1.09^2 + 3 x 17.74^2)				
	=	30.74 kg/cm2	<	1600kg/cm2	**(OK)**	

ı bentuk

1.599

kgm
kgm
kgm

(OK)

ı2

C1. SAMBUNGAN BALOK ANAK DAN BALOK INDUK

C.1. Data-data

M	=	**1039994**	kgcm
P	=	**718.98**	kg
d (baut)	=	**1.58**	cm
(tebal plat)		**1**	cm
#REF!			

Hub. Balok anak dengan baja siku adalah samb. Iris ganda (Baut A)

Data-data

P	**718.98**	kg	Bj. 33/37/41/44/50//52 ?		**37**
tebal plat sambung (δ)	**1.00**	cm	σ (ijin)		1600
diameter alat sambung (d)	**1.58**	cm	- *sambungan iris* ***ganda***		

σ (tp)	=	1.5 x 1600	=	2400	kg/cm2	
τ (baut)	=	0.58 x 1600	=	928	kg/cm2	
σ (t)	=	0.7 x 1600	=	1120	kg/cm2	

Jumlah alat sambung

Ngs =	2x0.25x3.14x1.58^2x928		=	3637	kg	
Ntp =	1.58 x 1 x 2400		=	3792	kg	
		Nmax	=	3792	kg	
n	=	718.98 / 3792	=	0.18	buah ~~~	**2** buah

Hub. Balok induk dengan baja siku adalah samb. Iris tunggal (Baut B)

Data-data

P	**718.98**	kg	Bj. 33/37/41/44/50//52 ?		**37**
tebal plat sambung (δ)	**1.00**	cm	σ (ijin)		1600
diameter alat sambung (d)	**1.58**	cm	- *sambungan iris* ***tunggal***		

σ (tp)	=	1.5 x 1600	=	2400	kg/cm2	
τ (baut)	=	0.58 x 1600	=	928	kg/cm2	
σ (t)	=	0.7 x 1600	=	1120	kg/cm2	

Jumlah alat sambung

Ngs =	1x0.25x3.14x1.58^2x928		=	1819	kg	
Ntp =	1.58 x 1 x 2400		=	3792	kg	
		Nmax	=	3792	kg	
n	=	718.98 / 3792	=	0.18	buah ~~~	**2** buah

Baut b hanya menerima gaya lintang

Data-data

P	**718.98**	kg	Bj. 33/37/41/44/50//52 ?		**37**
tebal plat sambung (δ)	**1.00**	cm	σ (ijin)		1600
diameter alat sambung (d)	**1.58**	cm	- *sambungan iris* ***tunggal***		
n	**2**	buah			

σ (tp)	=	1.5 x 1600	=	2400	kg/cm2

Δ (R)	=	718.98	=	179.745	kg

$$\sigma\ (tv) = \frac{\frac{179.75}{2 \times 2}}{1 \times 1.58} = 113.8\ kg/cm2 < 2400\ \textbf{(OK)}$$

$$\sigma\ (t) = \frac{179.75}{0.25x3.14x1.58^2x1} = 91.72\ kg/cm2$$

Baut a hanya menerima gaya moment penuh

Data-data

No.
X
Y
X^2
Y^2

BEBAN TERPUSAT ATAP

Nama Proyek : _____ Jenis Kegiatan : _____

Beban orang (kg)	100
Beban mati (kg)	50
Jarak kuda-kuda (m)	3
Jarak antar gording (m)	1.9
Sudut kuda-kuda (derajat)	38
Tekanan angin (kg/m2)	73

Beban mati

Ptengah = (orang+mati).Skuda-kuda.Sgording	855
Ppinggir = Ptengah/2	427.5

Beban angin

derajat<=65 = (0,02.sudut-0,4).Skuda-kuda.Sgording.Tangin	149.796
65<=derajat<=90 = (0,9).Skuda-kuda.Sgording.Tangin	374.49
Pangintekan	149.796
txt=Panginkiri.sin(derajat)	92.22363
tyt=Panginkiri.cos(derajat)	118.0409
Pangintarik=0,4.Skuda-kuda.Sgording.Tangin	166.44
hxt=Panginkiri.sin(derajat)	102.4707
hyt=Panginkiri.cos(derajat)	131.1565

Titik kordinat beban terpusat rangka atap

beban mati (L=1)

Psendiri pinggir = Ppinggir	**0** ,
Psendiri tengah = Ptengah	**0** ,
Psendiri pinggir = Ppinggir	**0** ,

beban angin (L=2)

Pangin tekan tumpuan (x,y) = (txt/2 , -tyt/2)	**46.11181** ,
Pangin tekan tengah (x , y) = (txt,-tyt)	**92.22363** ,
Pangin ujung (x,y) = (hxt+txt , hyt+tyt)	**194.6943** ,
Pangin tarik tengah (x , y) = (hxt,hyt)	**102.4707 ,**
Pangin tarik tumpuan (x,y) = (hxt/2 , hyt/2)	**51.23535 ,**

-427.5
855
-427.5

-59.020429
-118.04086
13.115651
131.15651
65.5782549

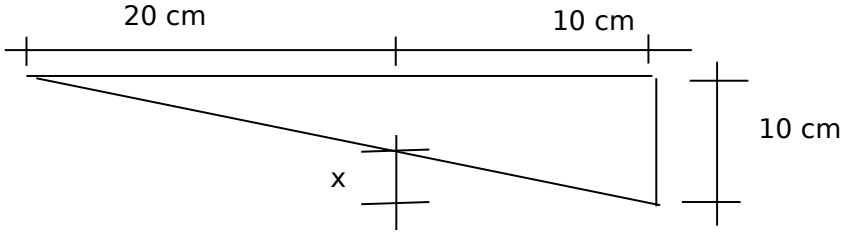
LAS ANAK TANGGA

Proyek : Cameron

Kontrol Konsol Plat Anak Tangga

Py (kg)	933.9		
Mz (kgm)	560.4		
Tegangan ijin baja	1600		
Dimensi plat (b xh cm)	0.4	x	30
A1plat = b.h	12		
Jumlah plat	3		
tegplat = Py/(jmlplat.Aplat)	25.94		
tegplat < tegijin	Luas plat Ok		

Menentukan ukuran plat penyangga

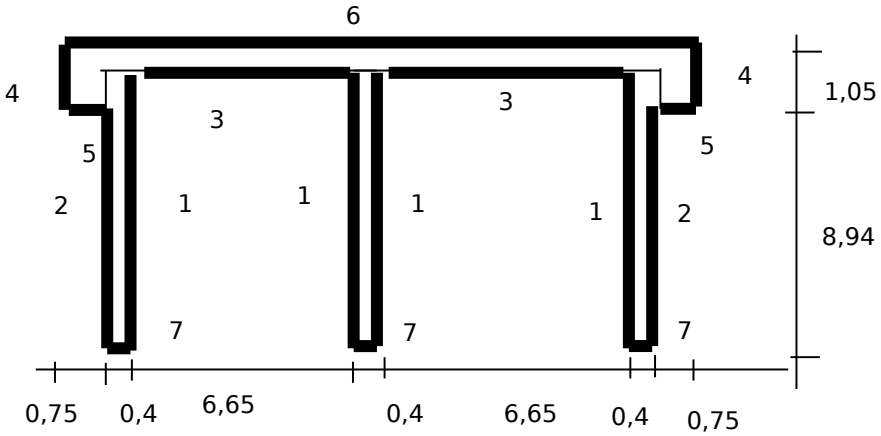


x = (10.10)/30	3.3	cm

Kontrol jarak e

eplat	30	cm
eijin =M/Py	60	cm
eplat < eijin	OK	
jika eplat = 30 cm		
Mplat = Py. eplat	280.2	kgm

Kontrol las balok utama dengan las plat konsol



Statis moment

Tebal las badan = 1/2.sqrt(2).0,75 0.53 dipakai 0.6

Tebal las sayap = 1/2.sqrt(2).1.05 0.74 dipakai 0.8

No. Las	Jumlah	y	b	h	A=b.h	A.y	sy=yb-y
1	4	5.425	0.6	9.25	5.55	30.1087	-5.425
2	2	5.27	0.6	8.94	5.364	28.2683	-5.27
3	2	9.25	6.65	0.8	5.32	49.21	-9.25
4	2	10.79	0.6	1.05	0.63	6.7977	-10.79
5	2	9.201	0.75	0.8	0.6	5.5206	-9.201
6	1	11.06	16	0.8	12.8	141.568	-11.06
7	3	0.53	0.4	0.8	0.32	0.1696	-0.53
					30.584	261.643	Jml(Iy)

yb = Jml(A.y)/Jml(A)		8.55
Wp=JmlIy/yb		457
tegtekan= P/jmlA	30.54	
teggeser = Mplat/wp	61.35	
tegijin = 0,75.tegijinbj	1200	
teglas = sqrt(teggeser^2 + 3.(tegtekan)^2)	81	
teglas < tegijin	Kontrol las OK	

jml(1/12.b.h^3+A.sy^2)

811.6505
369.3993696
910.952466666667
146.8101285
101.6540812
1566.42474666667
0.320864
3907.21215663333

C.2 KONSOL WF 75.150.5.7

C.2.1 Pembebanan

Data-data

Direncanakan memakai Konsol **WF 75.150.5.7**

h	=	15	cm	Jarak kuda2 max	=	3
b	=	7.5	cm	Bentang kuda-kuda	=	6.7
tb	=	0.5	cm	Berat penutup atap	=	75
ts	=	0.7	cm	Kemiringan atap	=	20
Wx	=	88.8	cm3	***Gording***		
A	=	17.85	cm2	Jarak gording	=	1.6
Ix	=	666	cm4	Berat gording	=	7.5
Iy	=	49.5	cm4	Berat plafond	=	18
G	=	14	kg/m'			

Pembebanan

- Berat sendiri konsol		14	kg/m'	n =	6.7 / cos 20 x1
- Berat sendiri gording					
{5x(7.5)x3}/6.7	=	16.791	kg/m'	n =	5
- Berat atap 75x3	=	225	kg/m'		
- Berat muatan hidup					
(5x100)/6.7		74.627	kg/m'		
- Berat plafond + penggantung					
3 x 18		54	kg/m'		
		384.42	kg/m'		
Lain-lain 10%		38.442			
		422.86	kg/m'		

C.2.2 Statika

- Balok Tumpuan jepit-jepit

P	=	0.00	kg	**(1)**	*max (3)*
q	=	422.86	kg/m'		
L induk	=	6.7	m		
L anak	=	3	m		

Mlap = (0.041x422.9x6.7^2) = 778.27 kgm

Mtump = (0.083x422.9x6.7^2) = 1575.52 kgm

D = (1/2x422.86x6.7) = 1416.58 kg

Statika

Dari hasil SAP 2000

D	=	**441.87**	kg
N	=	**243.16**	kg
Mtum	=	**255.06**	kgm
Mlap	=	**255.06**	kgm
f	=	**1.024**	cm

C.2.3 Kontrol Balok dipakai WF 150.75.5.7

Data-data

Dipakai		**WF 150.75.5.7**			
h	=	15	cm	Lendutan	**melendut**
b	=	7.5	cm	Geser	**(OK)**
tb	=	0.5	cm	Lipat balok	**(OK)**
ts	=	0.7	cm	KIP	**(OK)**
Wx	=	88.8	cm3		
A	=	17.85	cm2		
Ix	=	666	cm4		

Kesimpulan

Tegangan **OK**

Iy = 49.5 cm4

Kontrol Tegangan

Wx	=	88.8	cm3	Bj. 33/37/41/44/50//52 ?		**37**
A	=	17.85	cm3	σ (ijin)	1600	kg/cm2
P	=	243	kgcm			
M	=	25506	kgcm			

σ = 243 / 17.85 + 25,506 / 88.8
= 300.85 kg/cm2 < 1600kg/cm2

Kontrol Lendutan

L	=	670	cm		
Ix	=	666	cm4		
f ijin	=	1/360 x 670	=	1.86	cm
qx	=	422.86	kg/m'		

$$f = \frac{5 \times 42286 \times 670^4}{384 \times 2100000 \times 666}$$

= 7.93306048868809
= 7.933 cm > 1.86 cm **melendu**

Kontrol Geser

h		**15**	cm	b	**7.5**	cm
tb		**0.5**	cm	ts	**0.7**	cm
Ls		**670**	cm	Ix	**666**	cm4
Fe 310/360/430/510 ?		**360**				
σ (ijin)	1600	kg/cm2				

δ x = (7.5 x 0.7){0.5 x (15-0.7)} + (0.5 x 6.8) x 3.4
= 49.10 cm3
D = **441.87** kg

$$\tau = \frac{(441.87 \times 49.10)}{0.5 \times 666} = 65.15 \text{ kg/cm2} < 0.5 \times 160($$

Kontrol Lipat

σ r	=	3267	kg/cm2	bp =	7.5	cm
σ d	=	**300.85**	kg/cm2	tp =	0.7	cm

$\frac{7.5}{0.7}$ = 10.714 < 10 x sqrt(3267 / 300.85) = 32.95

Kontrol Stabilitas KIP

h	**15**	cm	b	**7.5**	cm
tb	**0.5**	cm	ts	**0.7**	cm
Ls	**670**	cm	Iy	**666**	cm4
Fe 310/360/430/510 ?		**360**			
σ (ijin)	1600	kg/cm2			

$\frac{150}{5}$ = 30.00 <= 75

$\frac{6700}{150}$ = 44.67 >= $\frac{1.25 \times 75}{7}$ = 13.39

Balok tidak berubah bentuk (KIP)* ---> *Statis tertentu

- Badan balok diberi pengkau samping

- Statis tertentu

h	**15**	cm	b	**7.5**	cm	Mki	
tb	**0.5**	cm	ts	**0.7**	cm	Mka	
Ls	**670**	cm	Iy	**49.5**	cm4	Mjep	
Fe 310/360/430/510 ?		**360**				E	
σ (ijin)	1600	kg/cm2					

C1 = $\frac{670 \times 15}{7.5 \times 0.7}$ = 1914.28571428571

C2 = $\frac{0.63 \times (2100000)}{1600}$ = 826.88

1914.3 =< 250

σ kip = 1600 kg/cm2

250 < 1914 < 826.88

σ kip = 1600 - ((1,914.29 - 250) / (826.88 - 250) x 0.3 x 1600
= 215.20 kg/cm2

1914.3 > 826.88

σ kip = $\frac{826.88 \times 0.7 \times 1600}{1914.28571428571}$ = 483.78 kg/cm2

Jadi
σ kip = *483.78* kg/cm2 < 1600 kg/cm2

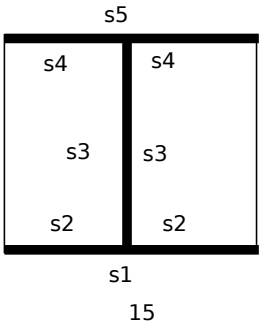
C.2.4 Sambungan

M = **25506.00** kgcm
P = **441.87** kg
Dipakai 10 D16

Perhitungan Kekuatan Las

- Tebal plat	**1** cm	- b	**15** cm
- ts	**1.3** cm	- h	**30** cm
- tb	**0.9** cm	α	**20**

Tebal las badan = 1/2 x sqrt(2) x 0.9 = 0.64 cm
Tebal las sayab = 1/2 x sqrt(2) x 1.3 = 0.92 cm



Moment Inersia
las terhadap las bagian bawah
- 2 x 0.92 x 15 x 16.91^2 = 7888.27 cm4
- 4 x 0.92 x 5.78 x 13.09^2 = 3638.30 cm4
- 2 x 0.64 x 25.56^3 : 12 = 1771.48062969791 cm4
Ix = 13298.05 cm4

Luas Penampang Las
- 2 x 0.92 x 15 = 27.58 cm2
- 4 x 0.92 x 5.78 = 21.24 cm2
- 2 x 0.64 x 25.56 = 32.53 cm2
F = 81.35 cm2

Moment Tahanan
Wx = $\frac{13298.05}{15.64}$ = 850.45 cm3

Kontrol Tegangan

M	=	**25506** kgcm	Bj. 33/37/41/44/50//52 ?		**37**
W	=	**850.45** cm3	σ (ijin)	1600	kg/cm2

P = **442** kg
F = **81.35** cm2

σ m = 25,506 / 850.45
= 29.99 kg/cm2

τ m = 442 / 81.35
= 5.43 kg/cm2

σ i = sqrt(29.99^2 + 3 x 5.43^2)
= 31.43 kg/cm2 < 1600kg/cm2 **(OK)**

Perhitungan Kekuatan Baut
Data-data

M = **255.06** kg/m h = **30**
P = **441.87** kg D = **1.6**
Dipakai 5 D16 n = **5**
s = (30 - 2 x 2
(5 - 1)

Moment Inersia
- h dihitung dari jarak alat sambung pertama (h0) = 5.9
diameter alat sambung (d) **1.6** cm

	h		*h^2*		h1 **5.9**
h1	**9.7**	cm	94.09	cm2	
h2	**23.4**	cm	547.56	cm2	
h3	**36.9**	cm	1361.6	cm2	
h4	**48.2**	cm	2323.2	cm2	
h5	**58.1**	cm	3375.6	cm2	
htot =	176.3	cm	A = 7702.1	cm2	

F = 1/4 x 3.14 x 1.6^2 = 2.01 cm2
Ix = 2 x 2.01 x 7702.11 = 30956.320512 cm4

Moment tahanan
Wx = 30956 / 58.1 = 532.81 cm3

*Kontrol tegangan sambungan **baut***
D (H) **7,056.34** kg Bj. 33/37/41/44/50//52 ? **37**
P (V) **0.00** kg σ (ijin) 1600 kg/cm2
M **255.06** kgm Wx **532.81** cm3
Dipakai 6 D16

σa = 0.7 x 1600 = 1120 kg/cm2
τ (ijin) = 0.6 x 1600 = 960 kg/cm2
σ = 0.00 / (1/4 x 3.14 x 1.6^2 x 6) = 0.00 kg/cm2 < 1120 kg/cm
σm = 255.06 x 100 / 532.81 = 47.87 kg/cm2
τ = 7,056 / (2 x 1/4 x 3.14 x 1.6^2 x 6) = 292.61 kg/cm2 > 960 kg/cm2

Tegangan Idiil
σi = sqrt(47.87^2 + 3 x 292.61^2)
= 509.07 kg/cm2 < 1600 kg/cm

meter
meter
kg/m2
derajat

meter
kg/m'
kg/m2

+ 1
..6
buah

OK

ıt

) = 928 kg/cm2
(OK)

(OK)

tidak berubah

255.06 kgm
255.06 kgm
255.06 kgm
2100000 kg/cm2

(OK)

cm
cm

2 x 1.6)

cm

ı2 (OK)

2 (OK)

ı2 (OK)

TABLE: Element Forces - Frames								
Frame	**Loc**	**Comb**	**P**	**V2**	**V3**	**T**	**M2**	**M3**
Text	m	Text	kg	kg	kg	kg	kg-m	kg-m

C.3 KUDA-KUDA WF 75.150.5.7

C.3.1 Pembebanan

Data-data

Direncanakan memakai Konsol **WF 75.150.5.7**

h	=	15	cm	Jarak kuda2 max	=	3
b	=	7.5	cm	Bentang kuda-kuda	=	6.7
tb	=	0.5	cm	Berat penutup atap	=	75
ts	=	0.7	cm	Kemiringan atap	=	20
Wx	=	88.8	cm3	***Gording***		
A	=	17.85	cm2	Jarak gording	=	1.6
Ix	=	666	cm4	Berat gording	=	7.5
Iy	=	49.5	cm4	Berat plafond	=	18
G	=	14	kg/m'			

Pembebanan

- Berat sendiri konsol		14	kg/m'	n =	6.7 / cos 20 x1
- Berat sendiri gording					
{5x(7.5)x3}/6.7	=	16.791	kg/m'	n =	5
- Berat atap 75x3	=	225	kg/m'		
- Berat muatan hidup					
(5x100)/6.7		74.627	kg/m'		
- Berat plafond + penggantung					
3 x 18		54	kg/m'		
		384.42	kg/m'		
Lain-lain 10%		38.442			
		422.86	kg/m'		

C.3.2 Statika

- Balok Tumpuan jepit-jepit

P	=	0.00	kg	**(1)**	*max (3)*
q	=	422.86	kg/m'		
L induk	=	6.7	m		
L anak	=	3	m		

Mlap = (0.041x422.9x6.7^2) = 778.27 kgm

Mtump = (0.083x422.9x6.7^2) = 1575.52 kgm

D = (1/2x422.86x6.7) = 1416.58 kg

Statika

Dari hasil SAP 2000

D	=	**441.87**	kg
N	=	**243.16**	kg
Mtum	=	**255.06**	kgm
Mlap	=	**255.06**	kgm
f	=	**1.024**	cm

C.3.3 Kontrol Balok dipakai WF 150.75.5.7

Data-data

Dipakai		**WF 150.75.5.7**		***Kesimpulan***	
h	=	15	cm	Tegangan	**OK**
b	=	7.5	cm	Lendutan	**melendut**
tb	=	0.5	cm	Geser	**(OK)**
ts	=	0.7	cm	Lipat balok	**(OK)**
Wx	=	88.8	cm3	KIP	**(OK)**
A	=	17.85	cm2		
Ix	=	666	cm4		

Iy = 49.5 cm4

Kontrol Tegangan

Wx	=	88.8	cm3	Bj. 33/37/41/44/50//52 ?		**37**
A	=	17.85	cm3	σ (ijin)	1600	kg/cm2
P	=	243	kgcm			
M	=	25506	kgcm			

σ = 243 / 17.85 + 25,506 / 88.8
= 300.85 kg/cm2 < 1600kg/cm2

Kontrol Lendutan

L	=	670	cm		
Ix	=	666	cm4		
f ijin	=	1/360 x 670	=	1.86	cm
qx	=	422.86	kg/m'		

$$f = \frac{5 \times 42286 \times 670^{4}}{384 \times 2100000 \times 666}$$

= 7.93306048868809
= 7.933 cm > 1.86 cm **melendu**

Kontrol Geser

h		**15**	cm	b	**7.5**	cm
tb		**0.5**	cm	ts	**0.7**	cm
Ls		**670**	cm	Ix	**666**	cm4
Fe 310/360/430/510 ?		**360**				
σ (ijin)	1600	kg/cm2				

δ x = (7.5 x 0.7){0.5 x (15-0.7)} + (0.5 x 6.8) x 3.4
= 49.10 cm3
D = **441.87** kg

$$\tau = \frac{(441.87 \times 49.10)}{0.5 \times 666} = 65.15 \text{ kg/cm2} < 0.5 \times 160($$

Kontrol Lipat

σ r	=	3267	kg/cm2	bp =	7.5	cm
σ d	=	**300.85**	kg/cm2	tp =	0.7	cm

$\frac{7.5}{0.7}$ = 10.714 < 10 x sqrt(3267 / 300.85) = 32.95

Kontrol Stabilitas KIP

h	**15** cm	b		**7.5**	cm
tb	**0.5** cm	ts		**0.7**	cm
Ls	**670** cm	Iy		**666**	cm4
Fe 310/360/430/510 ?		**360**			
σ (ijin)	1600	kg/cm2			

$\frac{150}{5}$ = 30.00 <= 75

$\frac{6700}{150}$ = 44.67 >= $\frac{1.25 \times 75}{7}$ = 13.39

Balok tidak berubah bentuk (KIP)* ---> *Statis tertentu

- Badan balok diberi pengkau samping

- Statis tertentu

h	**15** cm	b		**7.5**	cm	Mki
tb	**0.5** cm	ts		**0.7**	cm	Mka
Ls	**670** cm	Iy		**49.5**	cm4	Mjep
Fe 310/360/430/510 ?		**360**				E
σ (ijin)	1600	kg/cm2				

C1 = $\frac{670 \times 15}{7.5 \times 0.7}$ = 1914.28571428571

C2 = $\frac{0.63 \times (2100000)}{1600}$ = 826.88

1914.3 =< 250

σ kip = 1600 kg/cm2

250 < 1914 < 826.88

σ kip = 1600 - ((1,914.29 - 250) / (826.88 - 250) x 0.3 x 1600
= 215.20 kg/cm2

1914.3 > 826.88

σ kip = $\frac{826.88 \times 0.7 \times 1600}{1914.28571428571}$ = 483.78 kg/cm2

Jadi
σ kip = *483.78* kg/cm2 < 1600 kg/cm2

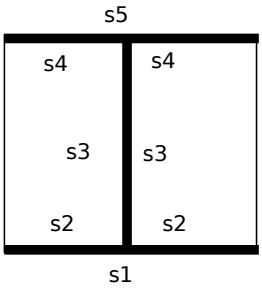
C.3.4 Sambungan

M = **25506.00** kgcm
P = **441.87** kg
Dipakai 10 D16

Perhitungan Kekuatan Las

- Tebal plat	**1** cm	- b	**15** cm
- ts	**1.3** cm	- h	**30** cm
- tb	**0.9** cm	α	**20**

Tebal las badan = 1/2 x sqrt(2) x 0.9 = 0.64 cm
Tebal las sayab = 1/2 x sqrt(2) x 1.3 = 0.92 cm



1.3
29.3
1.3
15

Moment Inersia
las terhadap las bagian bawah

- 2 x 0.92 x 15 x 16.91^2	=	7888.27	cm4
- 4 x 0.92 x 5.78 x 13.09^2	=	3638.30	cm4
- 2 x 0.64 x 25.56^3 : 12	=	1771.48062969791	cm4
Ix	=	13298.05	cm4

Luas Penampang Las

- 2 x 0.92 x 15	=	27.58	cm2
- 4 x 0.92 x 5.78	=	21.24	cm2
- 2 x 0.64 x 25.56	=	32.53	cm2
F	=	81.35	cm2

Moment Tahanan
Wx = $\frac{13298.05}{15.64}$ = 850.45 cm3

Kontrol Tegangan

M	=	**25506** kgcm	Bj. 33/37/41/44/50//52 ?		**37**
W	=	**850.45** cm3	σ (ijin)	1600	kg/cm2

P = **442** kg
F = **81.35** cm2

σ m = 25,506 / 850.45
= 29.99 kg/cm2

τ m = 442 / 81.35
= 5.43 kg/cm2

σ i = sqrt(29.99^2 + 3 x 5.43^2)
= 31.43 kg/cm2 < 1600kg/cm2 **(OK)**

Perhitungan Kekuatan Baut
Data-data

M = **255.06** kg/m h = **30**
P = **441.87** kg D = **1.6**
Dipakai 5 D16 n = **5**
s = (30 - 2 x
(5 - 1)
= 5.9

Moment Inersia
- h dihitung dari jarak alat sambung pertama (h0)
diameter alat sambung (d) **1.6** cm

	h		*h^2*		h1 **5.9**
h1	**9.7**	cm	94.09	cm2	
h2	**23.4**	cm	547.56	cm2	
h3	**36.9**	cm	1361.6	cm2	
h4	**48.2**	cm	2323.2	cm2	
h5	**58.1**	cm	3375.6	cm2	
htot =	176.3	cm	A = 7702.1	cm2	

F = 1/4 x 3.14 x 1.6^2 = 2.01 cm2
Ix = 2 x 2.01 x 7702.11 = 30956.320512 cm4

Moment tahanan
Wx = 30956 / 58.1 = 532.81 cm3

*Kontrol tegangan sambungan **baut***
D (H) **7,056.34** kg Bj. 33/37/41/44/50//52 ? **37**
P (V) **0.00** kg σ (ijin) 1600 kg/cm2
M **255.06** kgm Wx **532.81** cm3
Dipakai 6 D16

σa = 0.7 x 1600 = 1120 kg/cm2
τ (ijin) = 0.6 x 1600 = 960 kg/cm2
σ = 0.00 / (1/4 x 3.14 x 1.6^2 x 6) = 0.00 kg/cm2 < 1120 kg/cm
σm = 255.06 x 100 / 532.81 = 47.87 kg/cm2
τ = 7,056 / (2 x 1/4 x 3.14 x 1.6^2 x 6) = 292.61 kg/cm2 > 960 kg/cm2

Tegangan Idiil
σi = sqrt(47.87^2 + 3 x 292.61^2)
= 509.07 kg/cm2 < 1600 kg/cm

meter
meter
kg/m2
derajat

meter
kg/m'
kg/m2

+ 1
..6
buah

OK

ıt

) = 928 kg/cm2
(OK)

(OK)

tidak berubah

255.06 kgm
255.06 kgm
255.06 kgm
2100000 kg/cm2

(OK)

cm
cm

2 x 1.6)

cm

ı2 (OK)

2 (OK)

ı2 (OK)

GORDING (CNP 125 t=3 mm)

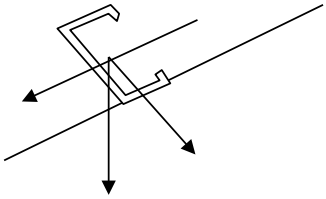
Perhitungan Gording

Data-data

- Jarak kuda-kuda max	=	**500** cm	- kode(1-17)
- Bentang kuda-kuda	=	**600** cm	- Gording
- Jarak Gording	=	**190** cm	
- Berat penutup atap	=	**5** kg/m2	
- Berat angin	=	**25** kg/m2	
- Kemiringan kuda-kuda	=	**26** derajat	
- Direncanakan Gording	**CNP 100 t=1.8 mm**	*(CNP100.50.20.1,8)*	

Wx	=	11.6635	cm3
Wy	=	4.2945	cm3
Ix	=	58.32	cm4
Iy	=	13.64	cm4
A	=	3.9	cm2
g	=	3.03	kg/m'

Peninjauan Searah Sumbu Y - Y



qx = q cos α
qy = q sin α

1. Berat sendiri = 3.03 x cos 26	=	2.72	kg
M1 = 1/8 x 2.72 x 5^2	=	*8.50*	kgm
2. Bs. Atap = 1.9 x 5 x cos 26	=	8.54	kgm
M2 = 1/8 x 8.54 x 5^2	=	*26.68*	kgm
3. Muatan Angin			
W = 0.02 x 26 - 0.4	=	0.12	
W1 = 0.12 x 1.9 x 25	=	5.7	kg/m'
M3 = 1/8 x 5.7 x 5^2	=	*17.81*	kgm
W2 = - 0.4 x 1.9 x 25	=	-19	kg/m'
M4 = 1/8 x -19 x 5^2	=	*-59.38*	kgm
3. Beban Berguna (P)	=	100	kg
M5 = 1/4 x cos 26 x 100 x 5	=	*112.35*	kgm
4. Kombinasi Muatan			
M1 + M2 + M3	=	52.99	kgm
M1 + M2 + M5	=	147.53	kgm

Peninjauan Searah Sumbu X - X

1. Berat sendiri = 3.03 x sin 26	=	1.33	kg/m'
M1 = 1/8 x 1.33 x 5^2	=	*4.14*	kgm
2. Bs Atap = 5 x sin 26	=	2.19	kg/m'
M2 = 1/8 x 2.19 x 5^2	=	*6.85*	kgm
3. Beban Berguna (P)	=	100	kg
M5 = 1/4 x sin 26 x 100 x 5	=	*54.80*	kgm
4. Kombinasi Muatan			
M1 + M2	=	10.99	kgm
M1 + M2 + M5	=	65.79	kgm

Kontrol Tegangan

Wx	=	11.6635 cm3	Bj. 33/37/41/44/50//52 ?		**37**
Wy	=	4.2945 cm3	σ (ijin)	1600	kg/cm2

Mx = 6579 kgcm
My = 14753 kgcm

σ = 6,579 / 4.2945 + 14,753 / 11.6635
= 2796.84 kg/cm2 > 1.3 x 1600 = 2080kg/cm2

Karena tegangan tidak memenuhi syarat maka dicoba lagi pakai CNP 125 t=3 mm

Perhitungan Gording Ulang

- Dicoba Gording **CNP 125 t=3 mm**

Wx = 25.1254 cm3 - kode(1-17)
Wy = 6.748 cm3
Ix = 157.03 cm4
Iy = 22.65 cm4
A = 7.0 cm2
g = 5.49 kg/m'

Peninjauan Searah Sumbu Y - Y

1. Berat sendiri = 5.49 x cos 26 = 4.94 kg
   M1 = 1/8 x 4.94 x 5^2 = *15.43* kgm
2. Bs. Atap = 1.9 x 5 x cos 26 = 8.54 kgm
   M2 = 1/8 x 8.54 x 5^2 = *26.68* kgm
3. Muatan Angin
   W = 0.02 x 26 - 0.4 = 0.12
   W1 = 0.12 x 1.9 x 25 = 5.7 kg/m'
   M3 = 1/8 x 5.7 x 5^2 = *17.81* kgm
   W2 = - 0.4 x 1.9 x 25 = -19 kg/m'
   M4 = 1/8 x -19 x 5^2 = *-59.38* kgm
3. Beban Berguna (P) = 100 kg
   M5 = 1/4 x cos 26 x 100 x 5 = *112.35* kgm
4. Kombinasi Muatan
   M1 + M2 + M3 = 59.92 kgm
   M1 + M2 + M5 = 154.46 kgm

Peninjauan Searah Sumbu X - X

1. Berat sendiri = 5.49 x sin 26 = 2.41 kg/m'
   M1 = 1/8 x 2.41 x 5^2 = *7.53* kgm
2. Bs Atap = 5 x sin 26 = 2.19 kg/m'
   M2 = 1/8 x 2.19 x 5^2 = *6.85* kgm
3. Beban Berguna (P) = 100 kg
   M5 = 1/4 x sin 26 x 100 x 5 = *54.80* kgm
4. Kombinasi Muatan
   M1 + M2 = 14.37 kgm
   M1 + M2 + M5 = 69.17 kgm

Kontrol Tegangan

Wx = 25.1254 cm3 Bj. 33/37/41/44/50//52 ? **37**
Wy = 6.748 cm3 σ (ijin) 1600 kg/cm2
Mx = 6917 kgcm
My = 15446 kgcm

σ = 6,917 / 6.748 + 15,446 / 25.1254
= 1639.82 kg/cm2 < 1.3 x 1600 = 2080kg/cm2

Jadi Gording CNP 125 t=3 mm Aman dipakai.

Kontrol Lendutan

n = **2** *(trestang 1 kolom antar gording)*
L = 250 cm
Ix = 157.03 cm4
Iy = 22.65 cm4

f = 1/250 x 250 = 1 cm

qx = 2.72 + 8.54 + 5.7 = 16.96 kg/m'
qy = 1.33 + 2.19 = 3.52 kg/m'
Px = 100 x cos 26 = 89.88 kg/m'
Py = 100 x sin 26 = 43.84 kg/m'

$$fx = \frac{5 \times 1696 \times 250^4}{384 \times 2100000 \times 157.0335} + \frac{89.88 \times 250^3}{48 \times 2100000 \times 157.0335}$$
$$= 0.026154601448843 + 0.0887212$$
$$= 0.115 \text{ cm}$$

$$fy = \frac{5 \times 0.04 \times 250^4}{384 \times 2100000 \times 22.6485} + \frac{43.84 \times 250^3}{48 \times 2100000 \times 22.6485}$$
$$= 0.037621074149416 + 0.3000282$$
$$= 0.338 \text{ cm}$$

ft = sqrt(0.115^2 + 0.338^2)
= 0.36 cm < 1 cm **OK**

Perhitungan Trestang

qy = 3.52 x 2.5 = 8.79 kg
Py = 43.84 kg
52.63 kg x 1.76
Q = 92.46 kg

Dimensi trestang yang diperlukan

Bj. 33/37/41/44/50//52 ? **37**
σ (ijin) 1600 kg/cm2

σ s = 1.3 x 1600 = 2080 kg/cm2
$$F = \frac{92.46}{2080} = 0.04 \text{ cm2}$$
d = sqrt(4 x 0.04/3.14) = 0.24 cm
dipasang trestang n = 2
$$\text{tg } \alpha = \frac{1.9}{2.5} = 0.76$$
α = 37.2
R = 1/2 x 92.46 = 46.23 kg
$$R = \frac{46.23}{\sin 37.23} = 76.40 \text{ kg}$$
$$F = \frac{76.40}{2080} = 0.04 \text{ cm2}$$
d = sqrt(4 x 0.04/3.14) = 0.22 cm ~ **D = 1.0 cm**

maka dipasang trestang sebanyak 1 kolom antar gording dengan diameter 10 mm.

S/01

12
1

not

16

OK

KUDA-KUDA JOINT ATAS WF 125.250.6.9

Pembebanan

Data-data

Direncanakan memakai **WF 125.250.6.9**

h	=	25	cm	Jarak kuda2 max	=	3.25
b	=	12.5	cm	Bentang kuda-kuda	=	13
tb	=	0.6	cm	Berat penutup atap	=	50
ts	=	0.9	cm	Kemiringan atap	=	20
Wx	=	324	cm3	***Gording***		
A	=	37.66	cm2	Jarak gording	=	1.5
Ix	=	4050	cm4	Berat gording	=	3.03
Iy	=	294	cm4	Berat plafond	=	0
G	=	29.6	kg/m'	Tekanan angin	=	40

Pembebanan

- Berat sendiri		0	kg/m'	n =	13
- Berat sendiri gording					cos 20 x1
	{10x(3.03)x3.25}/13 =	7.575	kg/m'	n =	10
- Berat atap	50x3.25 =	150	kg/m'		
		157.58	kg/m'		
	Lain-lain 10%	15.757			
	DL	173.33	kg/m'		
- Berat muatan hidup					
	(10x100)/13	76.923	kg/m'		
	LL	76.923	kg/m'		

- Beban angin kiri
  W = 0.9 x 3.25 x 40 = 117
- Beban angin kanan
  W = 0.4 x 3.25 x 40 = 52

Berat sendiri kuda-kuda akan dihitung otomatis oleh program SAP-2000
Selanjutnya untuk mencari gaya-gaya dalam dari rangka batang, digunakan program SAP2000

INPUT SAP2000

Beban mati (DL)

Beban hidup (LL)

Beban Angin (W)

OUTPUT SAP2000

Dari hasil SAP 2000

D	=	**1711.53**	kg
N	=	**243.16**	kg
Mtum	=	**932.36**	kgm
Mlap	=	**725.09**	kgm
f	=	**0.1356**	cm

Kontrol Balok dipakai WF 250.125.6.9

Data-data

Dipakai	**WF 250.125.6.9**		
h	=	25	cm
b	=	12.5	cm
tb	=	0.6	cm
ts	=	0.9	cm
Wx	=	324	cm3
A	=	37.66	cm2
Ix	=	4050	cm4
Iy	=	294	cm4

Kesimpulan

Tegangan	**OK**
Lendutan	**OK**
Geser	**(OK)**
Lipat balok	**(OK)**
KIP	**(OK)**

Kontrol Tegangan

Wx	=	324	cm3	Bj. 33/37/41/44/50//52 ?			**37**
A	=	37.66	cm3	σ (ijin)		1600	kg/cm2
P	=	243	kgcm				
M	=	72509	kgcm				

σ = 243 / 37.66 + 72,509 / 324
= 230.25 kg/cm2 < 1600kg/cm2

Kontrol Lendutan

L	=	1300	cm				
Ix	=	4050	cm4				

f ijin = 1/360 x 1300 = 3.61 cm

f = 0.136 cm < 3.61 cm **OK**

Kontrol Geser

h		**25**	cm	b		**12.5**	cm
tb		**0.6**	cm	ts		**0.9**	cm
Ls		**1300**	cm	Ix		**4050**	cm4
Fe 310/360/430/510 ?			**360**				
σ (ijin)		1600	kg/cm2				

δ x = (12.5 x 0.9){0.5 x (25-0.9)} + (0.6 x 11.6) x 5.8
= 175.93 cm3
D = **1711.53** kg
τ = $\frac{(1{,}711.53 \times 175.93)}{0.6 \times 4050}$ = 123.91 kg/cm2 < 0.5 x 160(

Kontrol Lipat

σ r	=	3267	kg/cm2	bp =		12.5	cm
σ d	=	**230.25**	kg/cm2	tp =		0.9	cm

$\frac{12.5}{0.9}$ = 13.889 < 10 x sqrt(3267 / 230.25) = 37.67

Kontrol Stabilitas KIP

h	**25**	cm	b		**12.5**	cm
tb	**0.6**	cm	ts		**0.9**	cm
Ls	**1300**	cm	Iy		**4050**	cm4
Fe 310/360/430/510 ?			**360**			
σ (ijin)		1600	kg/cm2			

$\frac{250}{6}$ = 41.67 <= 75

$\frac{13000}{250}$ = 52.00 >= $\frac{1.25 \times 125}{9}$ = 17.36

Balok tidak berubah bentuk (KIP)* ---> *Statis tertentu

- Badan balok diberi pengkau samping

- Statis tertentu

h	**25**	cm	b		**12.5**	cm	Mki
tb	**0.6**	cm	ts		**0.9**	cm	Mka
Ls	**1300**	cm	Iy		**294**	cm4	Mjep
Fe 310/360/430/510 ?			**360**				E
σ (ijin)		1600	kg/cm2				

C1 = $\frac{1300 \times 25}{12.5 \times 0.9}$ = 2888.88888888889

C2 = $\frac{0.63 \times (2100000)}{1600}$ = 826.88

2888.9 =< 250

σ kip = 1600 kg/cm2

250 **<** ***2889*** **<** ***826.88***

σ kip = 1600 - ((2,888.89 - 250) / (826.88 - 250) x 0.3 x 1600
= -595.74 kg/cm2

2888.9 **>** ***826.88***

σ kip = $\frac{826.88 \times 0.7 \times 1600}{2888.88888888889}$ = 320.57 kg/cm2

Jadi
σ kip = *320.57* kg/cm2 < 1600 kg/cm2

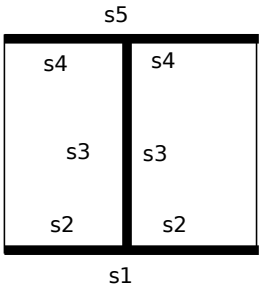
Sambungan

M = **93236.00** kgcm
P = **1711.53** kg
Dipakai 4 D16

Perhitungan Kekuatan Las

- Tebal plat	**1** cm	- b	**15** cm
- ts	**1.3** cm	- h	**30** cm
- tb	**0.9** cm	α	**20**

Tebal las badan = 1/2 x sqrt(2) x 0.9 = 0.64 cm
Tebal las sayab = 1/2 x sqrt(2) x 1.3 = 0.92 cm



Moment Inersia
las terhadap las bagian bawah
- 2 x 0.92 x 15 x 16.91^2 = 7888.27 cm4
- 4 x 0.92 x 5.78 x 13.09^2 = 3638.30 cm4
- 2 x 0.64 x 25.56^3 : 12 = 1771.48062969791 cm4
Ix = 13298.05 cm4

Luas Penampang Las
- 2 x 0.92 x 15 = 27.58 cm2
- 4 x 0.92 x 5.78 = 21.24 cm2
- 2 x 0.64 x 25.56 = 32.53 cm2
F = 81.35 cm2

Moment Tahanan
Wx = $\frac{13298.05}{15.64}$ = 850.45 cm3

Kontrol Tegangan

M	=	**93236** kgcm	Bj. 33/37/41/44/50//52 ?		**37**
W	=	**850.45** cm3	σ (ijin)	1600	kg/cm2
P	=	**1712** kg			
F	=	**81.35** cm2			

σ m = 93,236 / 850.45
= 109.63 kg/cm2

τ m = 1,712 / 81.35
= 21.04 kg/cm2

σ i = sqrt(109.63^2 + 3 x 21.04^2)
= 115.53 kg/cm2 < 1600kg/cm2 **(OK)**

Perhitungan Kekuatan Baut

Data-data

M = **932.36** kg/m h = **30**
P = **1711.53** kg D = **1.6**
Dipakai 2 D16 n = **2**
s = (30 - 2 x 2 / (2 - 1)

Moment Inersia

- h dihitung dari jarak alat sambung pertama (h0) = 23.6
diameter alat sambung (d) **1.6** cm

	h		*h^2*			
h1	**4**	cm	16	cm2	h1	**23.6**
h2	**0**	cm	0	cm2		
h3	**0**	cm	0	cm2		
h4	**0**	cm	0	cm2		
h5	**0**	cm	0	cm2		
htot =	4	cm	A = 16	cm2		

F = 2 x 1/4 x 3.14 x 1.6^2 = 4.02 cm2
Ix = 2 x 4.02 x 16 = 128.6144 cm4

Moment tahanan

Wx = 129 / 4 = 32.15 cm3

*Kontrol tegangan sambungan **baut***

D (H) **7,056.34** kg Bj. 33/37/41/44/50//52 ? **37**
P (V) **0.00** kg σ (ijin) 1600 kg/cm2
M **932.36** kgm Wx **32.15** cm3

Dipakai 6 D16

σa = 0.7 x 1600 = 1120 kg/cm2
τ (ijin) = 0.6 x 1600 = 960 kg/cm2
σ = 0.00 / 1/4 x 3.14 x 1.6^2 x 6 = 0.00 kg/cm2 < 1120 kg/cm
σm = 932.36 x 100 / 32.15 = 2899.71 kg/cm2
τ = 7,056 / 2 x 1/4 x 3.14 x 1.6^2 x 6 = 292.61 kg/cm2 > 960 kg/cm2

Tegangan Idiil

σi = sqrt(2,899.71^2 + 3 x 292.61^2)
= 2943.67 kg/cm2 > 1600 kg/cm

meter
meter
kg/m2
derajat

meter
kg/m'
kg/m2
kg/m2

+ 1
..5
buah

kg/m

kg/m

OK

) = 928 kg/cm2
(OK)

(OK)

tidak berubah

932.36 kgm
932.36 kgm
725.09 kgm
2100000 kg/cm2

(OK)

cm
cm

2 x 1.6)

cm

ı2 (OK)

ż (OK)

ı2 (control lagi)

PROFIL KUDA-KUDA

Jarak antar kuda-kuda	=	3.5	m
Bentang kuda-kuda	=	3	m
Sudut kemiringan	=	26	°
Balok anak.	=	D 3" t=3 mm	
Berat Balok Anak	=	6.34	kg/m'
Jarak antar Balok anak	=	190	cm
Atap	=	Galvalum	
Berat atap	=	7.5	kg/m2
Tekanan angin	=	40	kg/m2

PEMBEBANAN

Beban yang diterima gording :

- Berat atap	= 7.5 x 1.9 x 3	=		42.75
- Berat balok anak	= 6.34 x 3	=		19.02
				61.77
Lain-lain 10 %		=		6.18
		DL	=	67.95
- Berat air hujan	= 0.005 x 1000 x 3 x 1.9	=		28.50
- Beban pekerja	= 2/5 x 100	=		40.00
		LL	=	136.45

- Beban angin

W1	=	0.9 x 3.5 x 40	=	126
W2	=	0.5 x 3.5 x 40	=	70
W3	=	0.6 x 3.5 x 40	=	84
W4	=	0.4 x 3.5 x 40	=	56
W5	=	0.2 x 3.5 x 40	=	28
W6	=	0.4 x 3.5 x 40	=	56

Berat sendiri kuda-kuda akan dihitung otomatis oleh program SAP-2000
Selanjutnya untuk mencari gaya-gaya dalam dari rangka batang, digunakan program SAP2000

INPUT SAP2000

Beban mati (DL)

Beban hidup (LL)

Beban Angin (W)

Check bahan

OUTPUT SAP2000

Bentang kuda-kuda = 6 m

fijin = 1/400 x 600 = 1.5 cm
f sap = (point 1) = 0.0107 cm

f = 0.01 cm < 1.5 cm **OK**

KONTROL KEKUATAN PROFIL KOLOM

Dari hasil Output SAP-90 didapat :
Momen max terjadi pada element no. 3 :

- Momen max (M) = 214.04 kg.m
- Gaya Tekan (P) = - 248.92 kg
- panjang tekuk (lk) = 325.00 cm
- D 3" t=3 mm A = 8.1 cm2
  w = 16.7402 cm3
  ix = 3.0318 cm
  iy = 3.0318 cm

Cek tekuk :

terhadap sumbu x : $\lambda x = lk / ix$

$$= \frac{325.00}{3.0318} = 107.2$$

terhadap sumbu x : $\lambda x = lk / ix$

$$= \frac{325.00}{3.0318} = 107.2$$

... (menekul
pada sumbu

Cek terhadap syarat PPBBI ps 4.9.1 utk portal dimana ujungnya bergoyang

(1) $\sigma = \omega x \frac{P}{A} \quad 0.85\,\theta \quad \frac{M}{w} \frac{nx}{nx - 1} < \bar{\sigma}$

(2) $\sigma = \omega y \frac{P}{A} \quad 0.85\,\theta \quad \frac{M}{w} \frac{nx}{nx - 1} < \bar{\sigma}$

(3) $\sigma = \frac{P}{A} \quad \theta \quad \frac{M}{w} < \bar{\sigma}$

karena sumbu lentur (sb x) tegak lurus thd sumbu tekuk (sb y) maka
faktor amplifikasi $\frac{nx}{nx - 1} = 1$

θ = ambil 1

λx = 107.2 ---> ωx = 1.13

λy = 107.2 ---> ωy = 4.01

syarat PPBBI :

(1) $\sigma = 1.13 \frac{248.92}{8.1} + 0.85\ 1 \frac{21,404}{16.7402}$

= 34.73 + 1,086.81

= 1,121.53 kg/cm2 < 1600 kg/cm2 (ok)

(2) $\sigma = 4.01 \frac{248.92}{8.1} + 0.85\ 1 \frac{21,404}{16.7402}$

= 123.23 + 1,086.81

= 1,210.04 kg/cm2 < 1600 kg/cm2 (ok)

(3) $\sigma = \frac{248.92}{8.1} + 1 \frac{21,404}{16.7402}$

= 30.73 + 1,278.60

= 1,309.33 kg/cm2 < 1600 kg/cm2 (ok)

KONTROL KEKUATAN PROFIL KUDA-KUDA

Dari hasil Output SAP-2000 didapat :
Momen max terjadi pada element no. 13 :

- Momen max (M) = 129.99 kg.m
- Gaya Tekan (P) = - 507.68 kg
- D 3" t=3 mm = luas (A) = 8.1 cm2
  w = 16.7402 cm3

$$\sigma = \frac{P}{A} + \frac{M}{w}$$

$$= \frac{507.68}{8.1} + \frac{12,999}{16.7402}$$

$$= 62.68 + 776.51$$

$$= 839.19 \text{ kg/cm2} < 1600 \text{ kg/cm2}$$ OK!

maka digunakan profil **D 3" t=3** mm untuk kuda-kuda

kg
kg
kg
kg
kg

kg
kg
kg

kg/m
kg/m
kg/m
kg/m
kg/m
kg/m

<
ı y)

DUDUKAN KOLOM

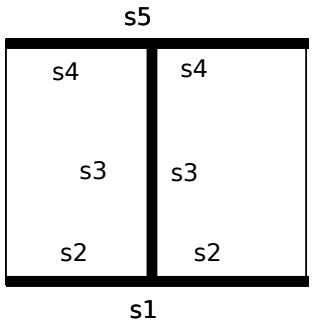
Data-data				*Kesimpulan*	
D	=	**1423**	kg	Tegangan	**(OK)**
N (P)	=	**1232**	kg		
L	=	**0.3**	m		
D kolom	=	**0.15**	m		
WF 250.125.6.9					
Wx	=	**324**	cm3		
F	=	**37.66**	cm2		
ix	=	**10.4**	cm		
iy	=	**2.79**	cm		
G	=	**29.6**	kg/m		

Kontrol Kekuatan Las plat kaki

Perhitungan Kekuatan Las

- Tebal plat	**1** cm	- b	**15**
- ts	**1.3** cm	- h	**30**
- tb	**0.9** cm	α	**20**

Tebal las badan = 1/2 x sqrt(2) x 0.9 = 0.64
Tebal las sayab = 1/2 x sqrt(2) x 1.3 = 0.92



1.3
29.3
1.3
15

Moment Inersia

las terhadap las bagian bawah

- 2 x 0.92 x 15 x 16.91^2	=	7888.27	cm4
- 4 x 0.92 x 5.78 x 13.09^2	=	3638.30	cm4
- 2 x 0.64 x 25.56^3 : 12	=	1771.48063	cm4
Ix	=	13298.05	cm4

Luas Penampang Las

- 2 x 0.92 x 15	=	27.58	cm2
- 4 x 0.92 x 5.78	=	21.24	cm2
- 2 x 0.64 x 25.56	=	32.53	cm2
F	=	81.35	cm2

Moment Tahanan

$$Wx = \frac{13298.05}{15.64} = 850.45 \text{ cm3}$$

Kontrol Tegangan

M	=	**427**	kgcm	Bj. 33/37/41/44/50//52 ?
W	=	**850.45**	cm3	σ (ijin) 1600
P	=	**1274**	kg	
F	=	**37.66**	cm2	

σ m = 427 / 850.45
= 0.50 kg/cm2

τ m = 1,274 / 37.66
= 33.84 kg/cm2

σ i = sqrt(0.50^2 + 3 x 33.84^2)
= 58.61 kg/cm2 < 1600kg/cm2

Kontrol Kekuatan Plat Kaki

Dimensi Plat

h	=	24.8	cm	Tegangan (OK)
b	=	12.4	cm	Dimensi plat 15 x 15 x 0.5 c
tb	=	0.5	cm	Angker 2 D22
ts	=	0.8	cm	Panjang angker 60 cm

Kesimpulan

B	=	2 x 5 + 12.4	=	22.4	cm	~
L	=	2 x 5 + 24.8	=	34.8	cm	~

W	=	1/6 x 15 x 15^2	=	562.50	cm3
A	=	15 x 15	=	225.00	cm2

Kontrol Tegangan

Wx	=	562.50	cm3	Mutu beton **K300**
A	=	225.00	cm2	σ (tekan) = 0.33 x 300
N	=	1274	kg	= 99
M	=	42690	kgcm	Bj. 33/37/41/44/50//52 ?
				σ (ijin) 1600

σ max = 1,274 / 225 + 42,690 / 562.50
= 81.56 kg/cm2 < 99

σ min = 1,274 / 225 - 42,690 / 562.50
= -70.23 kg/cm2

tegangan min harus ditahan oleh angker

Statika

D = **2.2** cm

$$\frac{x}{15 - x} = \frac{70.23}{42{,}690 / 562.50}$$

$$\frac{x}{15 - x} = \frac{70.23}{75.89}$$

$$x = \frac{(70.23 \times 15)}{(75.89 + 70.23)}$$

x = 7.21 cm

T = 7.21 x 15 x (1/2 x 70.23)
= 3797.34 kg

Perhitungan Plat Penyambung

T **3,797** kg Bj. 33/37/41/4
diameter alat sambung (d) **2.2** cm σ (ijin)

Tebal Plat Penyambung *L(cm) =* **14.00**

Fperlu = $\frac{3797.33626579167}{1600}$ = 2.373 cm2 (untuk 2 p

δ = $\frac{2.373}{(14-2.2)}$

= 0.20 cm ~

Perhitungan baut angker

T **3,797** kg Bj. 33/37/41/4
tebal plat sambung (δ) **0.50** cm σ (ijin)
diameter alat sambung (d) **2.2** cm - *sambungan i*

Jumlah baut angker

1/4 x 3.14 x 2.2 = 1.73 cm > 0.5 cm

n = $\frac{3797.33626579167}{0.5x2.2x1.2x1600}$ = 1.80 ----->

Perhitungan Panjang Angker

Mutu beton **K300** Bj. 33/37/41/44/50//52 **37**
σ b 300 kg/cm2 σ a 1600 kg/cm2
σ m 2080 kg/cm2
D **2.2** cm 3.80 cm2

Ln = $\frac{0.14 \times 3.80 \times 2080}{\text{sqrt}(300)}$ >= 0.013 x 2.2 x 2080

= 63.91 > 59.488

~ **60** cm

Sehingga dipakai angker D2.2 - 60 cm

cm
cm

cm
cm

37
kg/cm2

(OK)

:m

15 cm
15 cm

kg/cm2
37
kg/cm2

kg/cm2 **(OK)**

4/50//52 ? **37**
1600

ɔenampang profil)

0.50 cm

4/50//52 ? **37**
1600
*ris **ganda***

(tumpu menentukan)
2 D22 mm

(PBI '71 : 74)

(OK)

PENGARUH LUBANG

Dasar-Dasar Peraturan Perencanaan

- *Peraturan Perencanaan Bangunan Baja Indonesia (PPBBI)*, Penerbit Yayasan Lembaga Penyelidikan Masalah Bangunan, Bandung, 1984
- Ir. Oengtoeng, *Konstruksi Baja*, LPPM Universitas Kristen PETRA Surabaya, Penerbit Ansi Yogyakarta, 1999
- Teguh Santoso SPd, *Perhitungan Struktur OPTIMALISASI KEBUN-KEBUN BENIH DI BBI HORTIKULTURA SE - JAWA TIMUR Desa Jebeen Kec Jaboan Kab Sampang*, Desa Kincang Wetan Kec Jiwan Kab Madiun, Desa Lebo Kec Pudjon Kab Malang, Surabaya, Februari 2008

Pengaruh Penempatan Lubang Terhadap Luas Netto

Menurut PPBBI pasal 3.3.1 :

" Tegangan rata-rata pada batang tarik didapat dari gaya tarik yang bekerja d luas penampang bersih. Tegangan tersebut harus tidak boleh lebih besar dari dasar untuk penampang tidak berlubang, dan *tidak boleh lebih besar dari 0,75 tegangan dasa*r untuk penampang berlubang."

Baut ASTM HTB A325 N

Ft	44 Ksi	(Allowable Tension)
Fv	21 Ksi	(Allowable Shear)

Baut Angker ASTM A307 U-7/8"

Ft	20 Ksi	(Allowable Tension)
Fv	10 Ksi	(Allowable Shear)

Pembebanan

a. Beban Mati (DL)
Sesuai dengan Peraturan Pembebanan Indonesia dan berat jenis bahan yang dipakai.
b. Beban Hidup (LL)

Ir. Oengtoeng, Konstruksi Baja, LPPM Universitas Kristen PETRA Surabaya, Penerbit Ansi Yo
Peraturan Perencanaan Bangunan Baja Indonesia (PPBBI), Penerbit Yayasan Lembaga Peny

c. Beban Angin (W)
d. Kombinasi Pembebanan
1.4 DL
1.2 DL + 0.5 LL
1.2 DL + 1.6 LL + 0.8 W
1.2 DL + 1.6 LL - 0.8 W

Analisa Struktur

- Analisa struktur memakai program bantu SAP NonLinier Versi 9.0.3.

Perencanaan Elemen Struktur

- Perhitungan elemen struktur berdasarkan pada peraturan yang berlaku

ibagi dengan
tegangan
kali

ogyakarta, 1999
elidikan Masalah Bangunan, Bandung, 1984