LAMPIRAN

LAMPIRAN I

UNIVERSITAS ISLAM INDONESIA
FAKULTAS TEKNIK SIPIL DAN PERENCANAAN
JURUSAN TEKNIK SIPIL
Jl. Kaliurang Km. 14,4 Telp. 95330 Yogyakarta

KARTU PESERTA TUGAS AKHIR

No.	Nama	No. Mhs.	N.I.R.M.	Bidang Studi
1	[illegible]	[illegible]		[illegible]
2	[illegible]	[illegible]		[illegible]

JUDUL TUGAS AKHIR : .....

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Dosen Pembimbing I : [illegible]
Dosen Pembimbing II : [illegible]

1

2

Yogyakarta,
Dekan,

[illegible]

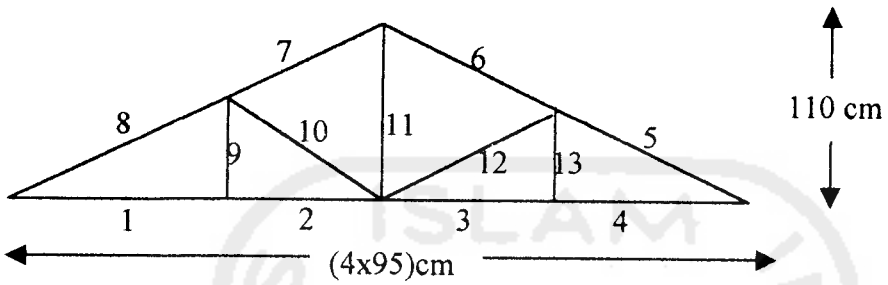
CATATAN - KONSULTASI

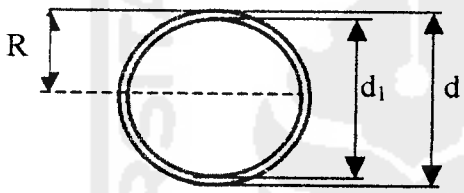
No.	Tanggal	Konsultasi ke ·	KETERANGAN	Paraf
			Tinjauan pustakan kurang cari jurnal atau text books lain yg menyg - cari analisi ragka, konsentrasi pada joint.	[paraf]
7/8/00	- Acc	dapat Seminar Proposal	[paraf]	
29/11	-2000		Buat laporan Segera.	[paraf]
			Dibuat grafik 1-s M-C ke ... sample pada pernyataan non dimensional sigabung.	[paraf]
			Dilanjutkan kepada DP. I	[paraf] 6/12-2000
2/00	Perbaiki [paraf]		12/12/00 Perbaiki [paraf]	
13/12/00	Acc	siapkan Sidang [paraf]		
		Perbaikan pasca Sidang dinyatakan selesai		[paraf]
9/12/00	Acc	[paraf]		
9/02	2001		Perbaikan pasca pendadaran dinyatakan selesai	[paraf]

LAMPIRAN II

Data profil :

- baja pipa diameter 4,8 cm dan 3,4 cm tebal masing-masing 2 mm.
- batang 1 s/d 8 dipakai profil 4,8 cm
- batang 9 s/d 13 dipakai profil 3,4 cm





Untuk profil 4,8 cm

Luas penampang, $A = \frac{1}{4}\pi d^2 - \frac{1}{4}\pi d_1^{\,2}$

$= \frac{1}{4}\pi 4{,}8^2 - \frac{1}{4}4{,}4^2 = 2{,}888 \text{ cm}^2$

Ineria profil, $I = \frac{\pi(d^4 - d_1^4)}{64}$

$= \frac{\pi\left(4{,}8^4 - 4{,}4^4\right)}{64} = 6{,}977 \text{ cm}^4$

Jari-jari inersia, $r = \sqrt{\frac{I}{A}}$

$= \sqrt{\frac{6{,}977}{2{,}888}} = 1{,}63 \text{ cm}$

Kelangsingan $\lambda = \frac{KL}{r}$

$= \frac{95}{1{,}63} = 58$

Untuk profil 3,4 cm

Didapat A = 2 cm^2
I = 2,366 cm^4
r = 1,4 cm
λ = 96

Beban kritis akan terjadi dititik 5 dan 8

$$P_{kr} = \frac{\pi^2 EI}{Lk^2}$$

$$= \frac{\pi^2 x 2100000 x 6.977}{110^2}$$

=11620 kg

chek tegangan pada titik 5 dan 8

$$\sigma = \frac{P}{A}$$

$$= \frac{11620}{2,388} = 4023 \text{ kg/cm}^2 = 402,3 \text{ MPa}$$

dari pengujian kuat tarik baja, didapat tegangan leleh, σ = 213.5 Mpa, sehingga keruntuhan elemen disebabkan oleh tegangan lelehnya terlampaui.

Gaya aksial terbesar yang mampu ditahan oleh batang 5 dan 8 adalah :

F = σ x A
= 2135 kg/cm^2x 2,888 cm^2
= 6134 kg

dari program komputer didapat beban rencana sampai elemen mulai leleh adalah 6500 kg.

Menghitung kebutuhan las plat buhul

Dari pengujian didapat kuat tarik ultimit las sebesar 800 Mpa atau 8000 Kg/cm^2

Tebal las, $t = \frac{1}{2}\sqrt{2}$ x tebal profil

$= \frac{1}{2}\sqrt{2}$ x 2 mm

= 1,414 mm = 0,1414 cm

Panjang las perlu, $Ln = \frac{F}{t_{las} x \sigma_{las}}$

Karena bidang lasnya ada 4 sisi maka $Ln = \frac{\frac{1}{4}F}{t_{las} x \sigma_{las}}$

Karena kerusakan pada sambungan tidak dikehendaki, maka beban harus lebih besar dari beban rencana awal (benda uji leleh) yaitu 6,5 ton.

Diambil beban 9 ton $>$ 6,5 ton, sehingga diharapkan terjadi kerusakan pada batang (sambungan masih aman)

Gaya aksial yang didapatkan dari SAP90 dan kebutuhan lasnya seperti dalam tabel dibawah:

Elemen	Axial Force Kg	1/4 F Kg	Tebal Las (cm)	Teg Las Kg/cm^2	Ln (cm)	Dipakai Ln (cm)
1	7700	1925.00	0.1414	8000	1.70	8
2	7712	1928.00	0.1414	8000	1.70	8
3	7712	1928.00	0.1414	8000	1.70	8
4	7700	1925.00	0.1414	8000	1.70	8
5	8907	2226.75	0.1414	8000	1.97	8
6	8974	2243.50	0.1414	8000	1.98	8
7	8974	2243.50	0.1414	8000	1.98	8
8	8907	2226.75	0.1414	8000	1.97	8
9	41	10.25	0.1414	8000	0.01	5
10	71	17.75	0.1414	8000	0.02	5
11	34	8.50	0.1414	8000	0.01	5
12	71	17.75	0.1414	8000	0.02	5
13	41	10.25	0.1414	8000	0.01	5

LAMPIRAN III

Tabel Hasil Pengujian Beban dan Lendutan Kuda-kuda baja dengan sambungan las langsung (benda uji 1)

Beban	Dial 1	Dial 2	Dial 3
Ton	mm	mm	mm
0	0	0	0
0.25	0.62	0.78	0.38
0.50	0.68	0.84	0.44
0.75	1.18	1.38	0.92
1.00	1.52	1.74	1.27
1.25	2.24	2.57	2.02
1.50	2.43	2.80	2.22
1.75	2.67	3.07	2.44
2.00	3.10	3.54	2.88
2.25	3.57	4.07	3.37
2.50	3.80	4.33	3.59
2.75	3.98	4.55	3.77
3.00	4.25	4.86	4.03
3.25	4.75	5.43	4.50
3.50	4.93	5.64	4.66
3.75	5.21	5.96	4.93
4.00	5.54	6.34	5.22
4.25	6.17	7.09	5.86
4.50	6.26	7.19	5.95
4.75	6.41	7.38	6.11
5.00	6.97	8.02	6.67
5.25	7.36	8.48	7.08
5.50	7.54	8.68	7.25
5.75	7.69	8.88	7.41
6.00	8.02	9.25	7.75
6.25	8.48	9.77	8.20
6.50	8.65	10.04	8.61
6.75	9.00	10.65	9.00
7.00	9.41	11.10	9.48
7.25	9.91	11.75	9.80
7.50	10.33	12.20	10.20
7.75	10.80	12.70	10.65
8.00	11.32	13.40	11.20
8.25	11.75	13.90	11.42
7.00	12.50	14.79	12.24
7.00	12.45	14.82	12.36
7.00	12.55	15.83	12.64
7.00	12.84	16.25	13.13
7.00	13.40	17.00	13.80
7.00	16.00	23.00	17.00
7.00	18.00	26.00	21.00
7.00	19.00	28.00	21.00

Tabel Hasil Pengujian Pengujian Beban dan Lendutan Kuda-kuda baja dengan sambungan las langsung (benda uji 2)

Beban	Dial 1	Dial 2	Dial 3
Ton	mm	mm	mm
0.00	0	0	0
0.25	0.46	0.98	0.48
0.50	0.67	1.21	0.68
0.75	0.89	1.43	0.87
1.00	1.10	1.66	1.10
1.25	1.60	2.22	1.63
1.50	1.92	2.48	1.97
1.75	2.14	2.84	2.02
2.00	2.43	3.17	2.52
2.25	2.85	3.61	2.94
2.50	3.07	3.88	3.18
2.75	3.34	4.16	3.41
3.00	3.71	4.54	3.84
3.25	4.07	4.98	4.20
3.50	4.37	5.32	4.52
3.75	4.67	5.66	4.81
4.00	4.95	6.00	5.12
4.25	5.27	6.36	5.44
4.50	5.52	6.65	5.70
4.75	5.67	7.22	5.86
5.00	6.05	7.25	6.25
5.25	6.40	7.75	6.61
5.50	6.62	8.00	6.84
5.75	6.84	8.27	7.07
6.00	7.17	8.59	7.40
6.25	7.57	9.06	7.84
6.50	7.80	9.37	8.08
6.75	8.05	9.70	8.64
7.00	8.42	10.2	8.91
7.25	8.95	10.95	9.33
7.50	9.26	11.38	9.90
7.75	9.58	11.85	10.31
7.50	10.18	12.42	10.62
7.75	10.86	13.28	10.90
8.00	11.27	13.95	11.38
7.50	11.52	14.10	11.80
6.00	12.51	15.58	12.80
6.00	13.26	16.32	13.80
6.00	14.65	17.22	14.55
6.00	16.00	18.00	16.00
6.00	18.00	22.00	19.00
6.00	22.00	28.00	23.00
6.00	22.00	28.00	24.00

Tabel Hasil Pengujian Beban Lendutan Kuda-kuda baja dengan sambungan menggunakan plat buhul (benda uji 3)

Beban	Dial 1	Dial 2	Dial 3
Ton	mm	mm	mm
0	0.00	0.00	0.00
0.25	0.05	0.09	0.10
0.50	0.26	0.36	0.38
0.75	0.62	0.80	0.84
1.00	0.90	1.12	1.18
1.25	1.55	1.79	1.74
1.50	1.88	2.14	2.11
1.75	2.17	2.44	2.35
2.00	2.45	2.72	2.60
2.25	3.25	3.62	3.16
2.50	3.85	3.88	3.45
2.75	3.67	3.92	3.52
3.00	3.97	4.37	3.87
3.25	4.36	4.72	4.22
3.50	4.69	5.25	4.50
3.75	5.00	5.60	4.75
4.00	5.35	5.90	5.07
4.25	5.96	6.31	5.57
4.50	6.20	6.53	5.71
4.75	6.28	6.62	5.77
5.00	6.86	7.23	6.23
5.25	7.38	7.76	6.63
5.50	7.60	7.98	6.79
5.75	7.89	8.28	7.00
6.00	8.37	8.77	7.34
6.25	8.86	9.23	7.66
6.50	9.20	9.56	7.88
6.75	9.49	9.84	8.05
7.00	9.86	10.17	8.28
7.25	10.16	11.05	9.05
7.50	10.62	11.48	9.28
7.75	11.09	12.17	9.91
8.00	11.13	12.57	10.38
7.00	12.70	14.88	11.58
7.00	13.56	17.30	13.50
7.00	14.92	18.21	14.23
7.00	17.00	22.00	16.00
7.00	22.00	25.00	22.00
7.00	24.00	28.00	24.00

Tabel Hasil Pengujian Beban Lendutan Kuda-kuda baja dengan sambungan menggunakan plat buhul (benda uji 4)

Beban	Dial 1	Dial 2	Dial 3
Ton	mm	mm	Mm
0.00	0	0	0
0.25	0.25	0.35	0.20
0.50	0.35	0.48	**0.41**
0.75	0.40	0.55	0.48
1.00	0.69	0.90	0.76
1.25	1.17	1.44	1.22
1.50	1.50	1.78	1.53
1.75	1.70	2.00	1.72
2.00	2.02	2.33	2.01
2.25	2.64	3.01	2.63
2.50	2.92	3.30	2.86
2.75	3.15	3.56	3.07
3.00	3.47	3.95	3.40
3.25	3.92	4.43	3.78
3.50	4.28	4.83	4.10
3.75	4.50	5.07	4.33
4.00	4.82	5.41	4.62
4.25	5.30	5.96	5.06
4.50	5.64	6.30	5.36
4.75	5.81	6.50	5.52
5.00	6.34	7.12	6.04
5.25	6.77	7.58	6.45
5.50	7.07	7.91	6.72
5.75	7.40	8.30	7.04
6.00	7.74	8.64	7.32
6.25	8.24	9.22	7.81
6.50	8.52	9.56	8.09
6.75	8.83	9.93	8.40
7.00	9.11	10.26	8.68
7.25	10.03	11.32	9.52
7.50	10.41	11.74	9.88
7.75	10.87	12.32	10.32
8.00	11.37	12.91	10.80
8.25	12.09	13.88	11.50
8.00	12.75	14.88	13.02
6.50	12.80	15.72	13.50
6.50	12.87	16.36	14.18
6.50	18.00	28.00	22.00
6.50	23.00	30.00	23.00

Tabel Hubungan momen-kelengkungan kuda-kuda baja dengan sambungan las langsung (benda uji 1)

Beban Ton	Dial 1 mm	Dial 2 mm	Dial 3 Mm	Momen KN-m	Kelengkungan 1/m
0	0	0	0	0	0
0.25	0.62	0.78	0.38	2.38	0.0006
0.50	0.68	0.84	0.44	4.75	0.0006
0.75	1.18	1.38	0.92	7.13	0.0007
1.00	1.52	1.74	1.27	9.50	0.0008
1.25	2.24	2.57	2.02	11.88	0.0010
1.50	2.43	2.80	2.22	14.25	0.0011
1.75	2.67	3.07	2.44	16.63	0.0011
2.00	3.10	3.54	2.88	19.00	0.0012
2.25	3.57	4.07	3.37	21.38	0.0013
2.50	3.80	4.33	3.59	23.75	0.0014
2.75	3.98	4.55	3.77	26.13	0.0015
3.00	4.25	4.86	4.03	28.50	0.0016
3.25	4.75	5.43	4.50	30.88	0.0018
3.50	4.93	5.64	4.66	33.25	0.0019
3.75	5.21	5.96	4.93	35.63	0.0020
4.00	5.54	6.34	5.22	38.00	0.0021
4.25	6.17	7.09	5.86	40.38	0.0024
4.50	6.26	7.19	5.95	42.75	0.0024
4.75	6.41	7.38	6.11	45.13	0.0025
5.00	6.97	8.02	6.67	47.50	0.0027
5.25	7.36	8.48	7.08	49.88	0.0028
5.50	7.54	8.68	7.25	52.25	0.0028
5.75	7.69	8.88	7.41	54.63	0.0029
6.00	8.02	9.25	7.75	57.00	0.0030
6.25	8.48	9.77	8.20	59.38	0.0032
6.50	8.65	10.04	8.61	61.75	0.0031
6.75	9.00	10.65	9.00	64.13	0.0037
7.00	9.41	11.10	9.48	66.50	0.0037
7.25	9.91	11.75	9.80	68.88	0.0042
7.50	10.33	12.20	10.20	71.25	0.0043
7.75	10.80	12.70	10.65	73.63	0.0044
8.00	11.32	13.40	11.20	76.00	0.0047
8.25	11.75	13.90	11.42	78.38	0.0051
7.00	12.50	14.79	12.24	66.50	0.0054
7.00	12.45	14.82	12.36	66.50	0.0054
7.00	12.55	15.83	12.64	66.50	0.0049
7.00	12.84	16.25	13.13	66.50	0.0063
7.00	13.40	17.00	13.80	66.50	0.0059
7.00	16.00	23.00	17.00	66.50	0.0144
7.00	18.00	26.00	21.00	66.50	0.0144
7.00	19.00	28.00	21.00	66.50	0.0177

Tabel Hubungan momen-kelengkungan kuda-kuda baja dengan sambungan las langsung (benda uji 2)

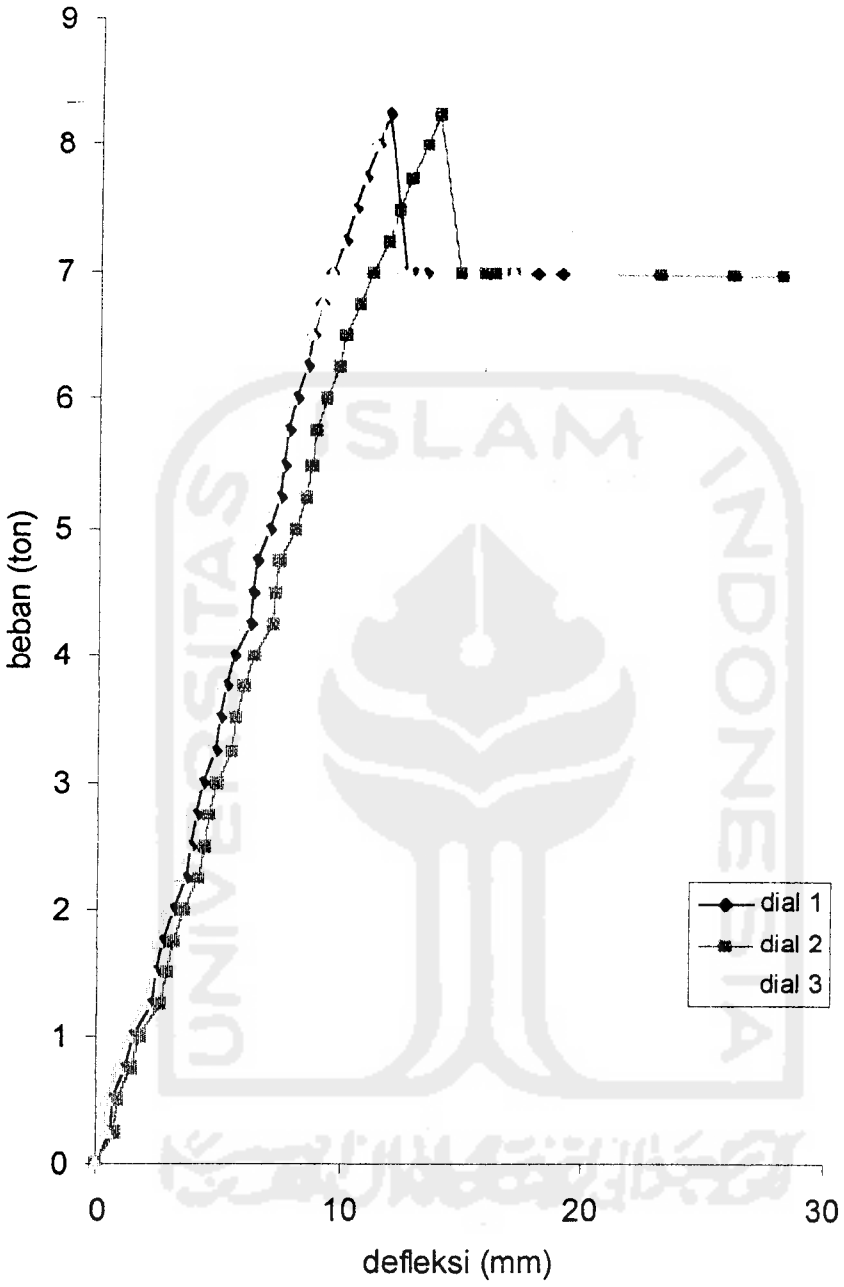
Beban Ton	**Dial 1** mm	**Dial 2 mm**	**Dial 3 mm**	**Momen KN-m**	**Kelengkungan 1/m**
0.00	0	0	0	0.00	0
0.25	0.46	0.98	0.48	2.38	0.0011
0.50	0.67	1.21	0.68	4.75	0.0012
0.75	0.89	1.43	0.87	7.13	0.0012
1.00	1.10	1.66	1.10	9.50	0.0012
1.25	1.60	2.22	1.63	11.88	0.0013
1.50	1.92	2.48	1.97	14.25	0.0012
1.75	2.14	2.84	2.02	16.63	0.0017
2.00	2.43	3.17	2.52	19.00	0.0015
2.25	2.85	3.61	2.94	21.38	0.0016
2.50	3.07	3.88	3.18	23.75	0.0017
2.75	3.34	4.16	3.41	26.13	0.0017
3.00	3.71	4.54	3.84	28.50	0.0017
3.25	4.07	4.98	4.20	30.88	0.0019
3.50	4.37	5.32	4.52	33.25	0.0019
3.75	4.67	5.66	4.81	35.63	0.0020
4.00	4.95	6.00	5.12	38.00	0.0021
4.25	5.27	6.36	5.44	40.38	0.0022
4.50	5.52	6.65	5.70	42.75	0.0023
4.75	5.67	7.22	5.86	45.13	0.0032
5.00	6.05	7.25	6.25	47.50	0.0024
5.25	6.40	7.75	6.61	49.88	0.0028
5.50	6.62	8.00	6.84	52.25	0.0028
5.75	6.84	8.27	7.07	54.63	0.0029
6.00	7.17	8.59	7.40	57.00	0.0029
6.25	7.57	9.06	7.84	59.38	0.0030
6.50	7.80	9.37	8.08	61.75	0.0032
6.75	8.05	9.70	8.64	64.13	0.0030
7.00	8.42	10.20	8.91	66.50	0.0034
7.25	8.95	10.95	9.33	68.88	0.0040
7.50	9.26	11.38	9.90	71.25	0.0040
7.75	9.58	11.85	10.31	73.63	0.0042
7.50	10.18	12.42	10.62	71.25	0.0045
7.75	10.86	13.28	10.90	73.63	0.0053
8.00	11.27	13.95	11.38	76.00	0.0058
7.50	11.52	14.10	11.80	71.25	0.0054
6.00	12.51	15.58	12.80	57.00	0.0065
6.00	13.26	16.32	13.80	57.00	0.0062
6.00	14.65	17.22	14.55	57.00	0.0058
6.00	16.00	18	16.00	57.00	0.0044
6.00	18.00	22	19.00	57.00	0.0078
6.00	22.00	28	23.00	57.00	0.0122
6.00	22.00	28	24.00	57.00	0.0111

Tabel Hubungan momen-kelengkungan kuda-kuda dengan sambungan plat buhul (benda uji 3)

Beban	Dial 1	Dial 2	Dial 3	Momen	Kelengkungan
Ton	mm	Mm	mm	KN-m	1/m
0	0.00	0.00	0.00	0	0
0.25	0.05	0.09	0.10	2.38	0.0001
0.50	0.26	0.36	0.38	4.75	0.0001
0.75	0.62	0.80	0.84	7.13	0.0002
1.00	0.90	1.12	1.18	9.50	0.0002
1.25	1.55	1.79	1.74	11.88	0.0003
1.50	1.88	2.14	2.11	14.25	0.0003
1.75	2.17	2.44	2.35	16.63	0.0004
2.00	2.45	2.72	2.60	19.00	0.0004
2.25	3.25	3.62	3.16	21.38	0.0009
2.50	3.85	3.88	3.45	23.75	0.0005
2.75	3.67	3.92	3.52	26.13	0.0007
3.00	3.97	4.37	3.87	28.50	0.0010
3.25	4.36	4.72	4.22	30.88	0.0009
3.50	4.69	5.25	4.50	33.25	0.0015
3.75	5.00	5.60	4.75	35.63	0.0016
4.00	5.35	5.90	5.07	38.00	0.0015
4.25	5.96	6.31	5.57	40.38	0.0012
4.50	6.20	6.53	5.71	42.75	0.0013
4.75	6.28	6.62	5.77	45.13	0.0013
5.00	6.86	7.23	6.23	47.50	0.0015
5.25	7.38	7.76	6.63	49.88	0.0017
5.50	7.60	7.98	6.79	52.25	0.0017
5.75	7.89	8.28	7.00	54.63	0.0018
6.00	8.37	8.77	7.34	57.00	0.0020
6.25	8.86	9.23	7.66	59.38	0.0022
6.50	9.20	9.56	7.88	61.75	0.0023
6.75	9.49	9.84	8.05	64.13	0.0024
7.00	9.86	10.17	8.28	66.50	0.0024
7.25	10.16	11.05	9.05	68.88	0.0032
7.50	10.62	11.48	9.28	71.25	0.0034
7.75	11.09	12.17	9.91	73.63	0.0037
8.00	11.13	12.57	10.38	76.00	0.0040
7.00	12.70	14.88	11.58	66.50	0.0061
7.00	13.56	17.30	13.50	66.50	0.0084
7.00	14.92	18.21	14.23	66.50	0.0081
7.00	17.00	22.00	16.00	66.50	0.0122
7.00	22.00	25.00	22.00	66.50	0.0066
7.00	24.00	28.00	24.00	66.50	0.0089

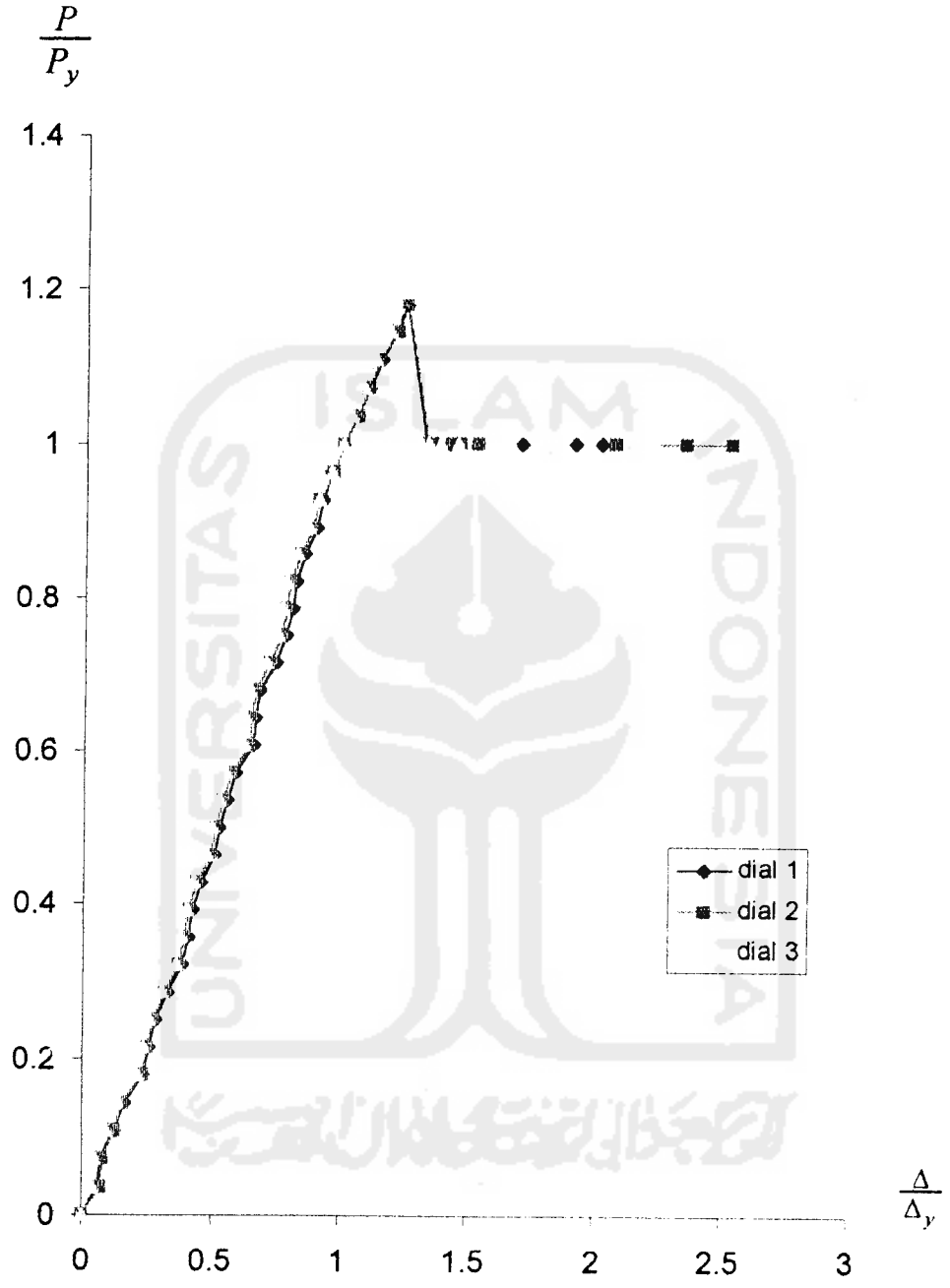
Tabel Hubungan momen-kelengkungan kuda-kuda
dengan sambungan plat buhul (benda uji 4)

Beban Ton	Dial 1 mm	Dial 2 mm	Dial 3 mm	Momen KN-m	Kelengkungan 1/m
0	0	0	0	0	0
0.25	0.25	0.35	0.20	2.38	0.0003
0.50	0.35	0.48	0.41	4.75	0.0002
0.75	0.40	0.55	0.48	7.13	0.0002
1.00	0.69	0.90	0.76	9.50	0.0004
1.25	1.17	1.44	1.22	11.88	0.0005
1.50	1.50	1.78	1.53	14.25	0.0006
1.75	1.70	2.00	1.72	16.63	0.0006
2.00	2.02	2.33	2.01	19.00	0.0007
2.25	2.64	3.01	2.63	21.38	0.0008
2.50	2.92	3.30	2.86	23.75	0.0009
2.75	3.15	3.56	3.07	26.13	0.0010
3.00	3.47	3.95	3.40	28.50	0.0011
3.25	3.92	4.43	3.78	30.88	0.0013
3.50	4.28	4.83	4.10	33.25	0.0014
3.75	4.50	5.07	4.33	35.63	0.0015
4.00	4.82	5.41	4.62	38.00	0.0015
4.25	5.30	5.96	5.06	40.38	0.0017
4.50	5.64	6.30	5.36	42.75	0.0018
4.75	5.81	6.50	5.52	45.13	0.0019
5.00	6.34	7.12	6.04	47.50	0.0021
5.25	6.77	7.58	6.45	49.88	0.0021
5.50	7.07	7.91	6.72	52.25	0.0022
5.75	7.40	8.30	7.04	54.63	0.0024
6.00	7.74	8.64	7.32	57.00	0.0025
6.25	8.24	9.22	7.81	59.38	0.0026
6.50	8.52	9.56	8.09	61.75	0.0028
6.75	8.83	9.93	8.40	64.13	0.0029
7.00	9.11	10.26	8.68	66.50	0.0030
7.25	10.03	11.32	9.52	68.88	0.0034
7.50	10.41	11.74	9.88	71.25	0.0035
7.75	10.87	12.32	10.32	73.63	0.0038
8.00	11.37	12.91	10.80	76.00	0.0040
8.25	12.09	13.88	11.50	78.38	0.0046
8.00	12.75	14.88	13.02	76.00	0.0044
6.50	12.80	15.72	13.50	61.75	0.0057
6.50	12.87	16.36	14.18	61.75	0.0063
6.50	18.00	28.00	22.00	61.75	0.0177
6.50	23.00	30.00	23.00	61.75	0.0155



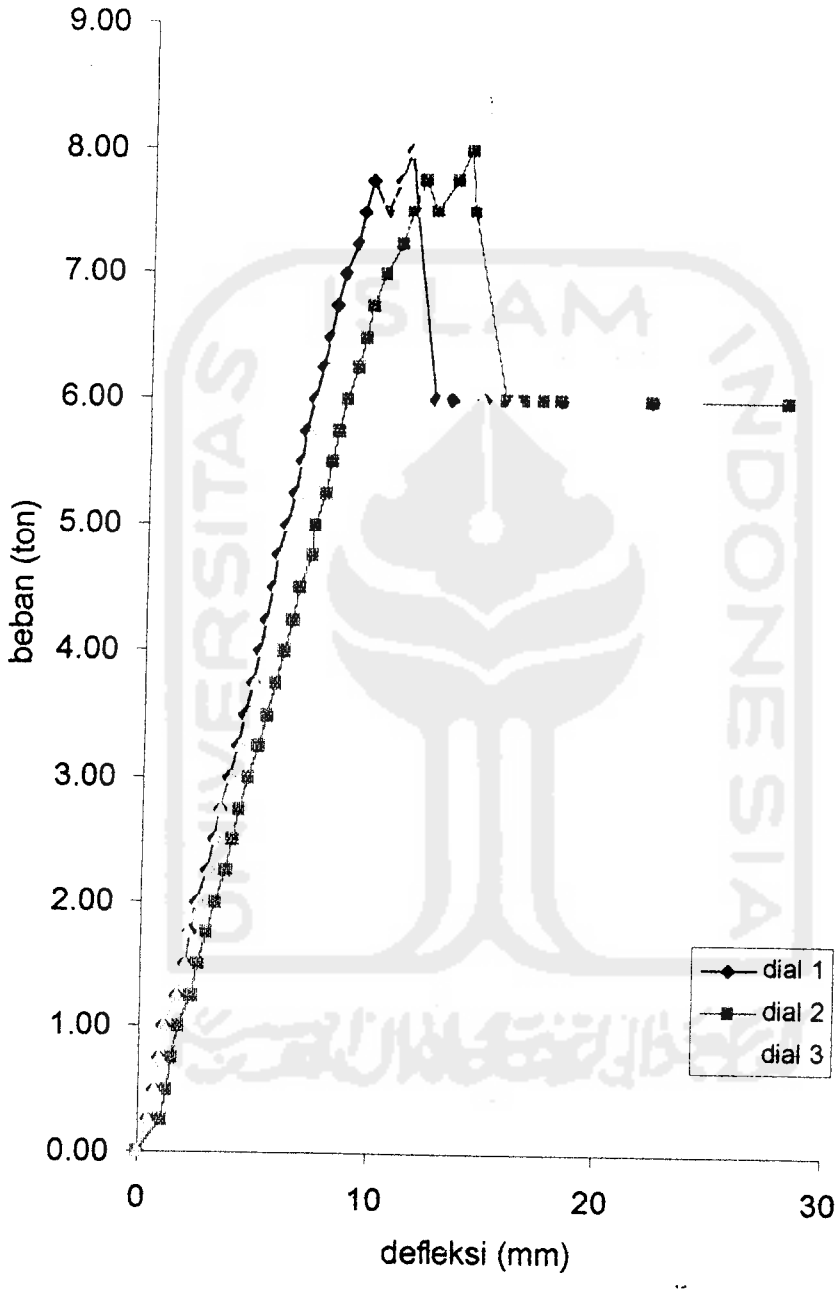
Hubungan beban dan defleksi Benda uji 1

(kuda-kuda dengan las langsung)



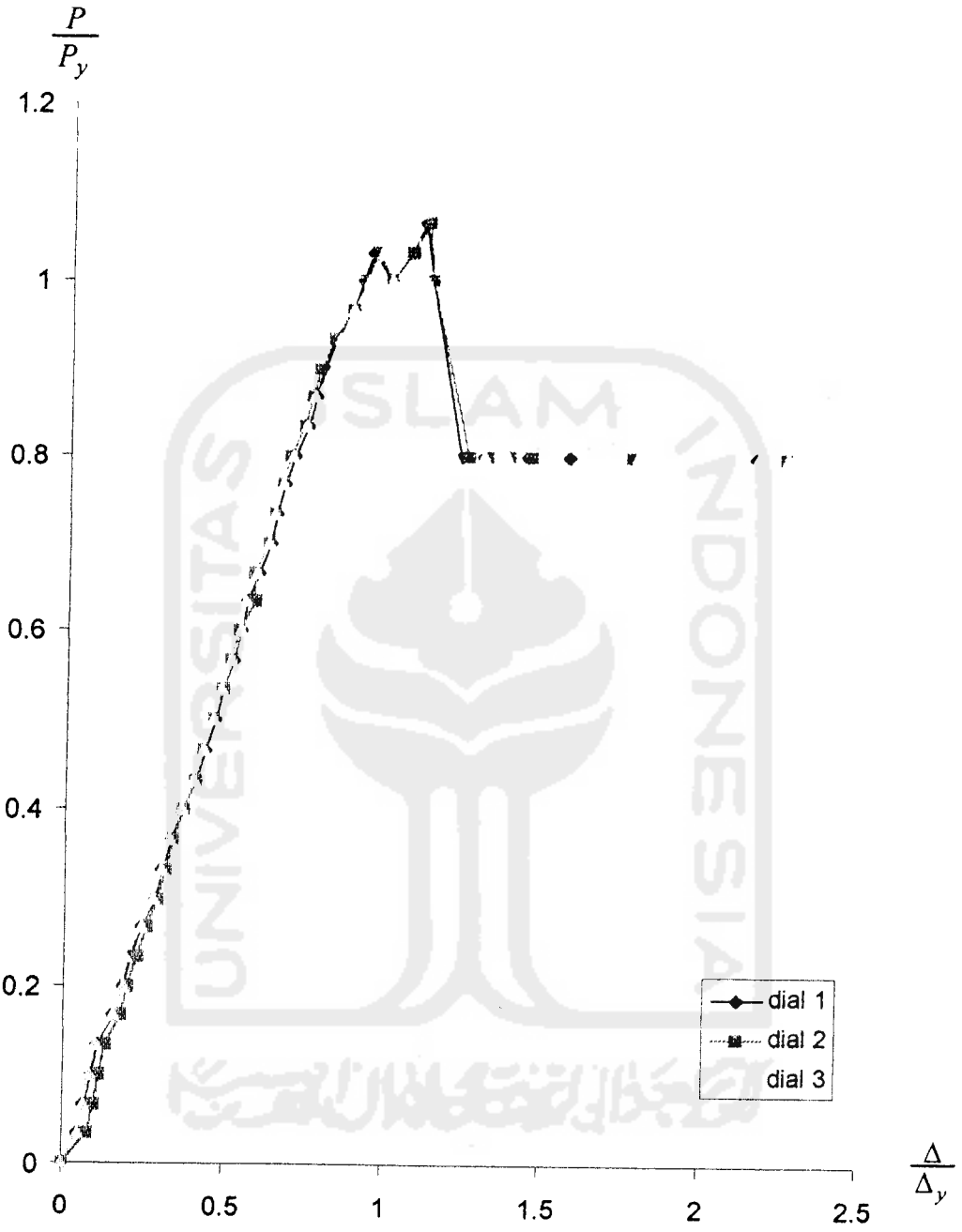
Grafik non dimensi $\frac{P}{P_y}$ versus $\frac{\Delta}{\Delta_y}$ Benda uji 1

(kuda-kuda dengan las langsung)



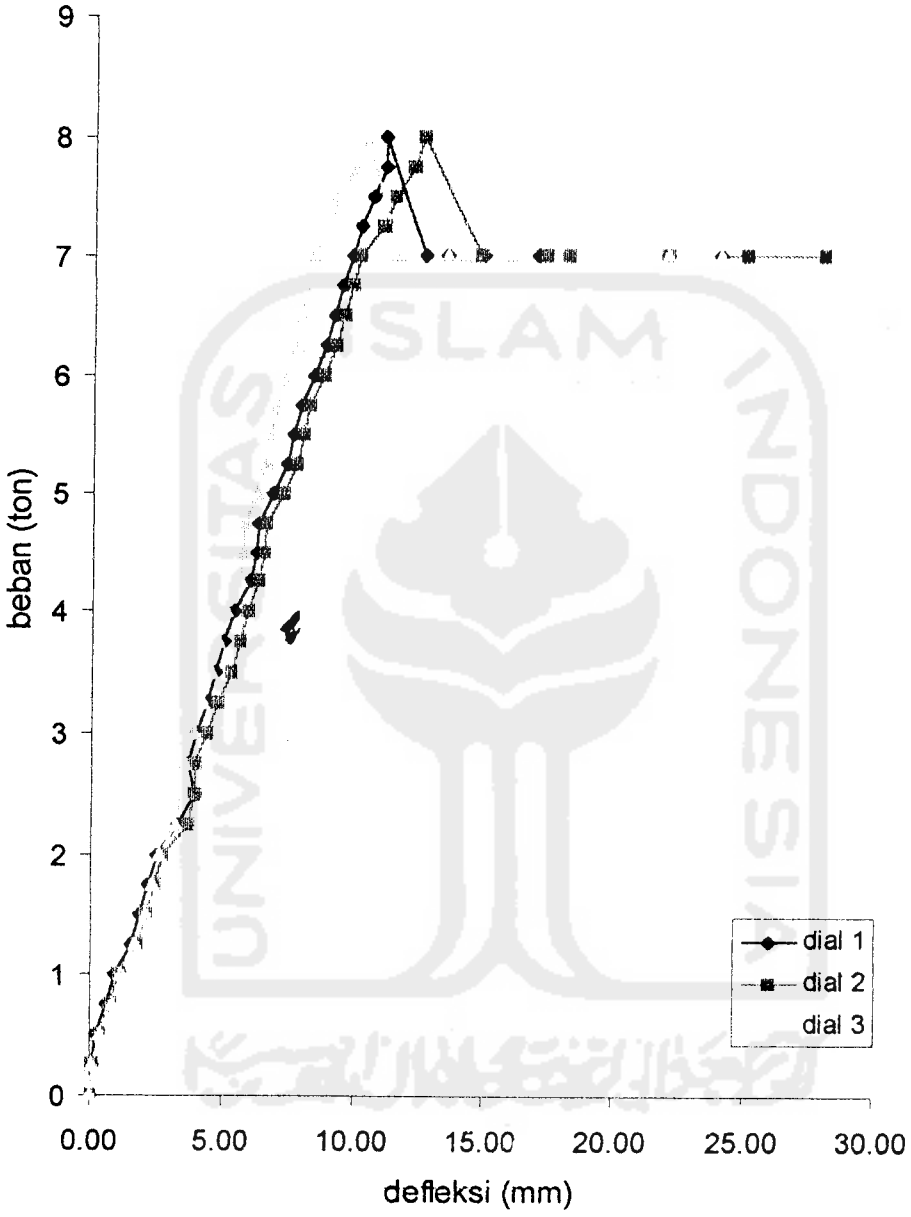
Hubungan beban dan defleksi Benda uji 2

(kuda-kuda dengan las langsung)



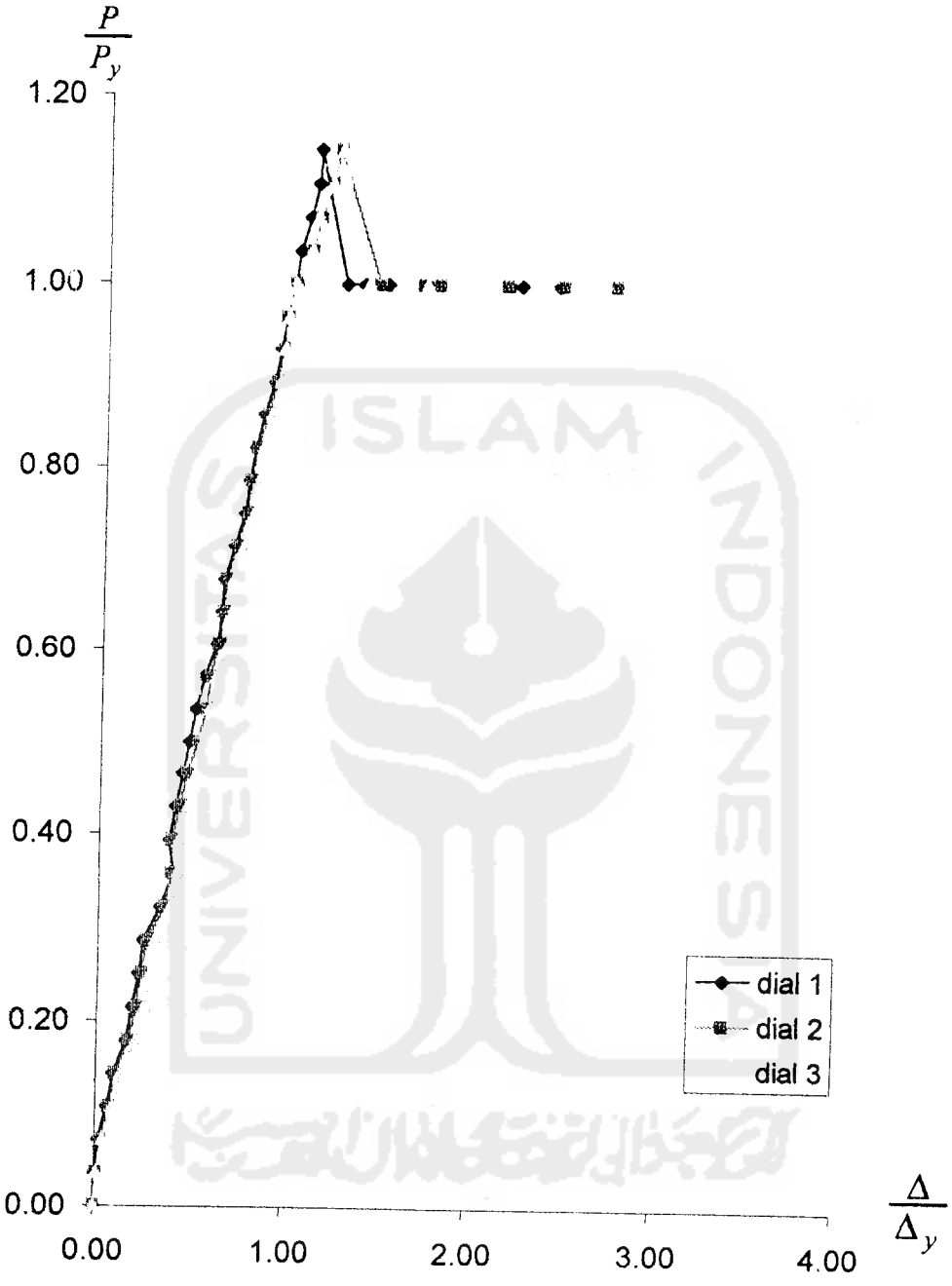
Grafik non dimensi $\frac{P}{P_y}$ versus $\frac{\Delta}{\Delta_y}$ benda uji 2

(kuda-kuda dengan las langsung)



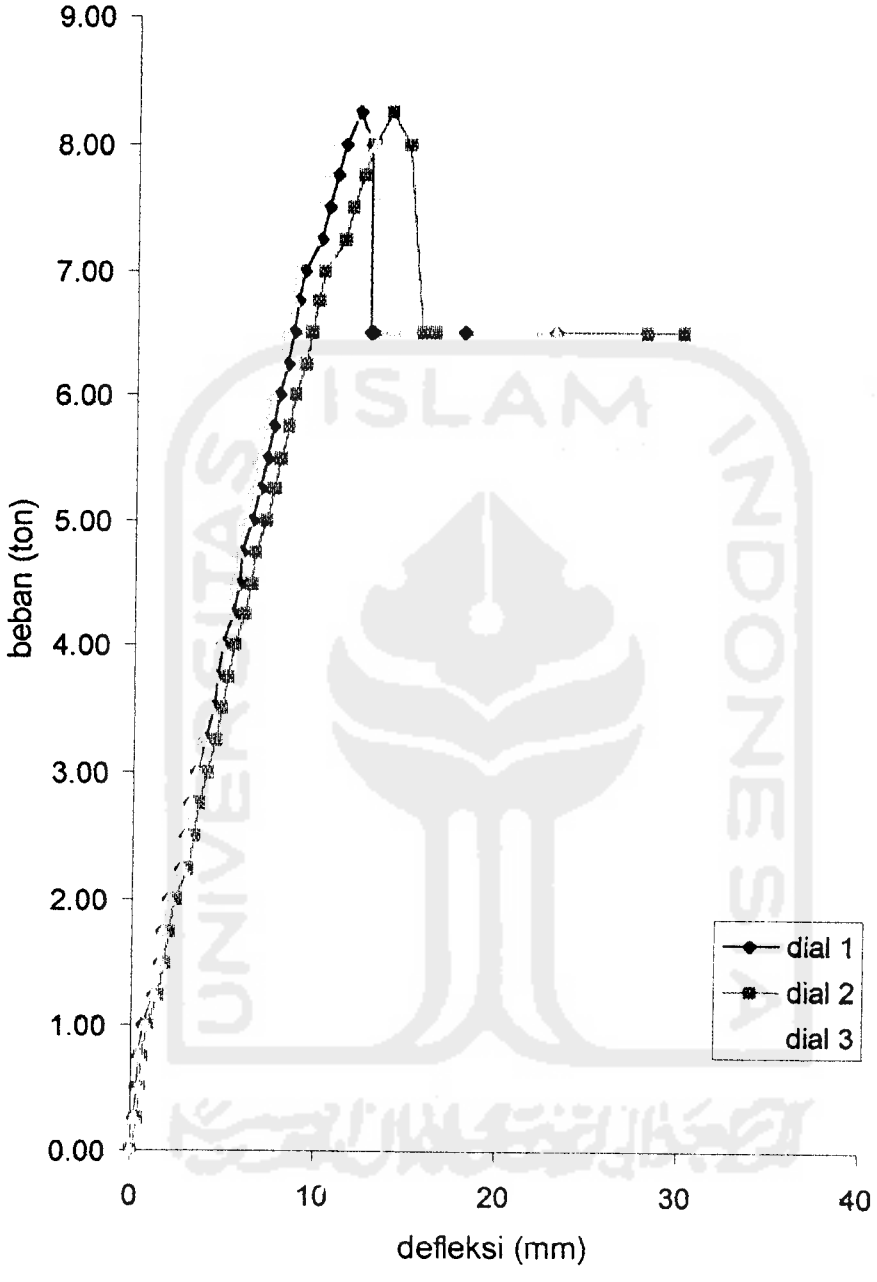
Hubungan beban dan defleksi Benda uji 3

(kuda-kuda dengan plat buhul)



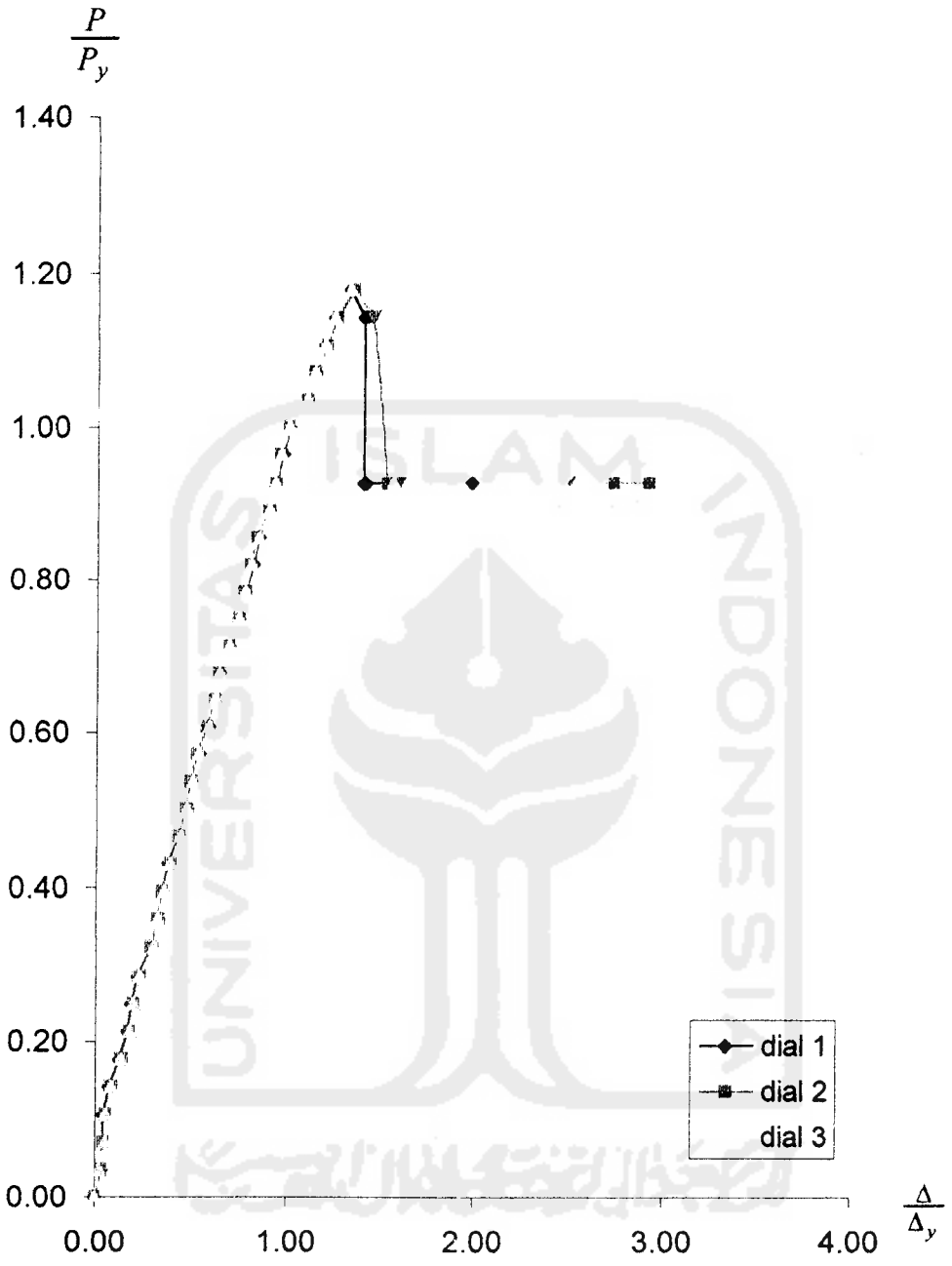
Grafik non dimensi $\frac{P}{P_y}$ versus $\frac{\Delta}{\Delta_y}$ Benda uji 3

(kuda-kuda dengan plat buhul)

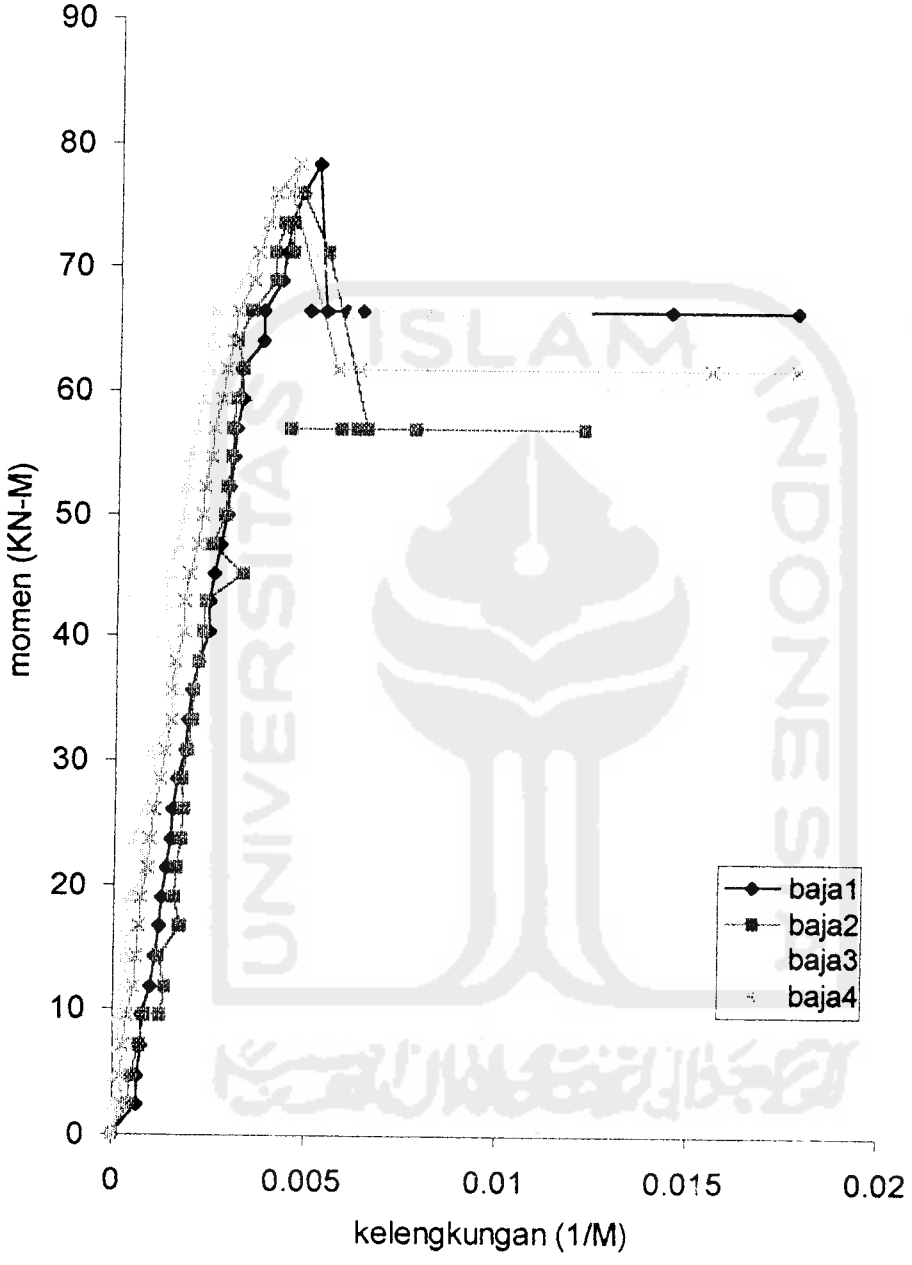


Hubungan beban dan defleksi Benda uji 4

(kuda-kuda dengan plat buhul)

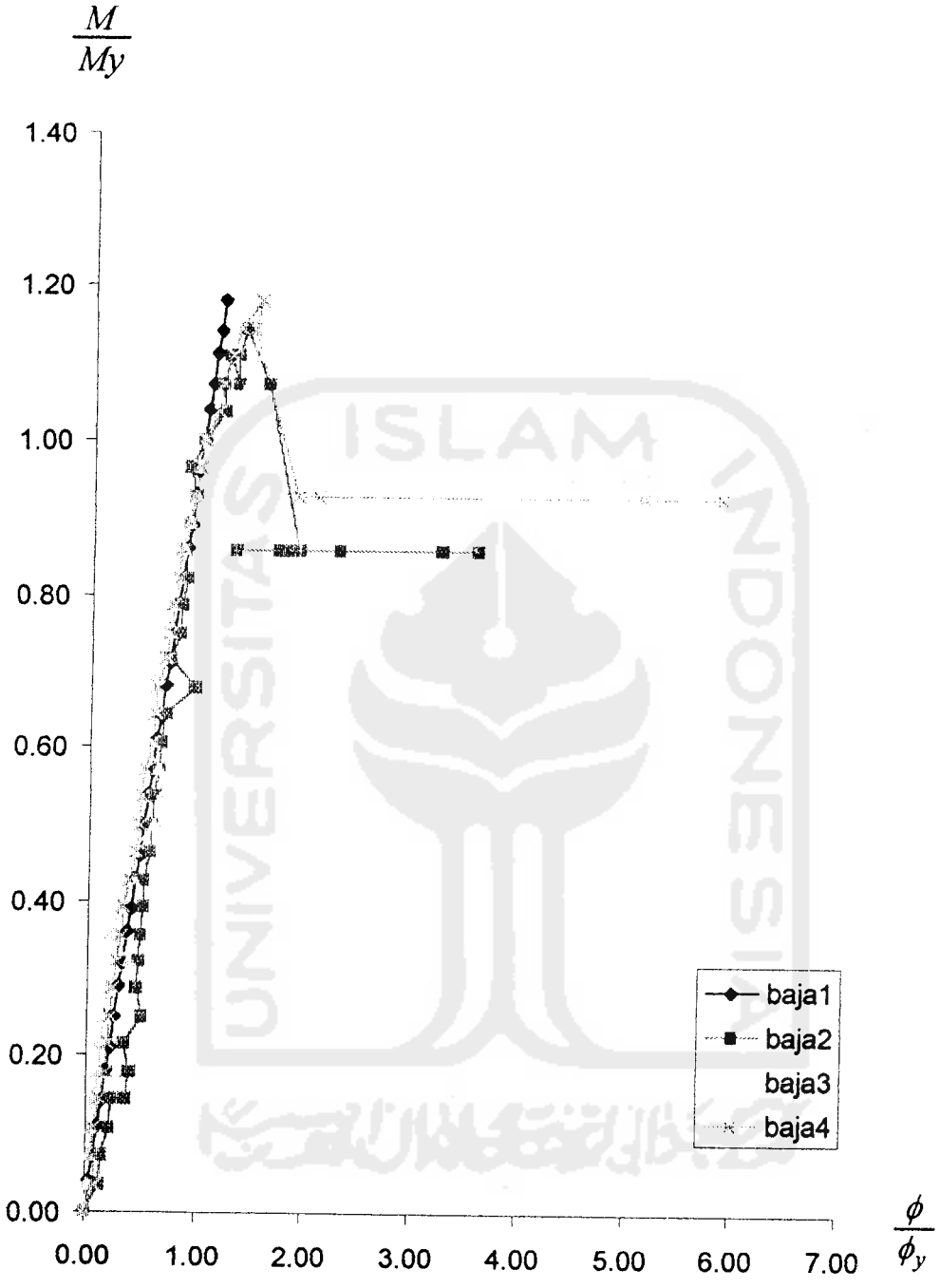


Grafik non dimensi $\frac{P}{P_y}$ versus $\frac{\Delta}{\Delta_y}$ Benda uji 4
(kuda-kuda dengan plat buhul)



Keterangan :
Baja1 : Benda uji 1, kuda-kuda dengan las langsung
Baja2 : Benda uji 2, kuda-kuda dengan las langsung
Baja3 : Benda uji 3, kuda-kuda dengan plat buhul
Baja4 : Benda uji 4, kuda-kuda dengan plat buhul

Hubungan momen dan kelengkungan dari ke-4 benda uji

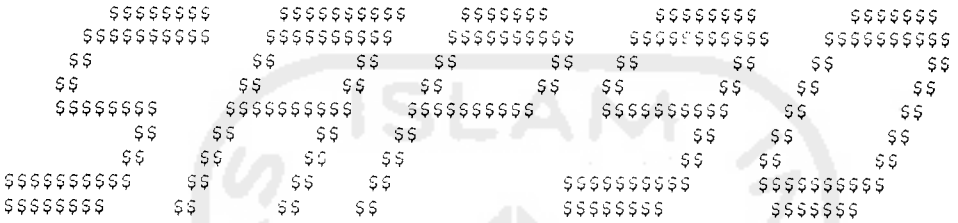


Keterangan :

Baja1 : Benda uji 1, kuda-kuda dengan las langsung
Baja2 : Benda uji 2, kuda-kuda dengan las langsung
Baja3 : Benda uji 3, kuda-kuda dengan plat buhul
Baja4 : Benda uji 4, kuda-kuda dengan plat buhul

Hubungan $\frac{M}{My}$ versus $\frac{\phi}{\phi_y}$ kurva non dimensi dari ke-4 benda uji

LAMPIRAN IV



STRUCTURAL ANALYSIS PROGRAMS

VERSION 5.20

```
ANALISIS STRUKTUR KUDA-KUDA (TRUSS 2D) - [X,Y] UNIT KG,CM
SYSTEM
L=1
JOINTS
1 X=0       Y=0
2 X=95      Y=0
3 X=190     Y=0
4 X=285     Y=0
5 X=380     Y=0
6 X=285     Y=55
7 X=190     Y=110
8 X=95      Y=55

RESTRAINTS
1 8 1  R=0,0,1,1,1,1
1      R=1,1,1,1,1,0
5      R=0,1,1,1,1,0

FRAME
NM=2 NSEC=3  Y=-1
C ----MATERIAL PROPERTI----
1 A=2.6  E=2.1E6
2 A=1.8  E=2.1E6
C ----FRAME ELEMENT LOCATION DATA----
1 1 2 M=1  LP=1,0
2 2 3 M=1  LP=1,0
3 3 4 M=1  LP=1,0
4 4 5 M=1  LP=1,0
5 5 6 M=1  LP=1,0
6 6 7 M=1  LP=1,0
7 7 8 M=1  LP=1,0
8 8 1 M=1  LP=1,0
9 2 8 M=2  LP=1,0
10 3 8 M=2 LP=1,0
11 3 7 M=2 LP=1,0
12 3 6 M=2 LP=1,0
13 4 6 M=2 LP=1,0

LOAD
7 F=0,-8250,0
```

		54.9	.00	.00
		109.8	.00	.00
11	---	---	---	---
	1	.00		
		.0	.00	.00
		55.0	.00	.00
		110.0	.00	.00
12	---	---	---	---
	1	.00		
		.0	.00	.00
		54.9	.00	.00
		109.8	.00	.00
13	---	---	---	---
	1	.00		
		.0	.00	.00
		27.5	.00	.00
		55.0	.00	.00

LABORATORIUM MEKANIKA STRUKTUR PAU-ILMU REKAYASA

PROGRAM:SAP90/FILE:truss.SOL
ANALISIS STRUKTUR TRUSS 2D - [X,Y] UNIT KG,CM

J O I N T D I S P L A C E M E N T S

LOAD CONDITION 1 - DISPLACEMENTS "U"

JOINT	U(X)	U(Y)	(E=2100000)
1	.000000	.000000	
2	.123970	-.923798	
3	.247940	-1.088978	
4	.371909	-.923798	
5	.495879	.000000	
6	.152309	-.923798	
7	.247940	-1.088978	
8	.343570	-.923798	

JOINT	U(X)	U(Y)	(90%E)
1	.000000	.000000	
2	.137744	-1.026442	
3	.275488	-1.209975	
4	.413233	-1.026442	
5	.550977	.000000	
6	.169232	-1.026442	
7	.275488	-1.209975	
8	.381744	-1.026442	

JOINT	U(X)	U(Y)	(80%E)
1	.000000	.000000	
2	.154962	-1.154748	
3	.309924	-1.361222	
4	.464887	-1.154748	
5	.619849	.000000	
6	.190387	-1.154748	
7	.309924	-1.361222	
8	.429462	-1.154748	

JOINT	U(X)	U(Y)	(60%E)
1	.000000	.000000	
2	.206616	-1.539664	
3	.413233	-1.814963	
4	.619849	-1.539664	
5	.826465	.000000	
6	.253849	-1.539664	
7	.413233	-1.814963	
8	.572616	-1.539664	

JOINT	U(X)	U(Y)	(40%E)
1	.000000	.000000	
2	.309924	-2.309495	
3	.619849	-2.722444	
4	.929773	-2.309495	
5	1.239698	.000000	
6	.380773	-2.309495	
7	.619849	-2.722444	
8	.858925	-2.309495	

```
ANALISIS STRUKTUR KUDA-KUDA (FRAME 2D) - [X,Y] UNIT KG,CM
SYSTEM
L=1
JOINTS
1 X=0       Y=0
2 X=95      Y=0
3 X=190     Y=0
4 X=285     Y=0
5 X=380     Y=0
6 X=285     Y=55
7 X=190     Y=110
8 X=95      Y=55

RESTRAINTS
1 8 1  R=0,0,1,1,1,1
1      R=1,1,1,1,1,0
5      R=0,1,1,1,1,0

FRAME
NM=2 NSEC=3  Y=-1
C ----MATERIAL PROPERTI----
1 A=2.6   E=2.1E6  I=6.9775
2 A=1.8   E=2.1E6  I=2.3661
C ----FRAME ELEMENT LOCATION DATA----
1 1 2 M=1  LP=1,0
2 2 3 M=1  LP=1,0
3 3 4 M=1  LP=1,0
4 4 5 M=1  LP=1,0
5 5 6 M=1  LP=1,0
6 6 7 M=1  LP=1,0
7 7 8 M=1  LP=1,0
8 8 1 M=1  LP=1,0
9 2 8 M=2  LP=1,0
10 3 8 M=2 LP=1,0
11 3 7 M=2 LP=1,0
12 3 6 M=2 LP=1,0
13 4 6 M=2 LP=1,0

LOAD
7 F=0,-8250,0
```

LABORATORIUM MEKANIKA STRUKTUR PAU-ILMU REKAYASA PAGE 1
PROGRAM:SAP90/FILE:frame.F3F

ANALISIS STRUKTUR FRAME 2D - [X,Y] UNIT KG,CM

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
1								
	1	7058.28						
			.0	22.26	-163.45			
			47.5	22.26	893.95			
			95.0	22.26	1951.35			
2								
	1	7070.16						
			.0	-15.91	1511.31			
			47.5	-15.91	755.42			
			95.0	-15.91	-.48			
3								
	1	7070.16						
			.0	15.91	-.48			
			47.5	15.91	755.42			
			95.0	15.91	1511.31			
4								
	1	7058.28						
			.0	-22.26	1951.35			
			47.5	-22.26	893.95			
			95.0	-22.26	-163.45			
5								
	1	-8164.04						
			.0	-14.17	-163.45			
			54.9	-14.17	-940.98			
			109.8	-14.17	-1718.52			
6								
	1	-8226.65						
			.0	14.54	-1284.58			
			54.9	14.54	-486.42			
			109.8	14.54	311.73			
7								
	1	-8226.65						
			.0	-14.54	311.73			
			54.9	-14.54	-486.42			
			109.8	-14.54	-1284.58			
8								
	1	-8164.04						
			.0	14.17	-1718.52			
			54.9	14.17	-940.98			
			109.8	14.17	-163.45			
9								
	1	-38.17						
			.0	-11.88	440.04			
			27.5	-11.88	113.25			
			55.0	-11.88	-213.53			
10								
	1	64.91						
			.0	-1.01	-109.49			

```
                54.9        -1.01      -164.95
               109.8        -1.01      -220.41
11 ----------------------------------------------
      1   -31.47
                 .0          .00          .00
               55.0          .00          .00
              110.0          .00          .00
12 ----------------------------------------------
      1    64.91
                 .0         1.01       109.49
               54.9         1.01       164.95
              109.8         1.01       220.41
13 ----------------------------------------------
      1   -38.17
                 .0        11.88      -440.04
              27.5         11.88      -113.25
              55.0         11.88       213.53
```

LABORATORIUM MEKANIKA STRUKTUR PAU-ILMU REKAYASA

PROGRAM:SAP90/FILE:frame.SOL
ANALISIS STRUKTUR FRAME 2D - [X,Y] UNIT KG,CM

J O I N T D I S P L A C E M E N T S

LOAD CONDITION 1 - DISPLACEMENTS "U"

JOINT	U(X)	U(Y)	
1	.000000	.000000	(E=2100000)
2	.114674	-.843456	
3	.228124	-1.005719	
4	.341575	-.843456	
5	.456249	.000000	
6	.145262	-.845488	
7	.228124	-1.016670	
8	.310987	-.845488	

JOINT	U(X)	U(Y)	(90%E)
1	.000000	.000000	
2	.127416	-.937173	
3	.253472	-1.117465	
4	.379527	-.937173	
5	.506943	.000000	
6	.161402	-.939432	
7	.253472	-1.129633	
8	.345541	-.939432	

JOINT	U(X)	U(Y)	(80%E)
1	.000000	.000000	
2	.143343	-1.054320	
3	.285155	-1.257148	
4	.426968	-1.054320	
5	.570311	.000000	
6	.181577	-1.056861	
7	.285155	-1.270837	
8	.388734	-1.056861	

JOINT	U(X)	U(Y)	(60%E)
1	.000000	.000000	
2	.191124	-1.405760	
3	.380207	-1.676198	
4	.569291	-1.405760	
5	.760415	.000000	
6	.242103	-1.409147	
7	.380207	-1.694450	
8	.518312	-1.409147	

JOINT	U(X)	U(Y)	(40%E)
1	.000000	.000000	
2	.286686	-2.108639	
3	.570311	-2.514297	
4	.853936	-2.108639	
5	1.140622	.000000	
6	.363154	-2.113721	
7	.570311	-2.541674	
8	.777468	-2.113721	

```
ANALISIS STRUKTUR KUDA-KUDA (TRUSS 2D) - [X,Y] UNIT KG,CM
SYSTEM
L=1
JOINTS
1 X=0       Y=0
2 X=95      Y=0
3 X=190     Y=0
4 X=285     Y=0
5 X=380     Y=0
6 X=285     Y=55
7 X=190     Y=110
8 X=95      Y=55

RESTRAINTS
1 8 1  R=0,0,1,1,1,1
1      R=1,1,1,1,1,0
5      R=0,1,1,1,1,0

FRAME
NM=2 NSEC=3  Y=-1
C ----MATERIAL PROPERTI----
1 A=2.6  E=2.1E6
2 A=1.8  E=2.1E6
C ----FRAME ELEMENT LOCATION DATA----
1 1 2 M=1  LP=1,0
2 2 3 M=1  LP=1,0
3 3 4 M=1  LP=1,0
4 4 5 M=1  LP=1,0
5 5 6 M=1  LP=1,0
6 6 7 M=1  LP=1,0
7 7 8 M=1  LP=1,0
8 8 1 M=1  LP=1,0
9 2 8 M=2  LP=1,0
10 3 8 M=2 LP=1,0
11 3 7 M=2 LP=1,0
12 3 6 M=2 LP=1,0
13 4 6 M=2 LP=1,0

LOAD
7 F=0,-8000,0
```

LABORATORIUM MEKANIKA STRUKTUR PAU-ILMU REKAYASA PAGE 1
PROGRAM:SAP90/FILE:truss.F3F

ANALISIS STRUKTUR TRUSS 2D - [X,Y] UNIT KG,CM

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
1								
	1	6909.09						
			.0	.00	.00			
			47.5	.00	.00			
			95.0	.00	.00			
2								
	1	6909.09						
			.0	.00	.00			
			47.5	.00	.00			
			95.0	.00	.00			
3								
	1	6909.09						
			.0	.00	.00			
			47.5	.00	.00			
			95.0	.00	.00			
4								
	1	6909.09						
			.0	.00	.00			
			47.5	.00	.00			
			95.0	.00	.00			
5								
	1	-7983.45						
			.0	.00	.00			
			54.9	.00	.00			
			109.8	.00	.00			
6								
	1	-7983.45						
			.0	.00	.00			
			54.9	.00	.00			
			109.8	.00	.00			
7								
	1	-7983.45						
			.0	.00	.00			
			54.9	.00	.00			
			109.8	.00	.00			
8								
	1	-7983.45						
			.0	.00	.00			
			54.9	.00	.00			
			109.8	.00	.00			
9								
	1	.00						
			.0	.00	.00			
			27.5	.00	.00			
			55.0	.00	.00			
10								
	1	.00						
			.0	.00	.00			

```
                54.9          .00          .00
               109.8          .00          .00
11 ----------------------------------------------
      1       .00
                 .0          .00          .00
                55.0          .00          .00
               110.0          .00          .00
12 ----------------------------------------------
      1       .00
                 .0          .00          .00
                54.9          .00          .00
               109.8          .00          .00
13 ----------------------------------------------
      1       .00
                 .0          .00          .00
                27.5          .00          .00
                55.0          .00          .00
```

```
ANALISIS STRUKTUR KUDA-KUDA (FRAME 2D) - [X,Y] UNIT KG,CM
SYSTEM
L=1
JOINTS
1 X=0       Y=0
2 X=95      Y=0
3 X=190     Y=0
4 X=285     Y=0
5 X=380     Y=0
6 X=285     Y=55
7 X=190     Y=110
8 X=95      Y=55

RESTRAINTS
1 8 1  R=0,0,1,1,1,1
1      R=1,1,1,1,1,0
5      R=0,1,1,1,1,0

FRAME
NM=2 NSEC=3  Y=-1
C ----MATERIAL PROPERTI----
1 A=2.6   E=2.1E6  I=6.9775
2 A=1.8   E=2.1E6  I=2.3661
C ----FRAME ELEMENT LOCATION DATA----
1 1 2 M=1  LP=1,0
2 2 3 M=1  LP=1,0
3 3 4 M=1  LP=1,0
4 4 5 M=1  LP=1,0
5 5 6 M=1  LP=1,0
6 6 7 M=1  LP=1,0
7 7 8 M=1  LP=1,0
8 8 1 M=1  LP=1,0
9 2 8 M=2  LP=1,0
10 3 8 M=2 LP=1,0
11 3 7 M=2 LP=1,0
12 3 6 M=2 LP=1,0
13 4 6 M=2 LP=1,0

LOAD
7 F=0,-8000,0
```

LABORATORIUM MEKANIKA STRUKTUR DAN ILMU REKAYASA PAGE 1
PROGRAM:SAP90/FILE:frame.F3F

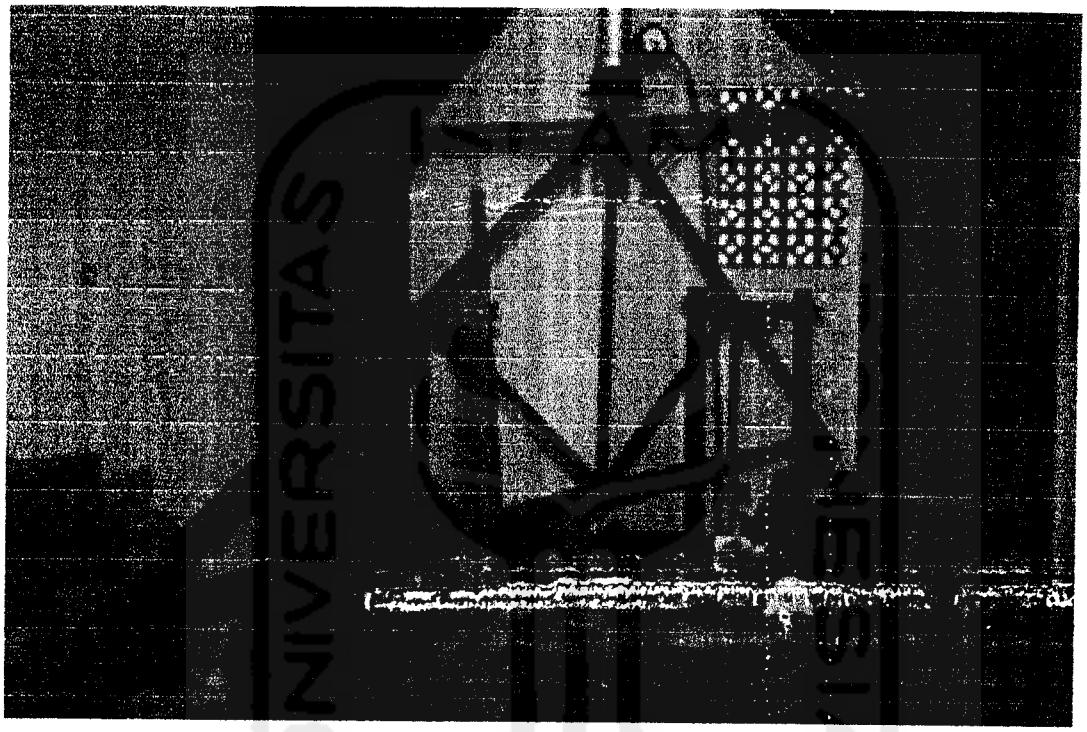
ANALISIS STRUKTUR FRAME 2D - [X,Y] UNIT KG,CM

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
1								
	1	6844.39						
			.0	21.59	-158.50			
			47.5	21.59	866.86			
			95.0	21.59	1892.22			
2								
	1	6855.91						
			.0	-15.43	1465.52			
			47.5	-15.43	732.53			
			95.0	-15.43	-.46			
3								
	1	6855.91						
			.0	15.43	-.46			
			47.5	15.43	732.53			
			95.0	15.43	1465.52			
4								
	1	6844.39						
			.0	-21.59	1892.22			
			47.5	-21.59	866.86			
			95.0	-21.59	-158.50			
5								
	1	-7916.64						
			.0	-13.74	-158.50			
			54.9	-13.74	-912.47			
			109.8	-13.74	-1666.44			
6								
	1	-7977.35						
			.0	14.10	-1245.65			
			54.9	14.10	-471.68			
			109.8	14.10	302.29			
7								
	1	-7977.35						
			.0	-14.10	302.29			
			54.9	-14.10	-471.68			
			109.8	-14.10	-1245.65			
8								
	1	-7916.64						
			.0	13.74	-1666.44			
			54.9	13.74	-912.47			
			109.8	13.74	-158.50			
9								
	1	-37.02						
			.0	-11.52	426.70			
			27.5	-11.52	109.82			
			55.0	-11.52	-207.06			
10								
	1	62.95						
			.0	-.98	-106.17			

```
                54.9          -.98      -159.95
               109.8          -.98      -213.73
11 ----------------------------------------------
      1   -30.52
                 .0           .00          .00
                55.0          .00          .00
               110.0          .00          .00
12 ----------------------------------------------
      1    62.95
                 .0           .98       106.17
                54.9          .98       159.95
               109.8          .98       213.73
13 ----------------------------------------------
      1   -37.02
                 .0         11.52      -426.70
                27.5         11.52      -109.82
                55.0         11.52       207.06
```

LAMPIRAN V



Kuda kuda sebelum dilakukan pengujian pembebanan

Benda uji 1 (kuda-kuda las langsung), kedua batang desak mengalami tekuk bersamaan

Benda uji 2 (kuda-kuda las langsung)

plat b

atas