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LAMPIRAN 1
HASIL TEST TARIK TULANGAN LENTUR





CENTER FOR MATERIAL PROCESSING AND FAILURE ANALYSIS
 UNIVERSITAS INDONESIA – DEPARTEMEN TEKNIK METALURGI & MATERIAL
LABORATORIUM UJI MATERIAL
 Kampus Baru UI – Depok 16424 – Indonesia
 Phone : 021 – 788 49045, 786 3510 Fax : 021 – 787 2350
 E-mail : cmpfa@metal.ui.ac.id

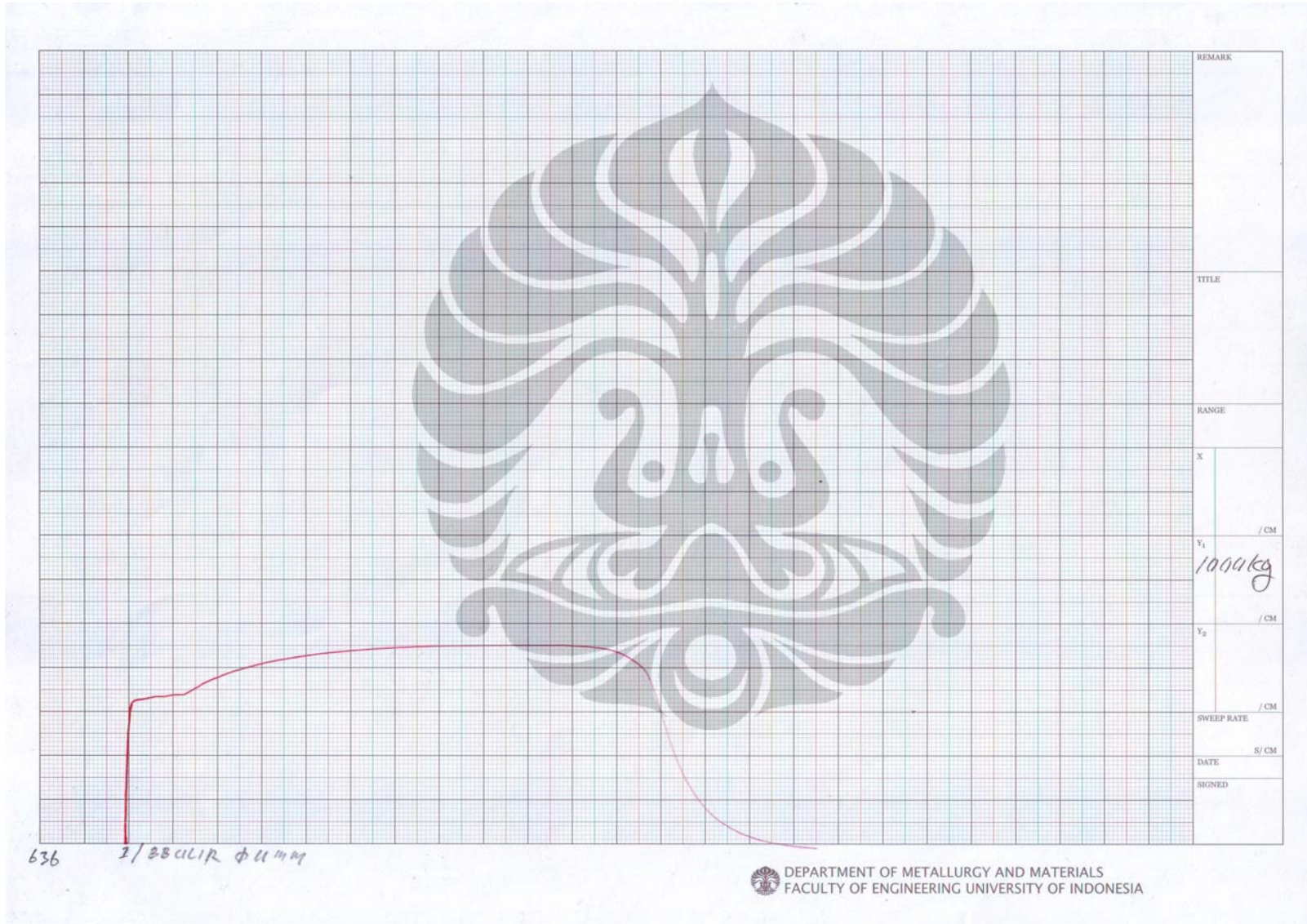
Lembar Data Pengujian Tarik
 (Tensile Testing Data Sheet)

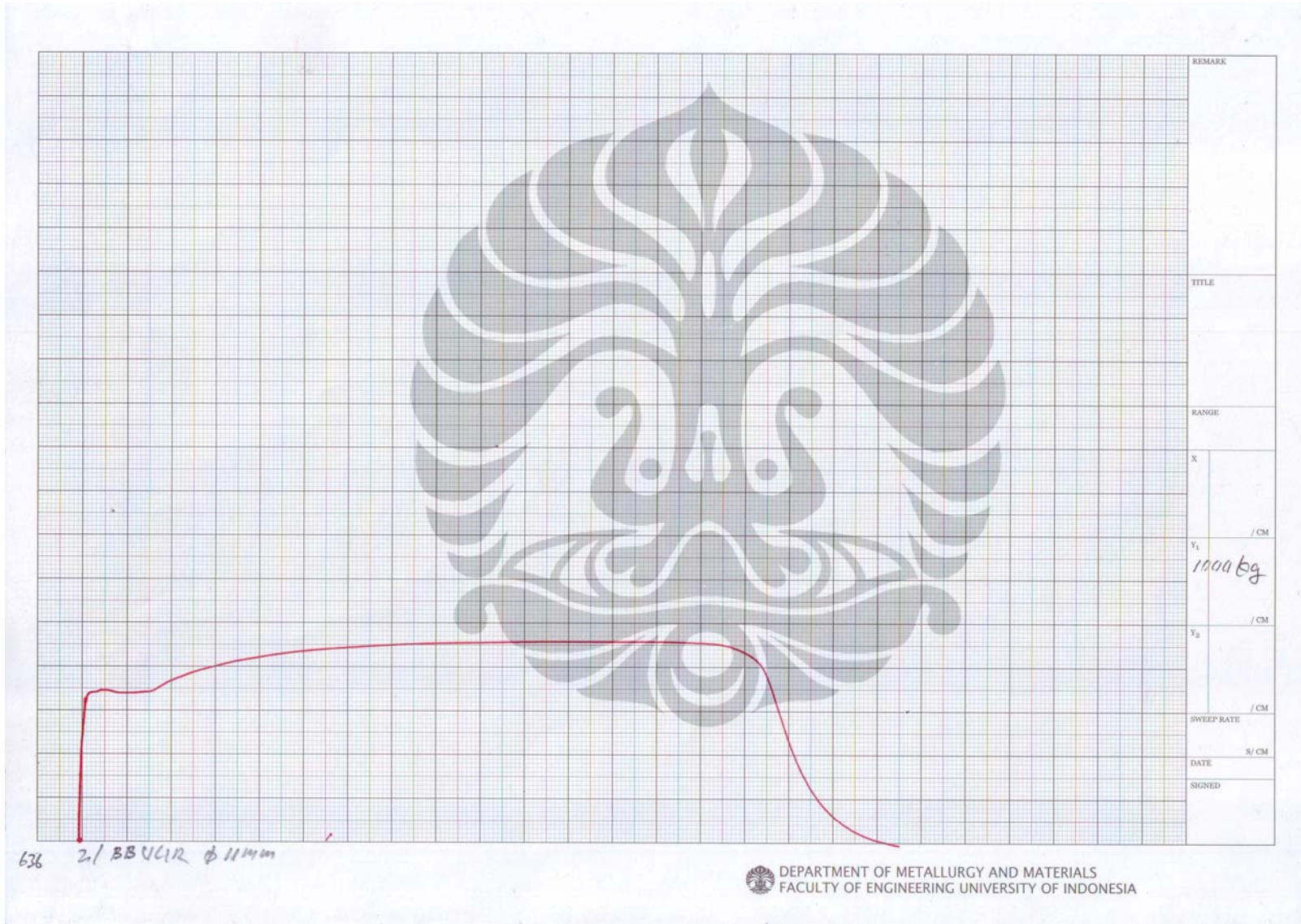
Nama customer	CMPFA	No. Kontrak : 636	Tanggal Uji : 24-6-2008
Mesin Uji	Servopulser Shimadzu Kapasitas 20 ton	Teknisi Penguji : N. N. N. N.	Paraf Teknisi : <i>[Signature]</i>
Bahan	BAJA BETON ULIR	Standar/Metode Uji : Z-2201	Tanggal bahan diterima :
Identitas Bahan	Rod ϕ 11 mm		

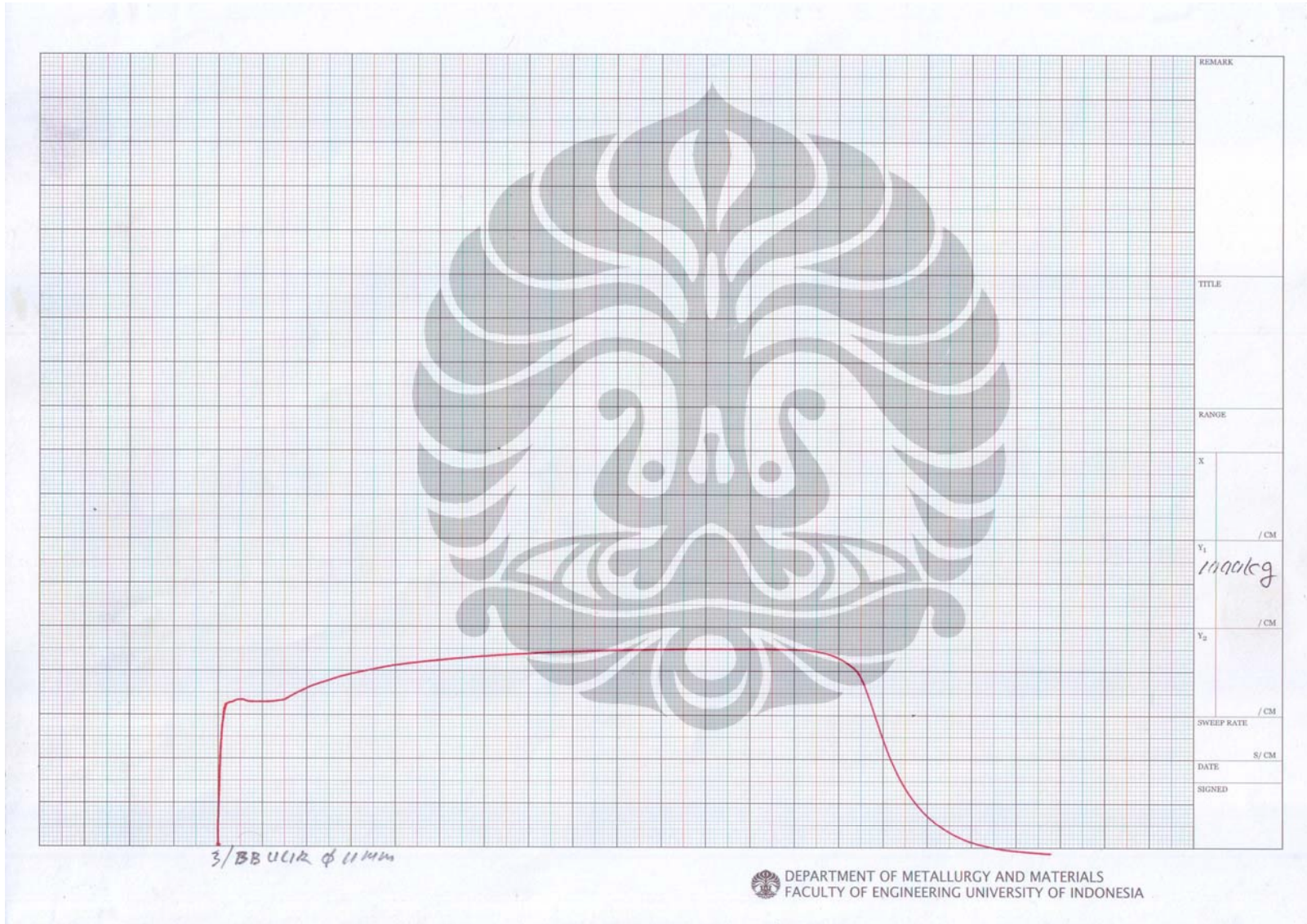
No	Kode Sampel	Bentuk Sampel	Dimensi Sampel (mm)	Luas penampang (mm ²)	Panjang ukur (mm)	Pu (kg)	Py (kg)	ΔL (mm)	σ_u (kg/mm ²)	σ_y (kg/mm ²)	e (%)	Ket.
1	BB ULIR ϕ 11 mm	<input checked="" type="checkbox"/> Rod/Tube <input type="checkbox"/> Pelat	11	95,03	88	4525	3300	25,30	47	34	28,75	
2	BB ULIR ϕ 11 mm	<input checked="" type="checkbox"/> Rod/Tube <input type="checkbox"/> Pelat	11	95,03	88	4600	3400	29,20	48	35	33,18	
3	- u -	<input checked="" type="checkbox"/> Rod/Tube <input type="checkbox"/> Pelat	11	95,03	88	4525	3300	27,8	47	34	31,59	
		<input type="checkbox"/> Rod/Tube <input type="checkbox"/> Pelat										
		<input type="checkbox"/> Rod/Tube <input type="checkbox"/> Pelat										
		<input type="checkbox"/> Rod/Tube <input type="checkbox"/> Pelat										
		<input type="checkbox"/> Rod/Tube <input type="checkbox"/> Pelat										

Formulir : FF-32/Met-UI Rev : 0

* Coret Yang Tirlak Perlu







LAMPIRAN 2
HASIL TEST TARIK TULANGAN GESER





CENTER FOR MATERIAL PROCESSING AND FAILURE ANALYSIS
UNIVERSITAS INDONESIA – DEPARTEMEN TEKNIK METALURGI & MATERIAL
LABORATORIUM UJI MATERIAL
Kampus Baru UI – Depok 16424 – Indonesia
Phone : 021 – 788 49045, 786 3510 Fax : 021 – 787 2350
E-mail : cmpfa@metal.ui.ac.id

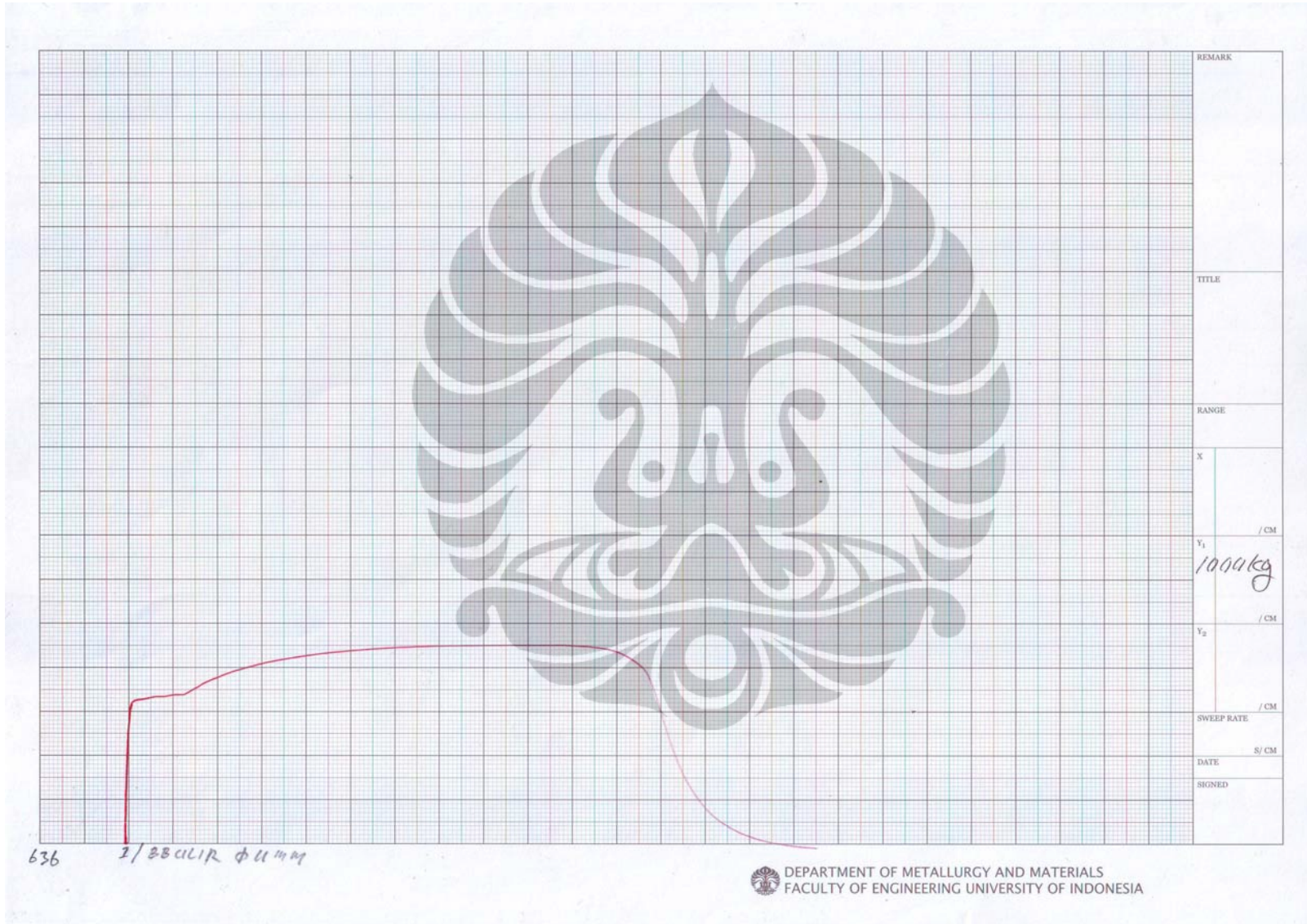
Lembar Data Pengujian Tarik
(Tensile Testing Data Sheet)

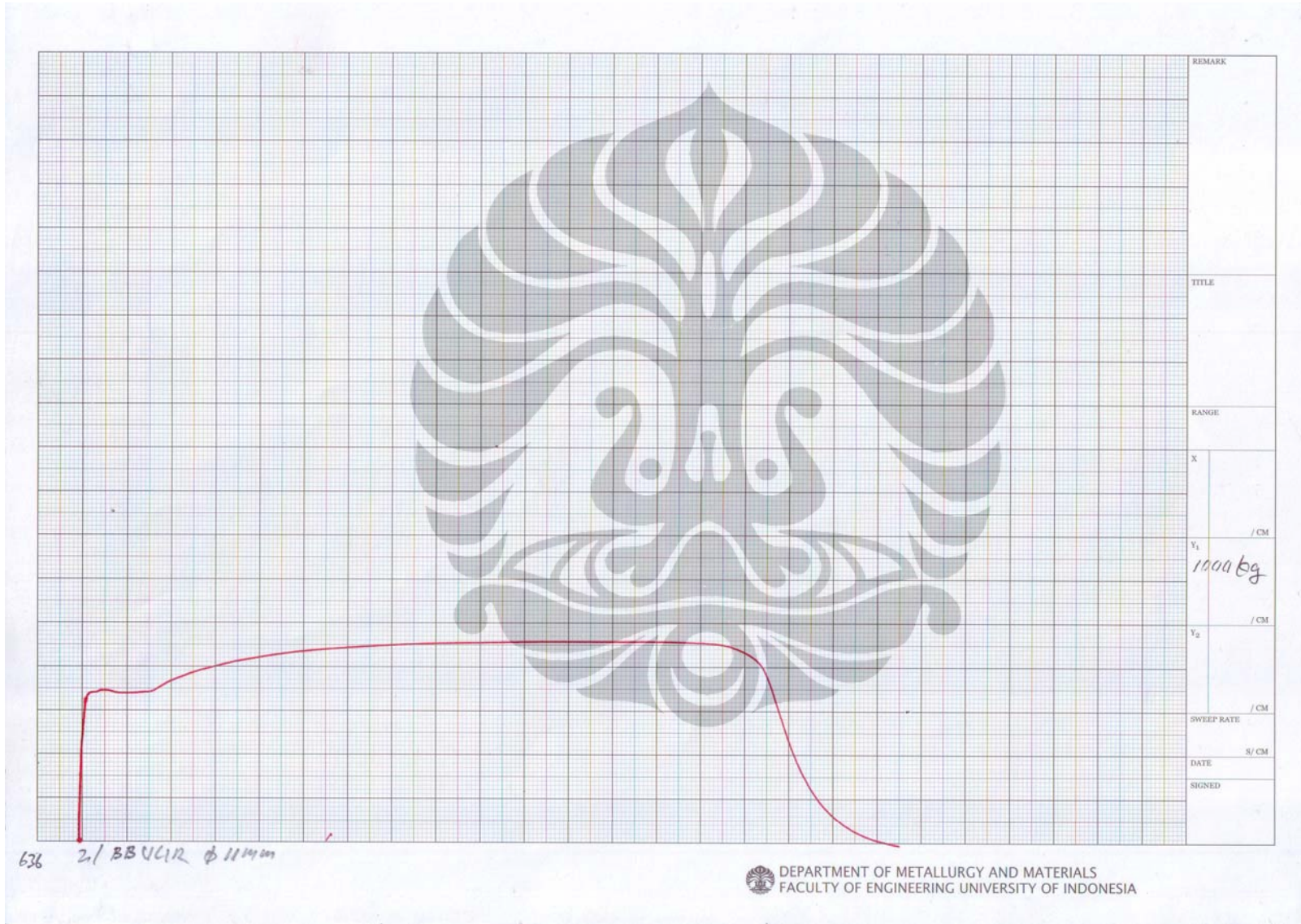
Nama customer	CMPFA	No. Kontrak : 636	Tanggal Uji : 24-6-2008
Mesin Uji	Servopulser Shimadzu Kapasitas 20 ton	Teknisi Penguji : N. Idris	Paraf Teknisi :
Bahan	BAJA BETON ULIR	Standar/Metode Uji : Z-2201	Tanggal bahan diterima :
Identitas Bahan	Rod ϕ 11 mm		

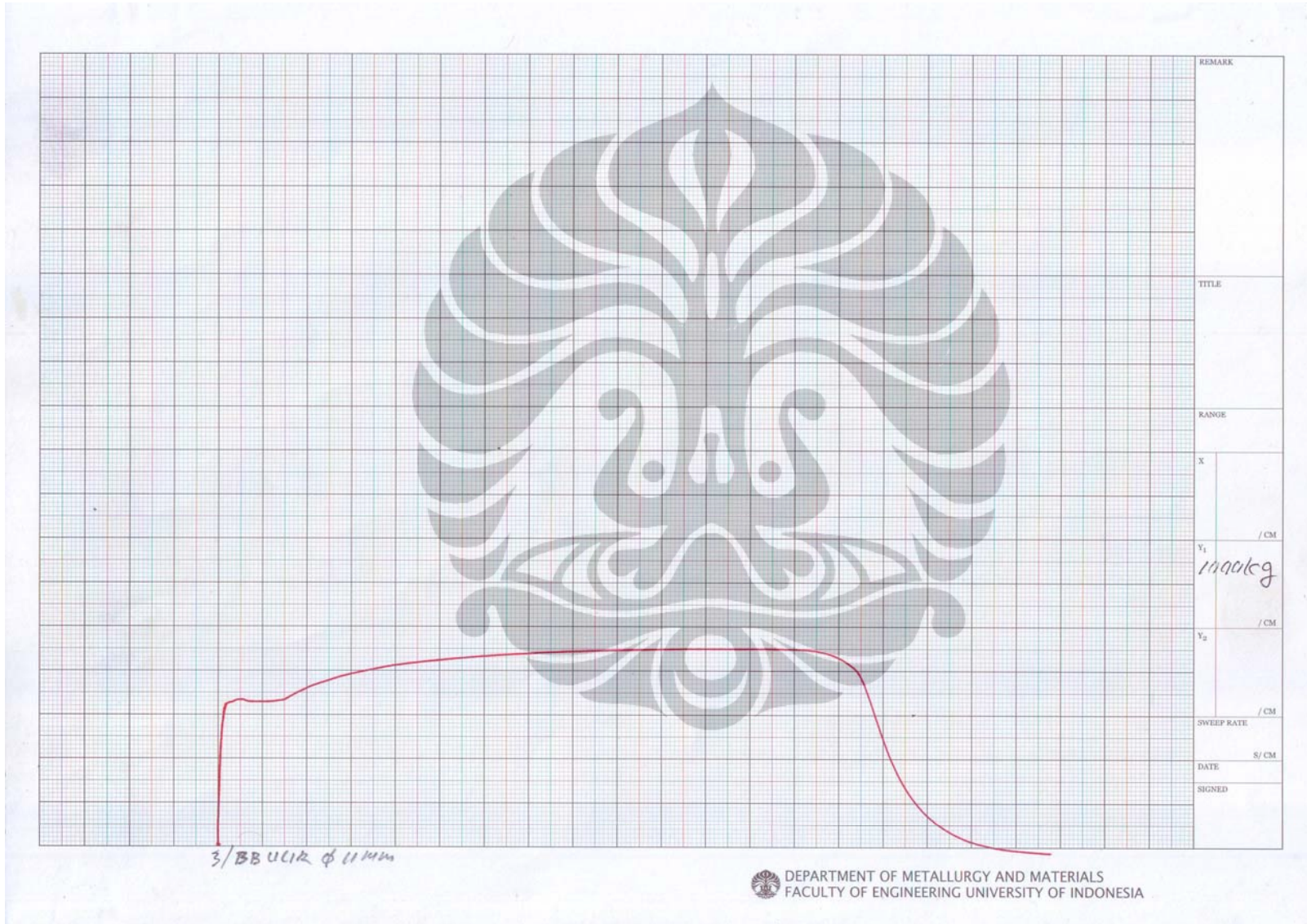
No	Kode Sampel	Bentuk Sampel	Dimensi Sampel (mm)	Luas penampang (mm ²)	Panjang ukur (mm)	Pu (kg)	Py (kg)	ΔL (mm)	σ_u (kg/mm ²)	σ_y (kg/mm ²)	e (%)	Ket.
1	BB ULIR ϕ 11 mm	<input checked="" type="checkbox"/> Rod/Tube <input type="checkbox"/> Pelat	11	95,03	88	4525	3300	25,30	47	34	28,75	
2	BB ULIR ϕ 11 mm	<input checked="" type="checkbox"/> Rod/Tube <input type="checkbox"/> Pelat	11	95,03	88	4600	3400	29,20	48	35	33,18	
3	- u -	<input checked="" type="checkbox"/> Rod/Tube <input type="checkbox"/> Pelat	11	95,03	88	4525	3300	27,8	47	34	31,59	
		<input type="checkbox"/> Rod/Tube <input type="checkbox"/> Pelat										
		<input type="checkbox"/> Rod/Tube <input type="checkbox"/> Pelat										
		<input type="checkbox"/> Rod/Tube <input type="checkbox"/> Pelat										
		<input type="checkbox"/> Rod/Tube <input type="checkbox"/> Pelat										

Formulir : FF-32/Met-UI Rev : 0

* Coret Yang Tirlak Perlu







LAMPIRAN 3
HASIL TEST TARIK PELAT





CENTER FOR MATERIAL PROCESSING AND FAILURE ANALYSIS
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 Kampus Baru UI – Depok 16424 – Indonesia
 Phone : 021 – 788 49045, 786 3510 Fax : 021 – 787 2350
 E-mail : cmpfa@metal.ui.ac.id

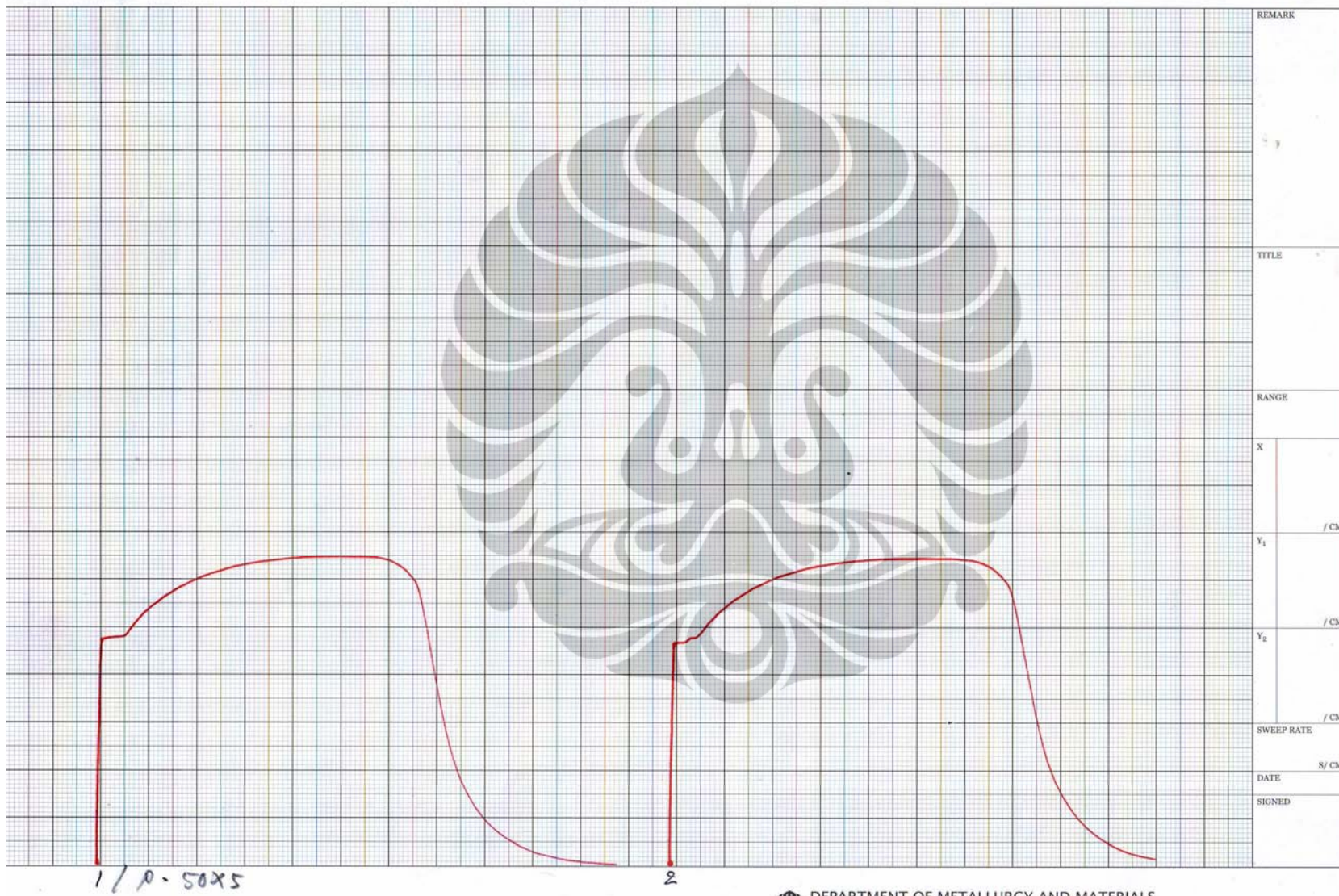
Lembar Data Pengujian Tarik
(Tensile Testing Data Sheet)

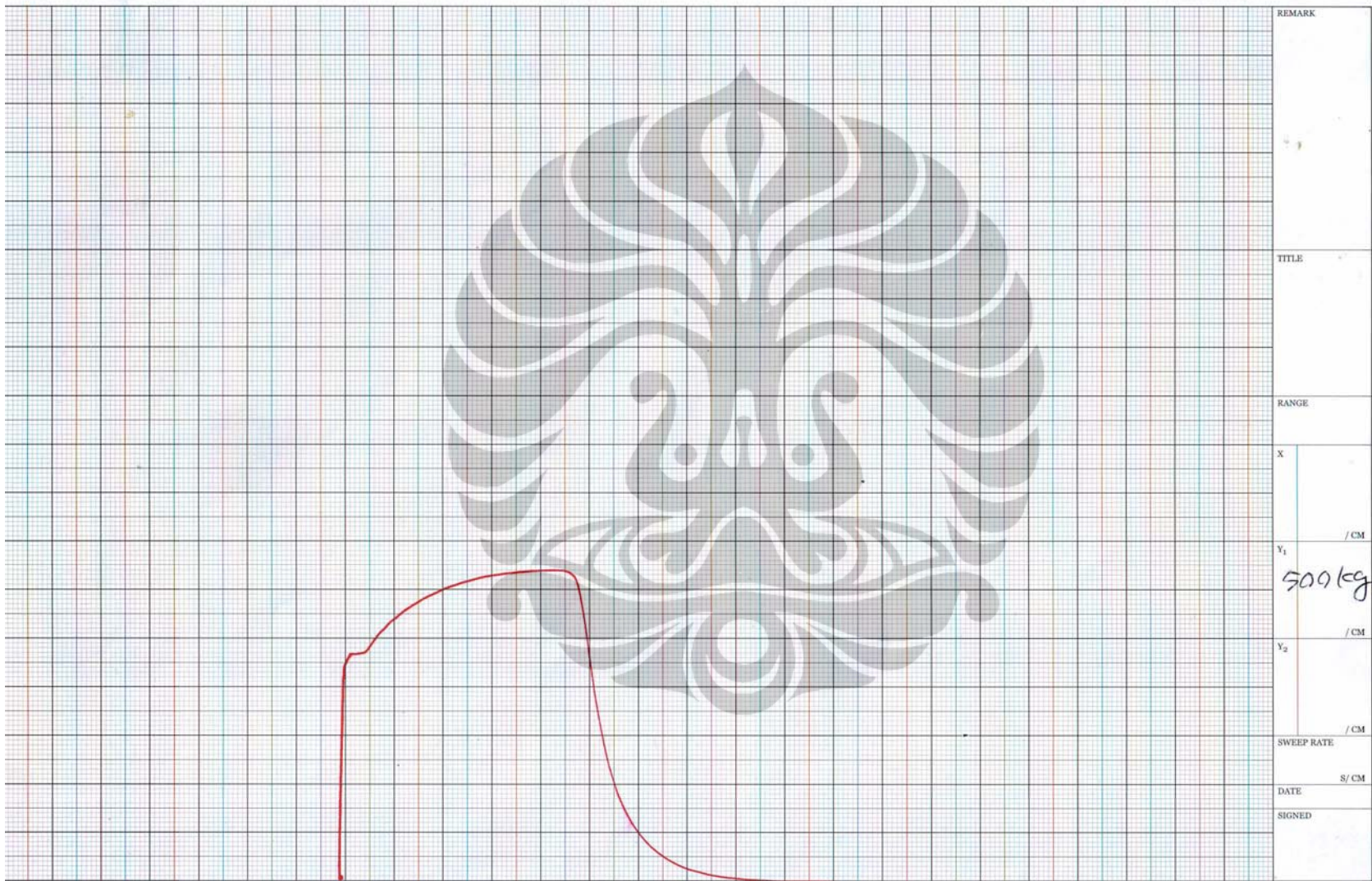
Nama customer	CMPFA	No Kontrak: 675 LAB BAHAN SIPIC	Tanggal Uji: 8-7-08
Mesin Uji	Servopulser Shimadzu Kapasitas 20 ton	Teknisi Penguji: NURDIA	Paraf Teknisi: <i>[Signature]</i>
Bahan	BAJA	Standar/Metode Uji: Z-2201	Tanggal bahan diterima:
Identitas Bahan	PLAT P. 50 X 5		

No	Kode Sampel	Bentuk Sampel	Dimensi Sampel (mm)	Luas penampang (mm ²)	Panjang ukur (mm)	Pu (kg)	Py (kg)	ΔL (mm)	σu (kg/mm ²)	σy (kg/mm ²)	e (%)	Ket.
1	P. 50 X 5	<input type="checkbox"/> Rod/Tube										
		<input checked="" type="checkbox"/> Pelat	$t=4,90$ $w=12,55$	61,00	50	3250	2400	19,75	53	39	29,50	
2	P. 50 X 5	<input type="checkbox"/> Rod/Tube										
		<input checked="" type="checkbox"/> Pelat	$t=4,90$ $w=12,55$	61,00	50	3225	2375	15,65	52	38	31,30	
3	P. 50 X 5	<input type="checkbox"/> Rod/Tube										
		<input checked="" type="checkbox"/> Pelat	$t=4,90$ $w=12,50$	61,25	50	3200	2350	12,05	52	38	24,10	
		<input type="checkbox"/> Rod/Tube										
		<input type="checkbox"/> Pelat										
		<input type="checkbox"/> Rod/Tube										
		<input type="checkbox"/> Pelat										
		<input type="checkbox"/> Rod/Tube										
		<input type="checkbox"/> Pelat										
		<input type="checkbox"/> Rod/Tube										
		<input type="checkbox"/> Pelat										

Formulir : FF-32/Met-UI Rev : 0

* Coret Yang Tidak Perlu





3/ P.50 X 5

REMARK
TITLE
RANGE
X
/ CM
Y ₁
500 kg
/ CM
Y ₂
/ CM
SWEEP RATE
S/ CM
DATE
SIGNED

LAMPIRAN 4
HASIL TEST TEKAN



HASIL TEST TEKAN

NO	TANGGAL		UMUR (hari)	CODE	A (cm ²)	SLUMP (cm)	BERAT (kg)	w (kg/m ³)	BEBAN (ton)	TEGANGAN (kg/cm ²)	fc' (MPa)	KONVERSI S-K	TEGANGAN (kg/cm ²)	fc' (MPa)	KONVERSI UMUR (PBI)	TEGANGAN (kg/cm ²)	KONVERSI UMUR (UI)	TEGANGAN (kg/cm ²)	fc' (MPa)
	DICOR	DITEST																	
1	11/06/08	21/06/08	10	10-1	176.71	12	12.24	2,295.90	47	265.97		0.83	327.26	33.37	0.749	436.93	0.78	419.56	42.78
				10-2			12.21		49.5	280.11									
				10-3			12.17		47.5	268.80									
							12.21			271.62									
							0.04			7.49									
							12.17			264.14	26.93			32.45					41.6
2		22/06/08	11	11-1			12.16	2,292.34	41	232.01			269.31	27.46	0.781	344.82	0.807	333.71	34.03
				11-2			12.19		36	203.72									
				11-3			12.16	2294.12	41.5	234.84	23.99								
							12.17			223.52									
							0.02			17.21									
							12.15			206.31	21.04			25.35					32.5
3		08/07/08	27	27-1			12.26	2,291.32	53.5	302.75			382.94	39.05	0.992	386.03	0.994	385.25	39.28
				27-2			12.24		57.5	325.38									
				27-3			12.67		57.5	325.38									
							12.39			317.84									
							0.24			13.07									
							12.15			304.77	31.08			37.44					48
4		10/07/08	29	29-1			12.28	2,291.70	57.25	323.97			405.66	41.37	1	405.66	1	405.66	41.37
				29-2			12.27		52	294.26									
				29-3			12.79	2291.51	69.25	391.87	30.15								
							12.45			336.70									
							0.30			50.04									
							12.15			286.66	29.23			35.22					45.15

LAMPIRAN 5
PERHITUNGAN MOMEN *ULTIMATE* BALOK BIASA



PERHITUNGAN MOMEN *ULTIMATE* BALOK BIASA

Data :

$b = 175 \text{ mm}$

$h = 225 \text{ mm}$

$d = 185 \text{ mm}$

$d' = 40 \text{ mm}$

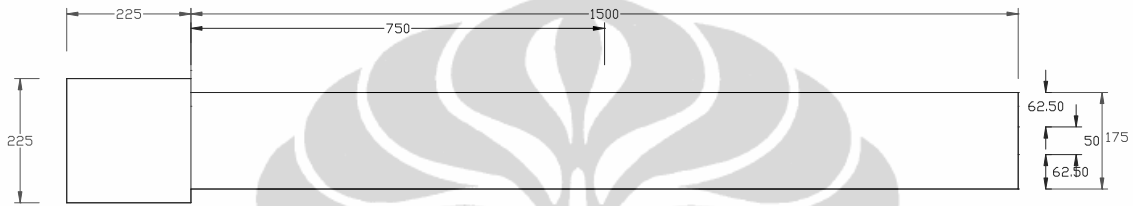
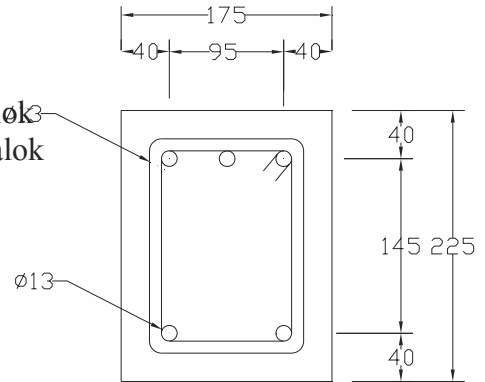
$f_c' = 24 \text{ MPa}$

$f_y = 338 \text{ MPa (D 13)}$

$f_y = 418 \text{ MPa (D 10)}$

$q = 0,89 \text{ kN/m}$

lebar penampang balok
tinggi penampang balok
tinggi efektif balok
tebal selimut beton



KOLOM 225/225

BALOK 175/225

Tampak atas pemasangan CFRP pada balok

(luas penampang tulangan pokok tekan)

$$A_s' = \left(\frac{1}{4} \cdot \pi \cdot D^2 \right) \cdot n = \left(\frac{1}{4} \cdot \pi \cdot 11^2 \right) \cdot 2 = 95,033 \cdot 2 = 190,07 \text{ mm}^2$$

(luas penampang tulangan pokok tarik)

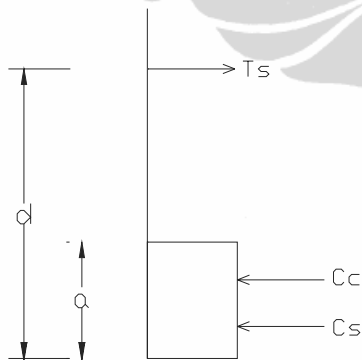
$$A_s' = \left(\frac{1}{4} \cdot \pi \cdot D^2 \right) \cdot n = \left(\frac{1}{4} \cdot \pi \cdot 11^2 \right) \cdot 3 = 95,033 \cdot 3 = 285,1 \text{ mm}^2$$

Desain tulangan rangkap :

$$C_s = A_s' \cdot f_y$$

$$C_c = 0,85 \cdot f_c' \cdot b \cdot a$$

$$T_s = A_s \cdot f_y$$



Cek Tulangan compressive dengan tensile :

$$600 - (600 - f_y) \cdot \frac{d'}{d} > f_y$$

$$600 - (600 - 338) \cdot \frac{40}{185} > 338$$

543,35 > 338 maka digunakan fy batas

$$\Sigma h = 0$$

$$As'.fy + 0,85.fc'.b.a = As'.fy$$

$$190,07.338 + 0,85.24.175.a = 285,1.338$$

$$a = \frac{32121,21}{3570} = 9,00 \text{ mm}$$

$$Mn = Cs.ls + Cc.lc$$

$$= ((As'.fy).(d - d')) + ((0,85.fc'.b.a).(d - 0,5.a))$$

$$= ((190,07.338).(185 - 40)) + ((0,85.24.175.9).(185 - 0,5.9))$$

$$= 15113070,75 \text{ Nmm} = 15,1 \text{ kNm}$$

$$Mn = P.L + \frac{1}{2}.q.L^2$$

$$P = \frac{Mn}{L} - \frac{1}{2}.q.L$$

$$= \frac{15,1}{1,5 \text{ meter}} - \frac{0,89.1,5 \text{ meter}}{2} = 10,27 \text{ kN}$$

2) Perhitungan Kuat Geser Nominal

$$Vn = Vc + Vs$$

$$Vc = \frac{1}{6}.\sqrt{fc'}.Bw.d$$

$$= \frac{1}{6}.\sqrt{24}.175.185 = 26434,08 \text{ N}$$

$$Vs = \frac{Av.fy.d}{s}$$

$$= \frac{2.\pi.5^2.418.185}{100} = 121469,68 \text{ N}$$

$$Vn = 26434,08 + 121469,68 = 147,904 \text{ kN}$$

LAMPIRAN 6
PERHITUNGAN MOMEN *ULTIMATE* BALOK DENGAN PERKUATAN



PERHITUNGAN MOMEN *ULTIMATE* BALOK DENGAN PERKUATAN

Data :

$$b = 175 \text{ mm}$$

$$h = 225 \text{ mm}$$

$$d = 185 \text{ mm}$$

$$d' = 40 \text{ mm}$$

$$f_c' = 30 \text{ MPa}$$

$$f_y = 338 \text{ MPa (D 11)}$$

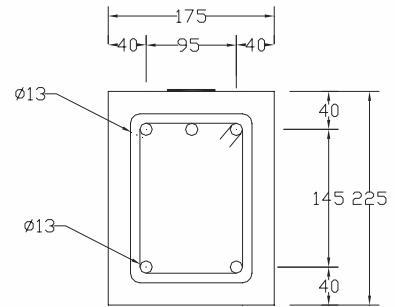
$$f_y = 418 \text{ MPa (D 10)}$$

$$q = 0,89 \text{ kN/m}$$

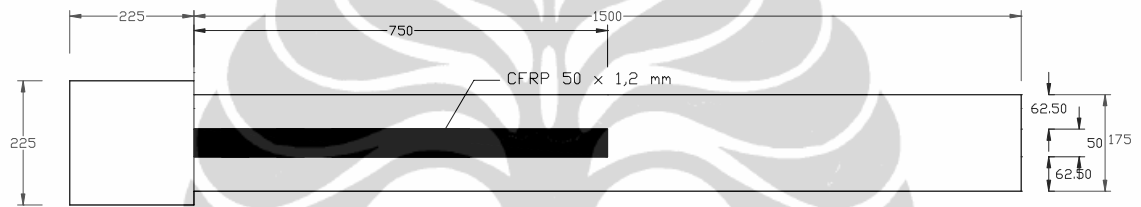
$$b_f = 50 \text{ mm}$$

$$h_f = 1,2 \text{ mm}$$

lebar penampang balok
tinggi penampang balok
tinggi efektif balok
tebal selimut beton



lebar penampang carbon fiber
tinggi penampang carbon fiber



KOLOM 225/225

BALOK 175/225

Tampak atas pemasangan CFRP pada balok

(luas penampang tulangan pokok tekan)

$$A_s' = \left(\frac{1}{4} \cdot \pi \cdot D^2 \right) \cdot n = \left(\frac{1}{4} \cdot \pi \cdot 11^2 \right) \cdot 2 = 95,033 \cdot 2 = 190,07 \text{ mm}^2$$

(luas penampang tulangan pokok tarik)

$$A_s = \left(\frac{1}{4} \cdot \pi \cdot D^2 \right) \cdot n = \left(\frac{1}{4} \cdot \pi \cdot 11^2 \right) \cdot 3 = 95,033 \cdot 3 = 285,1 \text{ mm}^2$$

(luas penampang carbon fiber)

$$A_{sf} = b_f \cdot h_f = 50 \cdot 1,2 = 60 \text{ mm}^2$$

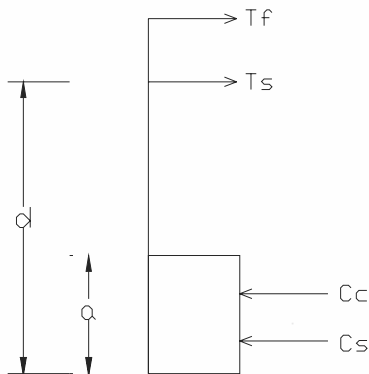
Desain tulangan rangkap :

$$C_s = A_s' \cdot F_s$$

$$C_c = 0,85 \cdot f_c' \cdot b \cdot a$$

$$T_s = A_s \cdot f_y$$

$$T_f = A_{sf} \cdot f_{yf}$$



Cek Tulangan compressive dengan tensile :

$$600 - (600 - f_y) \cdot \frac{d'}{d} > f_y$$

$$600 - (600 - 338) \cdot \frac{40}{185} > 338$$

543,35 > 338 maka digunakan f_y batas

$$\sum h = 0$$

$$A_s' \cdot f_y + 0,85 \cdot f_c' \cdot b \cdot a = A_s \cdot f_y + A_{sf} \cdot f_{yf}$$

$$190,07 \cdot 338 + 0,85 \cdot 30 \cdot 175 \cdot a = 285,1 \cdot 338 + 60 \cdot 2800$$

$$a = \frac{129948,84}{4462,5} = 29,12 \text{ mm}$$

$$M_n = C_s \cdot l_s + C_c \cdot l_c$$

$$= ((A_s' \cdot f_y) \cdot (d - d')) + ((0,85 \cdot f_c' \cdot b \cdot a) \cdot (d - 0,5 \cdot a))$$

$$= ((190,07 \cdot 338) \cdot (185 - 40)) + ((0,85 \cdot 30 \cdot 175 \cdot 29,12) \cdot (185 - 0,5 \cdot 29,12))$$

$$= 31463620,19 \text{ Nmm} = 31,5 \text{ kNm}$$

$$M_n = P \cdot L + \frac{1}{2} \cdot q \cdot L^2$$

$$P = \frac{M_n}{L} - \frac{1}{2} \cdot q \cdot L$$

$$= \frac{31,5}{1,5 \text{ meter}} - \frac{0,89 \cdot 1,5 \text{ meter}}{2} = 20,31 \text{ kN}$$

2) Perhitungan Kuat Geser Nominal

$$V_n = V_c + V_s$$

$$V_c = \frac{1}{6} \cdot \sqrt{f_c'} \cdot B_w \cdot d$$

$$= \frac{1}{6} \cdot \sqrt{30} \cdot 175 \cdot 185 = 29554,2 \text{ N}$$

$$V_s = \frac{A_v \cdot f_y \cdot d}{s}$$

$$= \frac{2 \cdot \pi \cdot 5^2 \cdot 418 \cdot 185}{100} = 121469,68 \text{ N}$$

$$V_n = 29554,2 + 121469,68 = 151,024 \text{ kN}$$

LAMPIRAN 7
CONCRETE MIX DESIGN DATA





CONCRETE MIX DESIGN DATA				
No: 0095 - CO301 / LAB / 06 / 08				
PROJECT :	PENELITIAN			
CONTRACTOR :	Bp. PIO			
SPECIFICATION :	CLASS OF CONCRETE : Fc 30 Minimum compressive strength 30 Mpa when tested at the age of 28 days using 15 x 30 cm cylinder samples. Slump on site : 12 ± 2 cm Maximum size of coarse aggregate 25 mm.			
MATERIAL				
FINE AGGREGATE	Natural sand ex Bangka Crushed dust ex Rumpin	SP.GRAVITY SSD SSD	2.58 2.56	
COARSE AGGREGATE	Crushed stone ex Rumpin	SSD	2.60	
CEMENT FLYASH	Tigaroda Brand ex PT Indocement. Ordinary Portland Cement Type I PT. Wahana Pozolanik		3.15 2.10	
WATER	Pottable		1.00	
ADDITIVES	Pozzolith 100 Ri	1.13 Ltr / m3		1.06
DESIGN CALCULATION				
Water cement ratio	0.47			
Free water required	196	kg/m ³	196	dm ³
Cement	378	kg/m ³	120	dm ³
Fly ash	42	kg/m ³	20	dm ³
Additives	1.13	lt/m ³	1.07	dm ³
PASTE VOLUME			337	dm ³
AGGREGATE VOLUME			663	dm ³
Fine aggregate 1 (SSD)	0.29	663 x	2.58	503 kg
Fine aggregate 2 (SSD)	0.13	663 x	2.56	214 kg
Coarse aggregate (SSD)	0.58	663 x	2.60	1,000 kg
Prepared by :			Jakarta 11 Juni 2008 Approved by : 	
Quality Control Dept.			Plant Manager / Supervisor	

PT. ADHIMIX PRECAST INDONESIA

Graha Anugerah Lt. 3 Jl. Raya Pasar Minggu No 17A Pancoran, Jakarta 12780 Tel. (021) 7210066, Fax. (021) 7268669 Web site : www.adhimix.co.id. E-mail : beton@adhimix.co.id

LAMPIRAN 8
DATA HASIL PENGUKURAN LENDUTAN BALOK BIASA



DATA HASIL PENGUKURAN LENDUTAN BALOK BIASA

M-1.1

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	24.00	19.00	17.00	10.00	15.00
2	23.48	18.65	16.95	9.91	15.06
3	22.58	18.05	16.87	9.81	15.15
4	21.90	17.79	16.80	9.76	15.20
5	20.10	16.71	16.64	9.65	15.28
6	17.60	15.40	16.45	9.51	15.40
7	15.20	14.70	16.28	9.39	15.56
8	13.60	13.30	16.15	9.32	15.69
9	12.40	12.65	16.05	9.28	15.79
10	10.45	11.66	15.90	9.20	15.94
11	8.50	10.60	15.75	9.11	15.96
12	6.30	8.48	15.56	9.02	15.97
13	4.82	6.80	15.32	9.01	15.98
14				9.00	15.98
15					

M-1.2

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	23.00	14.00	9.00	25.00	9.00
2	22.60	13.81	8.98	24.97	9.02
3	21.92	13.45	8.94	24.90	9.05
4	20.91	12.85	8.86	24.83	9.06
5	19.25	11.90	8.77	24.75	9.07
6	17.00	10.84	8.68	24.68	9.08
7	15.35	9.96	8.60	24.57	9.08
8	14.10	9.20	8.55	24.49	9.08
9	12.30	8.20	8.45	24.39	9.08
10	10.45	7.40	8.35	24.29	9.08
11	8.25	6.30	8.22	24.15	9.08
12	0.00	5.10	8.10	24.11	9.08
13					
14					
15					

M-1.3

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	24.00	16.00	17.00	30.00	8.00
2	23.56	15.81	16.98	29.92	8.00
3	22.93	14.45	16.95	29.82	8.01
4	22.10	14.03	16.88	29.72	8.02
5	20.89	13.03	16.81	29.63	8.03
6	20.20	12.56	16.74	29.56	8.05
7	18.20	11.96	16.68	29.50	8.06
8	16.80	11.26	16.61	29.42	8.08
9	15.70	10.70	16.53	29.34	8.09
10	14.50	9.90	16.46	29.24	8.10
11	12.80	8.95	16.35	29.13	8.11
12	11.10	8.10	16.27	28.99	8.11
13	9.20	7.40	16.14	28.89	8.11
14	6.00				
15					

M-2.1

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	19.00	22.00	12.00	13.00	0.00
2	18.50	21.78	11.97	12.87	0.05
4	16.55	20.63	11.79	12.72	0.12
6	13.32	19.94	10.55	12.53	0.26
8	10.00	17.08	10.30	12.31	0.39
10	5.50	15.78	10.25	12.10	0.61
12	0.00	12.00	9.44	11.90	0.81
14			8.95	11.84	1.91

M-2.2

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	22.00	19.00	10.00	3.00	10.00
2	21.43	18.69	9.89	2.86	10.03
3	20.45	17.68	9.78	2.48	10.05
4	19.10	17.19	9.57	2.47	10.11
5	17.80	16.59	9.41	2.42	10.20
6	16.40	15.80	9.31	2.39	10.31
7	15.01	15.10	9.20	2.35	10.40
8	13.80	13.30	9.16	2.32	10.45
9	12.20	12.60	9.06	2.25	10.55
10	10.60	11.30	8.98	2.20	10.65
11	8.91	10.90	8.82	2.16	10.82
12	7.30	10.05	8.73	2.10	10.94
13	5.50	9.92	8.58	2.08	11.08
14				2.06	11.25
15					

M-2.3

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	24.00	14.00	18.10	23.00	5.00
2	23.79	13.86	18.02	23.00	5.04
3	23.21	13.56	17.96	22.98	5.09
4	22.56	13.25	17.90	22.92	5.15
5	21.50	12.65	17.81	22.81	5.21
6	19.70	11.80	17.69	22.71	5.29
7	18.25	10.86	17.59	22.62	5.36
8	16.70	9.98	17.48	22.53	5.45
9	15.40	9.25	17.38	22.46	5.55
10	13.60	8.30	17.27	22.40	5.69
11	12.40	7.28	17.13	22.32	5.82
12	10.30	5.60	17.05	22.25	6.07
13	8.40	4.70	16.93	22.17	6.12
14	5.80	3.25	16.74	22.10	6.16
15					

M-3.1

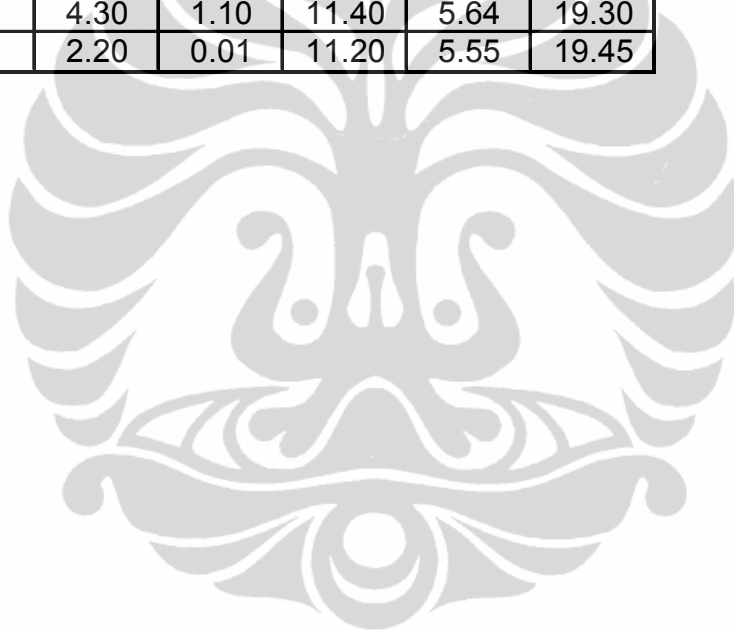
BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	24.00	21.00	19.00	5.00	25.00
2	23.52	20.75	18.98	4.94	25.06
3	22.85	20.40	18.94	4.92	25.14
4	21.10	19.95	18.86	4.88	25.21
5	20.75	19.10	18.79	4.80	25.30
6	18.02	18.20	18.66	4.72	25.40
7	17.35	17.30	18.55	4.63	25.50
8	15.60	16.40	18.42	4.55	25.59
9	14.20	15.81	18.30	4.48	25.69
10	12.56	14.88	18.17	4.40	25.80
11	11.00	13.98	17.64	4.33	25.92
12	9.20	13.05	16.92	4.27	26.05
13	7.40	12.00	16.76	4.20	26.18
14	5.00	10.00	16.45	4.15	26.30
15					

M-3.2

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	24.00	25.00	20.00	25.00	5.00
2	23.30	24.80	19.94	24.98	5.11
3	22.75	24.25	19.90	24.94	5.21
4	21.99	24.00	19.83	24.90	5.31
5	20.91	23.45	19.74	24.82	5.42
6	19.50	21.65	19.64	24.75	5.55
7	17.90	20.72	19.50	24.65	5.69
8	16.29	19.80	19.36	24.58	5.82
9	14.99	19.01	19.25	24.50	5.95
10	13.25	18.10	19.09	24.42	6.17
11	11.30	17.00	18.90	24.36	6.37
12	9.00	16.01	18.74	24.29	6.58
13	7.30	15.01	18.55	24.24	6.80
14	5.45	14.00	18.33	24.18	7.07
15					

M-3.3

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	23.00	12.00	13.00	7.00	18.00
2	22.44	11.67	12.95	6.93	18.18
3	21.55	11.20	12.85	6.84	18.19
4	20.65	10.65	12.74	6.75	18.27
5	19.16	9.85	12.60	6.63	18.34
6	17.80	9.10	12.50	6.54	18.42
7	16.50	8.35	12.40	6.44	18.50
8	14.90	7.55	12.29	6.34	18.58
9	13.35	6.72	12.15	6.25	18.72
10	11.60	5.80	12.02	6.12	18.85
11	9.70	4.83	11.85	6.01	18.97
12	8.15	3.90	11.70	5.89	19.08
13	6.20	2.15	11.55	5.75	19.19
14	4.30	1.10	11.40	5.64	19.30
15	2.20	0.01	11.20	5.55	19.45



LAMPIRAN 9
DATA HASIL PENGUKURAN LENDUTAN BALOK
DENGAN PERKUATAN



DATA HASIL PENGUKURAN LENDUTAN BALOK
DENGAN PERKUATAN

M-1.1

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	24.00	24.00	27.00	7.00	7.00
2	23.39	23.74	26.96	6.91	7.00
3	22.52	23.32	26.90	6.81	7.01
4	21.68	22.85	26.85	6.72	7.02
5	20.54	22.23	26.75	6.65	7.02
6	19.07	21.55	26.64	6.57	7.02
7	17.60	20.79	26.52	6.47	7.02
8	16.50	20.20	26.43	6.41	7.02
9	15.20	19.50	26.35	6.34	7.02
10	14.65	18.75	26.24	6.22	7.02
11	12.30	18.12	26.14	6.13	7.02
12	10.90	17.40	26.05	6.05	7.03
13	9.45	16.73	25.95	5.95	7.03
14	1.50	13.40	25.35	5.90	7.05
14.2	-2.25	11.81	25.16	5.90	7.05

M-1.2

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	24.00	24.00	27.00	7.00	7.00
2	23.39	23.74	26.96	6.91	7.00
3	22.52	23.32	26.90	6.81	7.01
4	21.68	22.85	26.85	6.72	7.02
5	20.54	22.23	26.75	6.65	7.02
6	19.07	21.55	26.64	6.57	7.02
7	17.60	20.79	26.52	6.47	7.02
8	16.50	20.20	26.43	6.41	7.02
9	15.20	19.50	26.35	6.34	7.02
10	14.65	18.75	26.24	6.22	7.02
11	12.30	18.12	26.14	6.13	7.02
12	10.90	17.40	26.05	6.05	7.03
13	9.45	16.73	25.95	5.95	7.03
14	1.50	13.40	25.35	5.90	7.05
14.2	-2.25	11.81	25.16	5.90	7.05

M-1.3

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	24.00	30.00	1.00	23.00	10.00
2	22.87	29.45	0.95	22.93	10.02
3	21.54	28.78	0.86	22.84	10.08
4	19.34	27.69	0.71	22.68	10.15
5	17.61	26.81	0.59	22.56	10.22
6	17.41	26.72	0.59	22.55	10.22
7	16.25	26.13	0.52	22.47	10.28
8	14.57	25.28	0.41	22.38	10.30
9	13.90	24.92	0.37	22.32	10.31
10	11.62	23.75	0.23	22.16	10.31
11	10.45	23.27	0.18	22.07	10.32
12	8.63	22.15	0.05	21.97	10.32
12.4	2.45	18.77	-0.32	21.89	10.32
12.8	0.79	17.91	-0.38	21.88	10.32
13	-0.33	16.88	-0.46	21.87	10.32
13.2	-2.50	16.10	-0.56	21.85	10.32
13.4	-4.07	15.17	-0.67	21.84	10.32
13.8	-7.10	12.70	-0.81	21.81	10.32
14	-10.00	9.78	-1.04	21.78	10.32
14.2	-14.00	8.05	-1.17	21.77	10.32

M-2.1

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	24.00	21.00	30.00	1.00	0.00
2	23.45	20.75	30.02	0.98	0.02
3	22.40	20.25	29.89	0.88	0.03
4	22.00	20.04	29.86	0.84	0.04
5	21.30	19.65	29.78	0.81	0.05
6	20.30	19.00	29.66	0.75	0.05
7	18.20	18.25	29.55	0.69	0.06
8	17.60	17.70	29.46	0.61	0.07
9	16.59	17.05	29.36	0.55	0.09
10	15.01	16.32	29.25	0.49	0.11
11	13.60	15.65	29.15	0.42	0.16
12	12.30	15.03	29.06	0.37	0.20
13	11.10	13.47	28.96	0.32	0.24
14	9.30	12.60	28.76	0.26	0.28
15	6.00	9.80	27.70	0.20	0.33
15	2.00	6.40	27.42	0.18	0.35
15	0.00	5.00	27.26	0.18	0.35
15.4	-0.50	3.30	27.10	0.18	0.35
15.8	-1.00	2.20	27.02	0.17	0.37
16	-1.50	1.00	26.88	0.17	0.37
16.2	-2.00	0.10	26.68	0.17	0.37

M-2.2

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	22.00	30.00	18.00	7.00	7.00
2	21.42	29.69	17.98	6.96	7.02
3	20.62	29.33	17.92	6.86	7.03
4	19.35	28.62	17.81	6.72	7.04
5	17.54	27.70	17.66	6.54	7.05
6	16.25	27.20	17.55	6.43	7.08
7	14.75	26.23	17.42	6.31	7.11
8	13.82	25.73	17.33	6.24	7.14
9	12.23	24.95	17.20	6.13	7.19
10	10.95	24.43	17.08	6.06	7.24
11	9.77	23.77	17.01	6.00	7.27
12	8.65	23.18	16.92	5.93	7.31
13	7.35	22.46	16.80	5.87	7.35
13.6	2.80	18.90	16.30	5.82	7.38
13.8	-0.20	18.20	16.19	5.81	7.39
14	-3.00	17.50	16.05	5.80	7.39
14.2	-5.00	15.40	15.90	5.79	7.40
14.4	-7.00	15.25	15.78	5.77	7.41
14.6	-9.00	14.40	15.65	5.76	7.41
14.8	-9.50	13.30	15.51	5.74	7.42
15	-12.00	11.60	15.31	5.73	7.43
15.2	-15.00	9.90	15.00	5.71	7.43
15.4	-18.00	8.30	14.80	5.70	7.43

M-2.3

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	22.00	26.00	10.00	8.00	0.00
2	21.42	25.61	9.95	7.97	0.06
3	20.62	24.45	9.73	7.91	0.20
4	19.35	23.27	9.50	7.80	0.35
5	17.54	22.42	9.34	7.72	0.47
6	16.25	21.71	9.21	7.64	0.57
7	14.75	21.37	9.19	7.64	0.60
8	13.82	20.81	9.05	7.64	0.72
9	12.23	20.00	8.90	7.52	0.72
10	10.95	19.18	8.73	7.41	0.74
11	9.77	18.40	8.60	7.39	0.74
12	8.65	17.74	8.47	7.24	0.74
13	7.35	17.16	8.37	7.19	0.74
14	2.80	16.05	8.15	7.09	0.74
15	-0.20	13.69	7.75	7.03	0.74
16	-3.00	10.75	7.24	6.96	0.74
16.2	-5.00	8.95	6.99	6.95	0.74
16.4	-7.00	8.04	6.85	6.93	0.74
16.6	-9.00	6.68	6.39	6.90	0.74

M-3.1

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	24.00	25.00	30.00	9.00	8.00
2	23.60	24.84	30.00	8.95	8.00
3	22.86	24.45	29.96	8.88	8.02
4	22.07	24.09	29.90	8.81	8.05
5	21.00	23.65	29.81	8.74	8.07
6	19.62	22.74	29.67	8.67	8.09
7	15.20	21.95	29.54	8.58	8.14
8	14.00	21.25	29.41	8.52	8.19
9	13.70	20.50	29.30	8.44	8.22
10	11.45	19.85	29.20	8.38	8.34
11	10.10	19.22	29.10	8.30	8.41
12	8.43	18.55	28.00	8.23	8.48
13	4.07	17.85	27.90	8.15	8.56
14	1.85	17.07	27.78	8.06	8.62
15	0.00	15.60	27.42	7.98	8.69
16	-0.50	13.00	27.05	7.92	8.72
16	-0.80	10.60	26.75	7.90	8.75
16.2	-1.10	9.75	26.45	7.88	8.77
16.4	-1.20	8.67	26.25	7.86	8.79
16.6	-1.40	5.43	25.90	7.84	8.80
16.8	-1.60	4.68	25.78	7.82	8.80
17	-1.70	4.30	25.73	7.82	8.80
17.2	-1.80	3.90	25.68	7.82	8.80
17.4	-1.90	3.00	25.54	7.81	8.80
18	-2.00	2.00	25.50	7.79	8.81
18.2	-2.10	1.00	25.46	7.76	8.81
18.4	-2.20	0.00	25.43	7.76	8.82

M-3.2

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	24.00	30.00	10.00	10.00	23.00
2	23.55	29.78	9.95	10.00	23.07
3	22.20	29.10	9.83	9.95	23.27
4	21.70	28.84	9.79	9.88	23.30
5	20.48	28.21	9.69	9.81	23.44
6	19.32	27.57	9.59	9.81	23.58
7	17.90	26.85	9.51	9.79	23.66
8	16.70	26.20	9.45	9.75	23.71
9	15.70	25.75	9.40	9.71	23.75
10	14.50	25.10	9.33	9.62	23.77
11	13.60	24.63	9.27	9.54	23.79
12	12.50	24.07	9.22	9.46	23.80
13	11.25	23.49	9.13	9.35	23.81
14	10.30	22.97	9.09	9.27	23.82
15	9.10	22.30	9.02	9.20	23.84
16	5.00	20.20	8.83	9.15	23.86
17	2.09	17.30	8.58	9.06	23.90
18	-3.30	15.39	8.28	9.02	23.92
18.2	-6.50	13.90	8.10	9.02	23.94
18.4	-9.50	10.12	8.03	9.02	23.96
18.6	-12.50	8.75	7.92	9.03	23.98
18.8	-16.00	7.30	7.88	9.03	24.00
19	-19.00	5.50	7.62	9.03	24.02
19.2	-22.00	3.90	7.50	9.04	24.03
19.4	-25.50	2.05	7.30	9.04	24.04
19.6	-28.50	0.04	7.22	9.04	24.05
19.8	-35.00	-0.45	7.01	9.04	24.06

M-3.3

BEBAN (kN)	DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5
0	24.00	30.00	10.00	9.00	22.00
2	23.32	29.66	9.96	8.94	22.04
3	22.47	29.22	9.88	8.89	22.12
4	21.57	28.75	9.80	8.83	22.20
5	20.51	28.21	9.69	8.77	22.29
6	19.70	27.21	9.53	8.71	22.40
7	17.43	26.56	9.42	8.67	22.49
8	16.30	25.97	9.34	8.62	22.58
9	15.30	25.38	9.25	8.57	22.65
10	14.05	24.52	9.14	8.50	22.80
11	12.50	24.04	9.07	8.45	22.87
12	10.28	22.92	8.92	8.35	23.03
13	9.81	22.71	8.89	8.32	23.06
14	7.44	21.64	8.73	8.21	23.21
15	5.64	20.51	8.63	8.17	23.25
16	1.40	17.12	8.37	8.11	23.31
17	0.00	15.60	8.07	8.02	23.37
18	-15.00	11.50	7.61	7.94	23.45
19	-23.00	5.31	6.98	7.87	23.47
19.2	-30.00	1.60	6.66	7.82	23.47
19.4	-33.00	0.37	6.30	7.77	23.47
19.6	-37.00	-5.00	6.17	7.72	23.47
19.8	-43.00	-9.00	5.95	7.70	23.47
20	-50.00	-12.00	5.62	7.68	23.47

LAMPIRAN 10
FOTO



BEKISTING



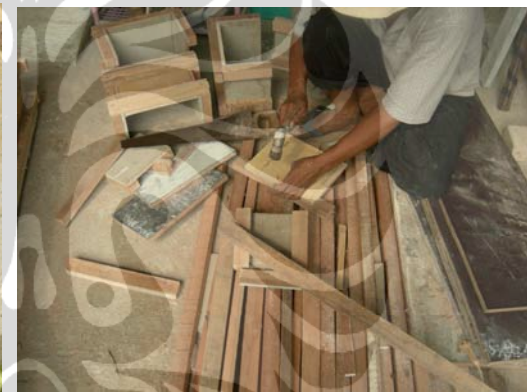
Gambar L1. Pengukuran



Gambar L2. Pemotongan



Gambar L3. Persiapan Pemasangan



Gambar L4. Pemasangan



Gambar L5. Pemasangan Bekisting



Gambar L6. Bekisting

PENULANGAN



Gambar L7. Persiapan Tulangan



Gambar L8. Pengikatan Tulangan



Gambar L9. Pengikatan Tulangan



Gambar L10. Pengikatan Tulangan



Gambar L11. Pengikatan Tulangan



Gambar L12. Tulangan

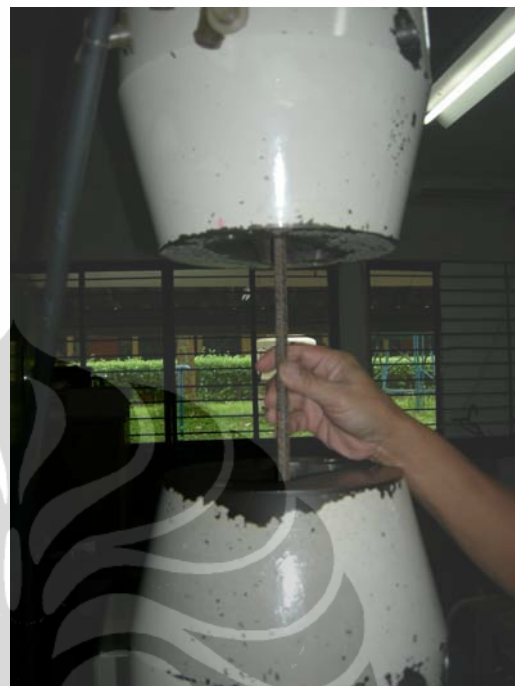


Gambar L13. Tulangan

TEST TARIK



Gambar L14. Persiapan Test Tarik



Gambar L15. Proses Test Tarik



Gambar L16. Mesin Output Test Tarik

PEMASANGAN PELAT



Gambar L17. Proses Pengelasan



Gambar L18. Persiapan Pengelasan



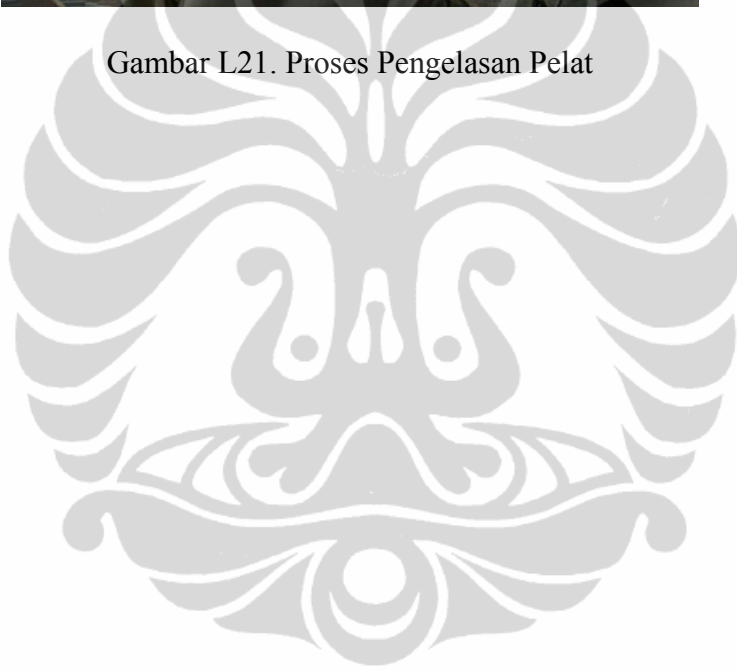
Gambar L19. Pengelasan Tulangan-Pelat



Gambar L20. Pengelasan Pelat



Gambar L21. Proses Pengelasan Pelat



PEMSANGAN *STRAIN GAGES* PADA TULANGAN



Gambar L22. Proses Pembersihan



Gambar L23. Pengamplasan Tulangan



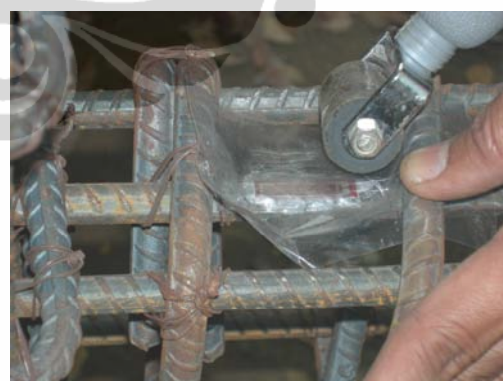
Gambar L24. Penempatan *Strain Gages*



Gambar L25. Pelekatan *Strain Gages*



Gambar L26. Penempatan *Strain Gages*



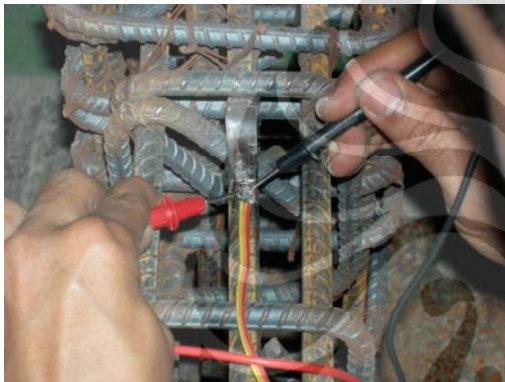
Gambar L27. Pelekatan *Strain Gages*



Gambar L28. *Strain Gages*



Gambar L29. Penyolderan *Strain Gages*



Gambar L30. Pengecakan *Strain Gages*



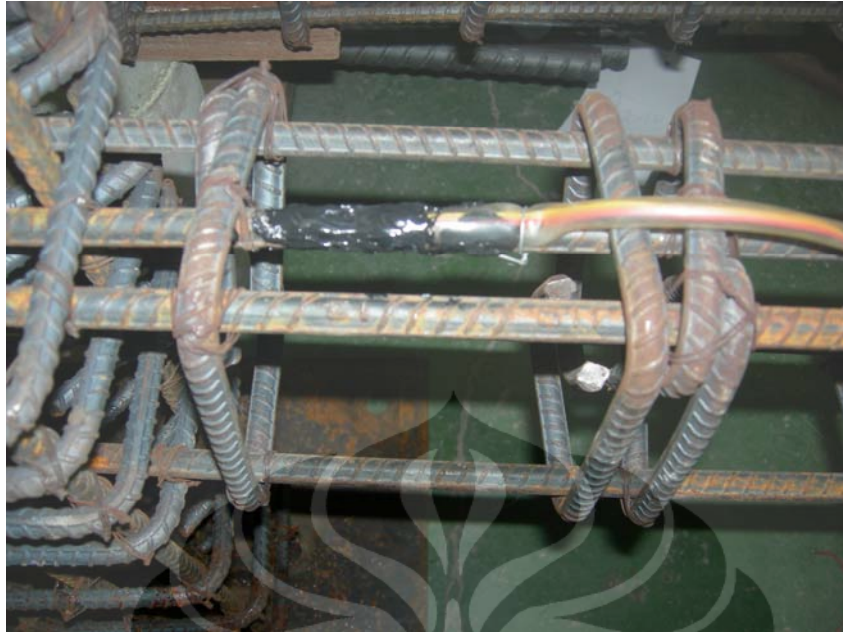
Gambar L31. Perapihan *Strain Gages*



Gambar L32. Pengadukan *Epoxy*



Gambar L33. *Epoxy Strain Gages*



Gambar L-34. *Strain Gages*

PERSIAPAN PENGECORAN



Gambar L35. Pengolesan *Olie*



Gambar L36. Sudah diolesi *Olie*



Gambar L37. Penempatan Tulangan



Gambar L38. Tulangan



Gambar L39. Perapihan



Gambar L40. Beton Tahu

PENGECORAN



Gambar L41. Perapihan



Gambar L42. Pengecekan



Gambar L43. Persiapan



Gambar L44. Awal Pengecekan



Gambar L45. *Slump Test*



Gambar L46. Pengecoran



Gambar L47. Proses Pengecoran



Gambar L48. Pengecoran



Gambar L49. *Finishing*



Gambar L50. *Finishing* Pengecoran



Gambar L51. Hasil Pengecoran

CURING



Gambar L52. Setelah disiram



Gambar L53. Setelah disiram



Gambar L54. Proses *Curing*



Gambar L55. Proses *Curing*



Gambar L56. Proses *Curing*

PEMBONGKARAN BEKISTING



Gambar L57. Pembongkaran Bekisting



Gambar L58. Pembongkaran Bekisting



Gambar L59. Pembongkaran Bekisting



Gambar L60. Pembongkaran Bekisting



Gambar L61. Modul

PEMBUATAN GARIS



Gambar L62. Perapihan



Gambar L63. Perapihan



Gambar L64. Pengecatan



Gambar L65. Pengecatan



Gambar L66. Pembuatan Garis



Gambar L67. Pembuatan Garis

LOADING TEST SEBELUM PERBAIKAN



Gambar L68. Persiapan



Gambar L69. Mobilisasi



Gambar L70. Mobilisasi



Gambar L71. Mobilisasi



Gambar L72. Pasang Mur-Baut



Gambar L73. Pasang Mur-Baut



Gambar L74. Pasang Mur-Baut



Gambar L75. Pelepasan



Gambar L76. Persiapan *Dial Gauge*



Gambar L77. Pemasangan *Dial Gauge*



Gambar L78. Pembacaan *Dial Gauge*



Gambar L79. Pembacaan *Dial Gauge*

PERBAIKAN MODEL



Gambar L80. Pembersihan



Gambar L81. Pembersihan



Gambar L82. Pembersihan



Gambar L83. Pembersihan



Gambar L84. Pasang pipa injeksi



Gambar L85. Pasang pipa injeksi



Gambar L86. Pelaksanaan injeksi



Gambar L87. Pelaksanaan injeksi



Gambar L88. Tutup injeksi



Gambar L89. Tutup injeksi



Gambar L90. Pemotongan



Gambar L91. Pemotongan



Gambar L92. Persiapan



Gambar L93. Pembersihan



Gambar L94. Persiapan



Gambar L95. Pasang CFRP



Gambar L96. Pasang CFRP



Gambar L97. Pasang CFRP



Gambar L98. Pasang Pelat



Gambar L99. Pasang Pelat



Gambar L100. Pasang *Epoxy* Pelat



Gambar L101. Pasang *Epoxy* Pelat



Gambar L102. Pasang *Epoxy* Pelat



Gambar L103. Pasang *Epoxy* Pelat

STRAIN GAGES SESUDAH PERBAIKAN



Gambar L104. *Strain Gages Model-1*



Gambar L105. *Strain Gages Model-2*



Gambar L106. *Strain Gages Model-3*

LOADING TEST SESUDAH PERBAIKAN



Gambar L107. *Dial Gauge Model-1*



Gambar L108. *Dial Gauge Model-2*



Gambar L109. *Dial Gauge Model-2*



Gambar L110. *Dial Gauge Model-2*



Gambar L111. *Dial Gauge Model-3*



Gambar L112. Penggambaran Pola Retak



Gambar L113. Pelat Arah Kolom Lepas



Gambar L114. Pola Retak Model-3



Gambar L115. Pelat Arah Balok Lepas



Gambar L116. Pola Retak Model-3



Gambar L117. Pelat Arah Balok Lepas



Gambar L118. Model-3



Gambar L119. Tampak Balok Eksperimen Model-3



Gambar L120. Capping Silinder Beton



Gambar L121. Capping Silinder Beton



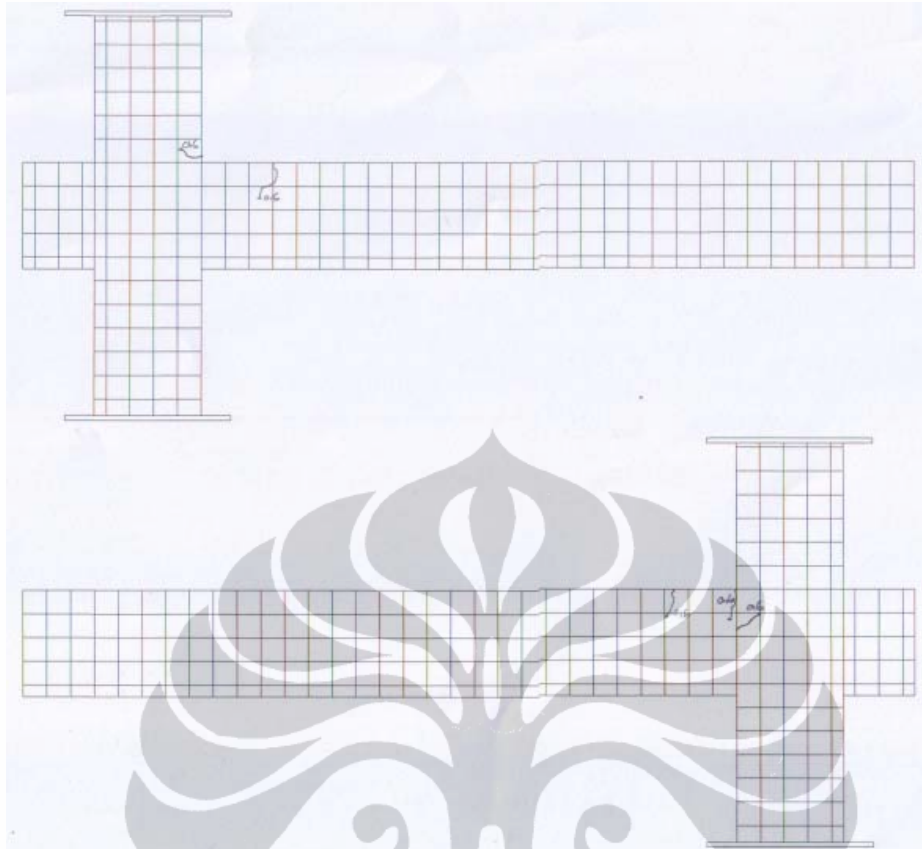
Gambar L122. Alat test tekan



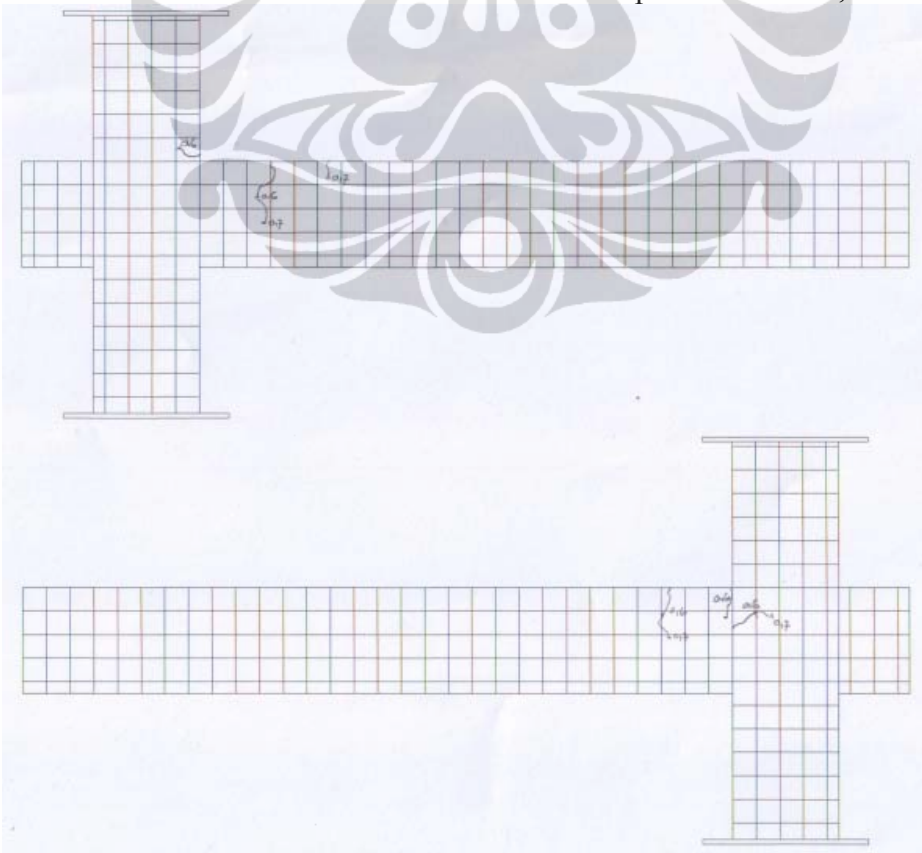
Gambar L123. Test Tekan

LAMPIRAN 11
POLA RETAK

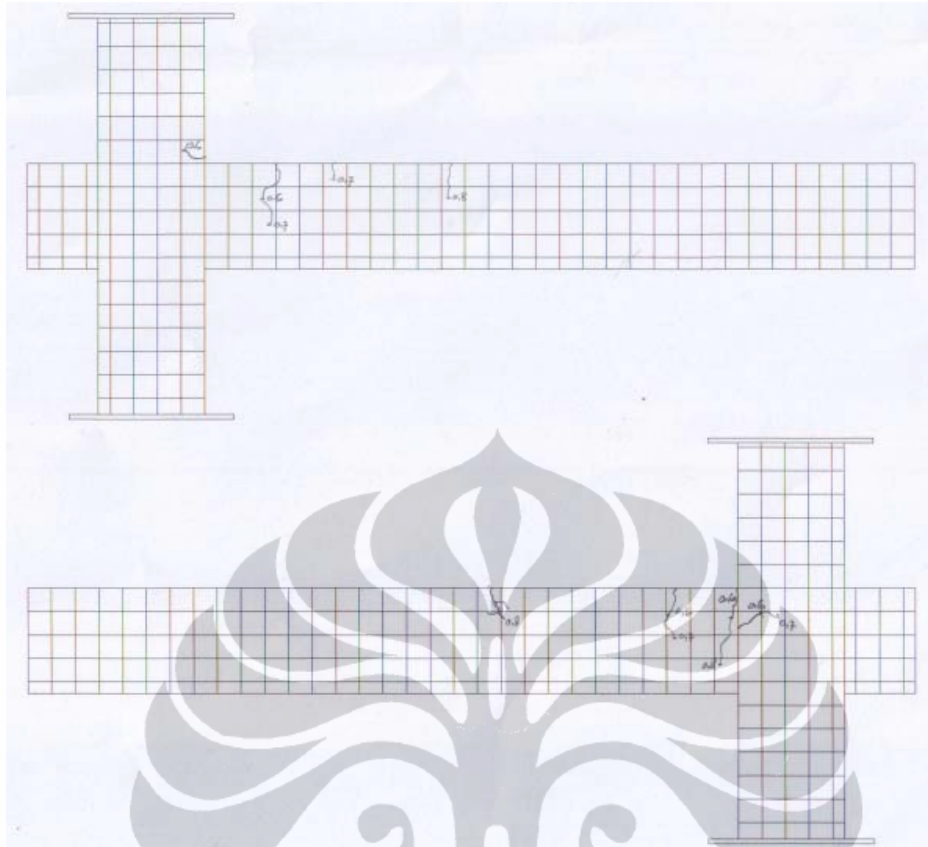




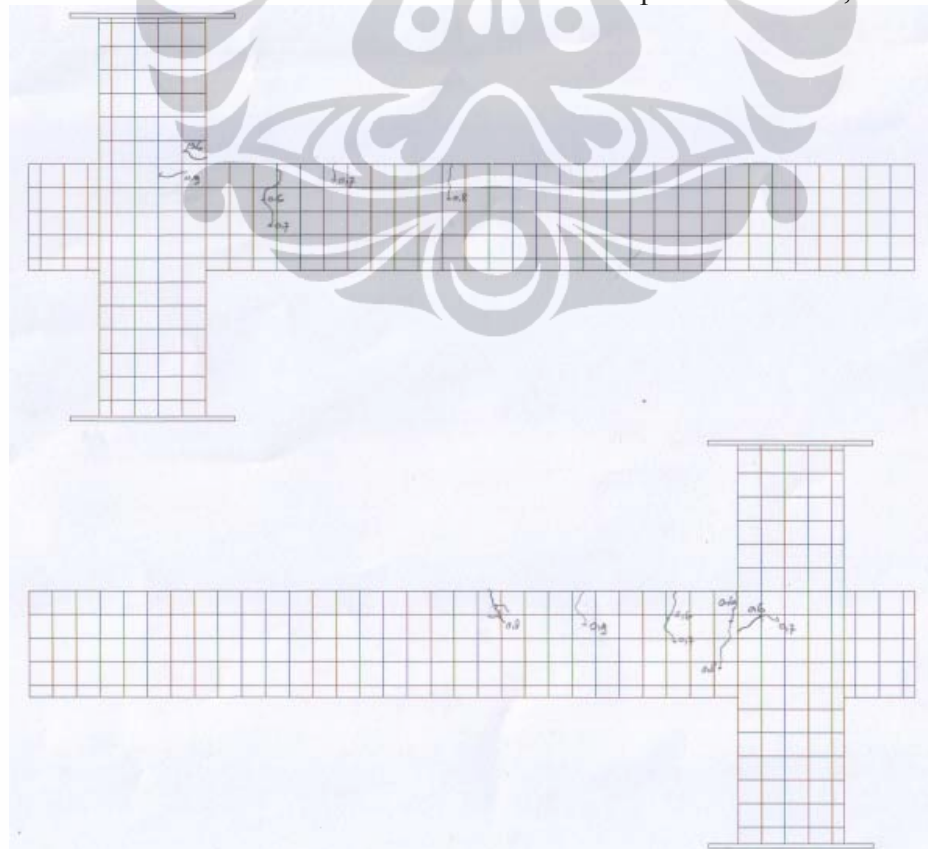
Gambar L124. Pola Retak Model-1.1. Sebelum perkuatan : $P=0,6$ kN



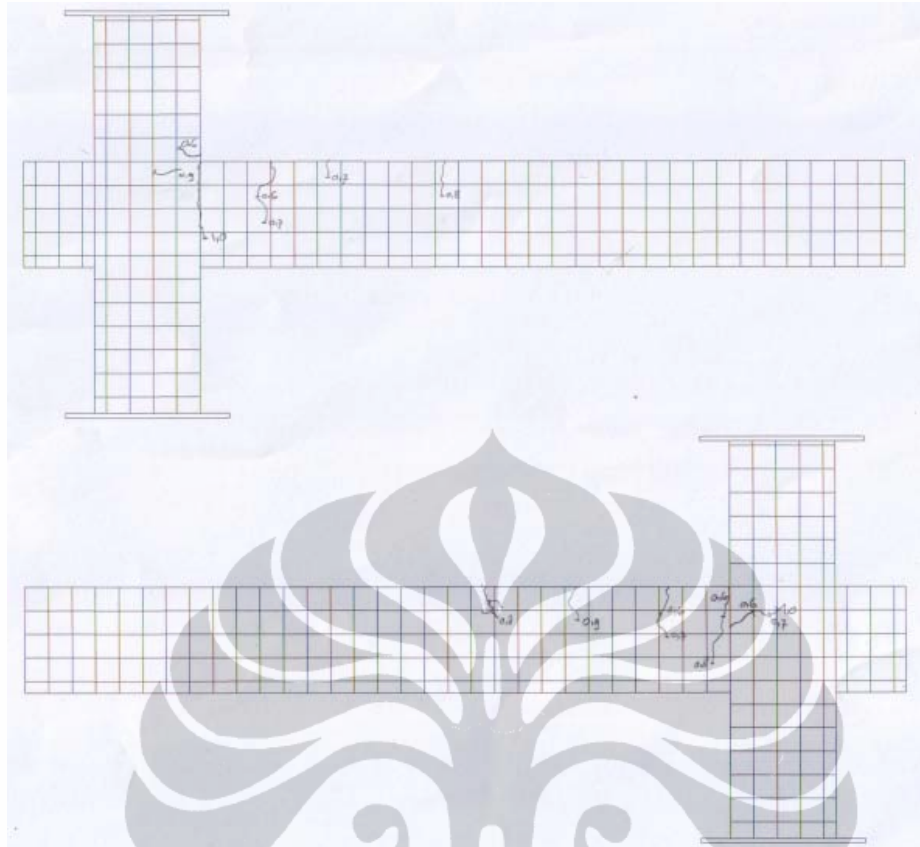
Gambar L125. Pola Retak Model-1.1. Sebelum perkuatan : $P=0,7$ kN



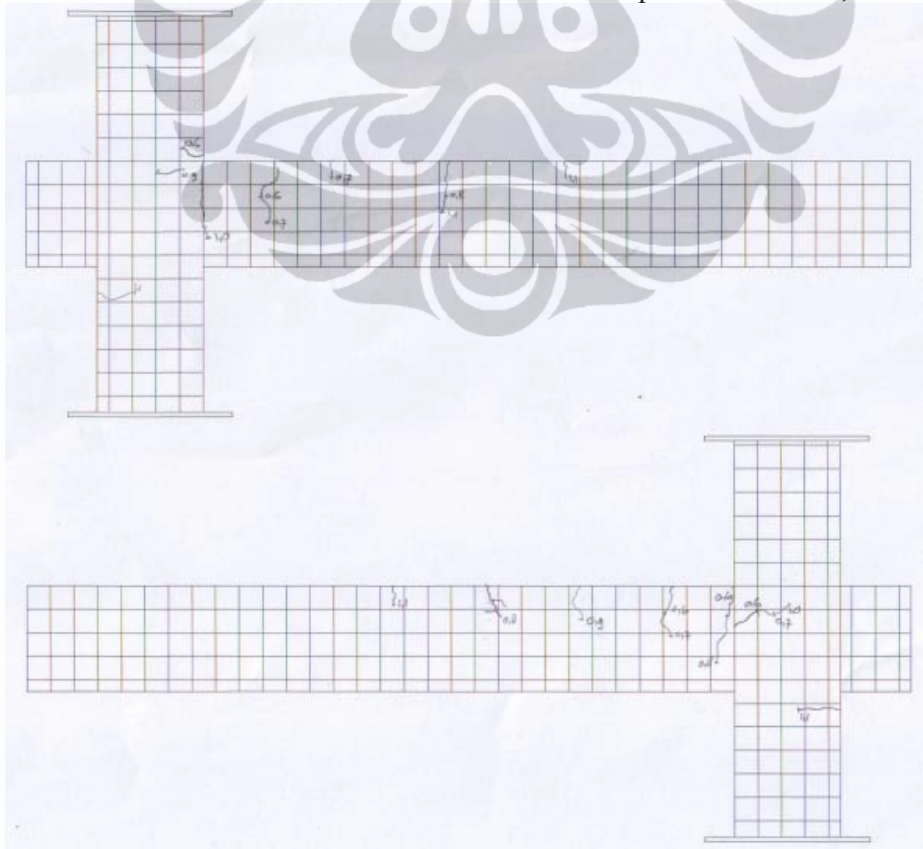
Gambar L126. Pola Retak Model-1.1. Sebelum perkuatan : $P=0,8$ kN



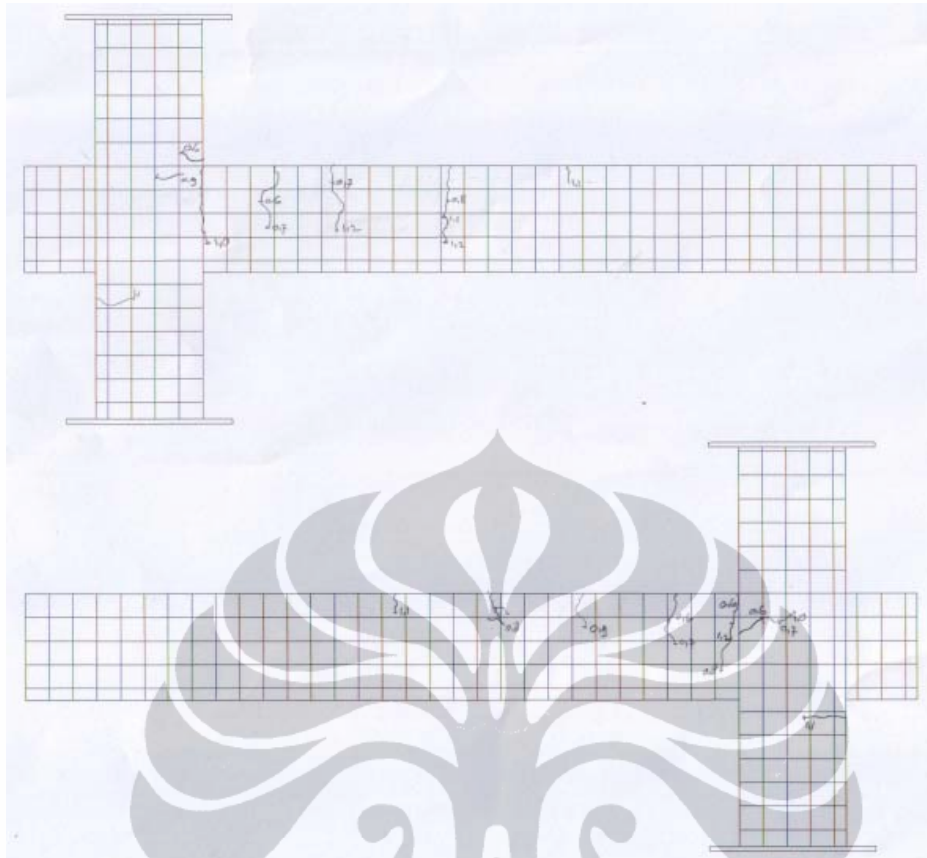
Gambar L127. Pola Retak Model-1.1. Sebelum perkuatan : $P=0,9$ kN



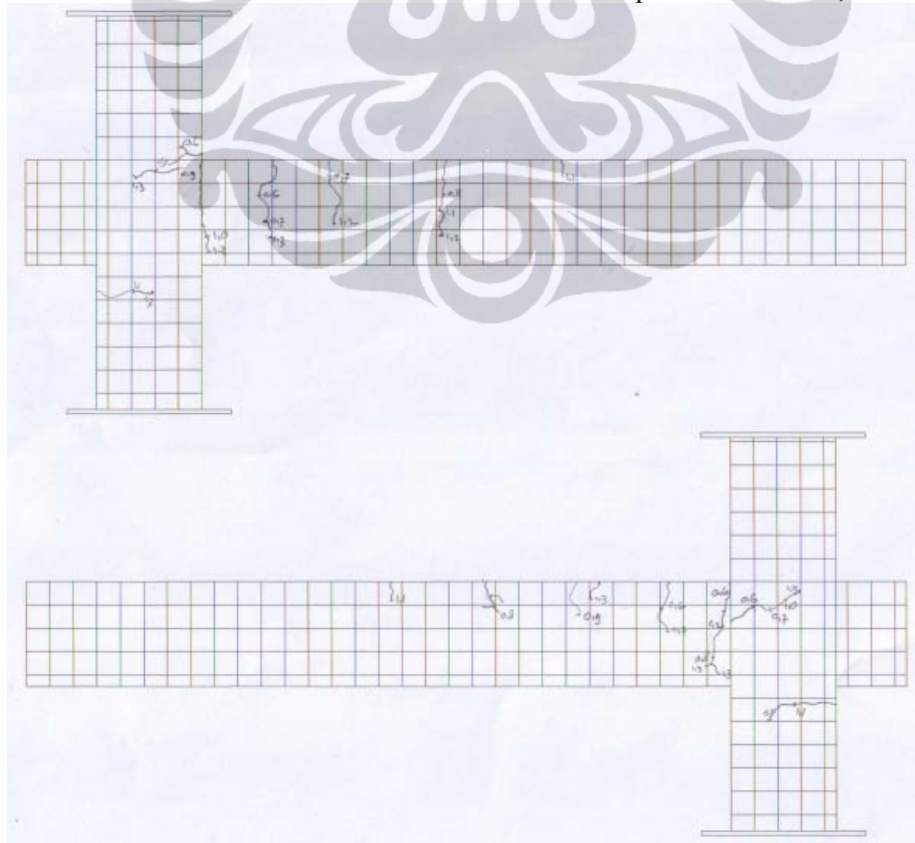
Gambar L128. Pola Retak Model-1.1. Sebelum perkuatan : $P=1,0$ kN



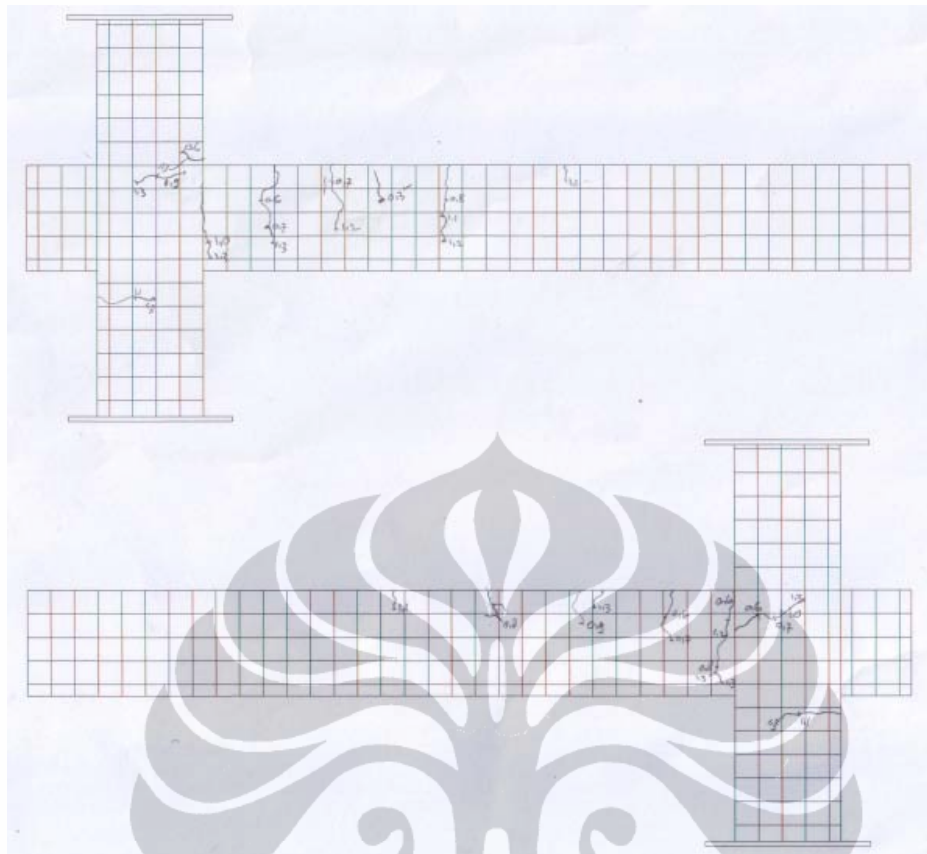
Gambar L129. Pola Retak Model-1.1. Sebelum perkuatan : $P=1,1$ kN



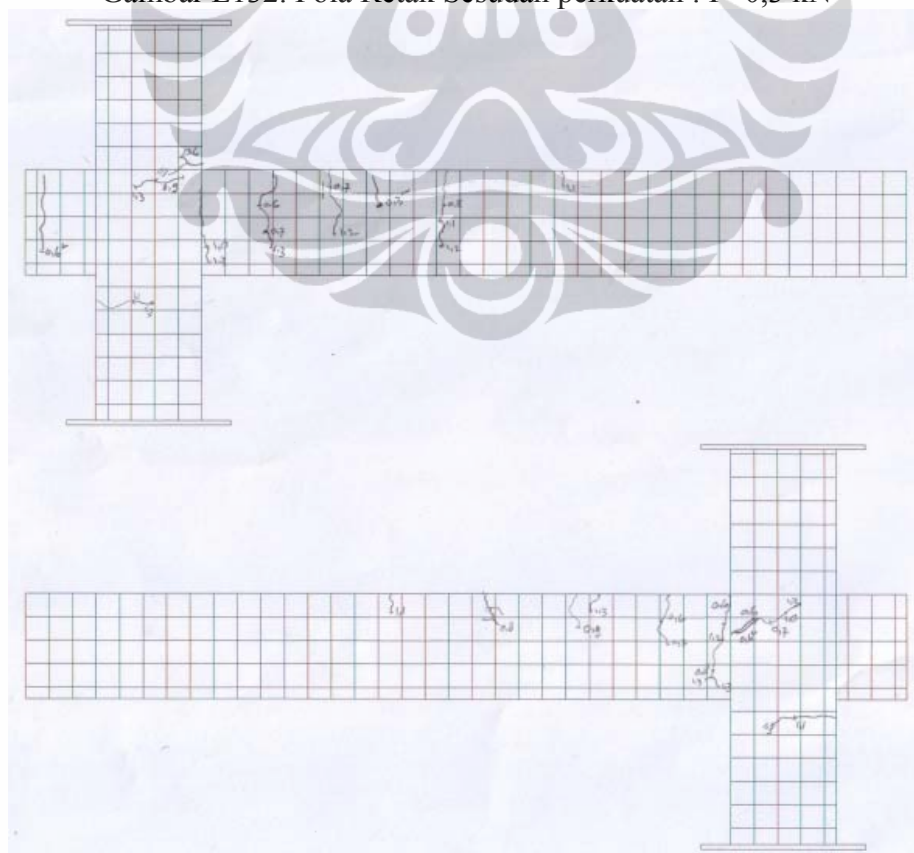
Gambar L130. Pola Retak Model-1.1. Sebelum perkuatan : $P=1,2$ kN



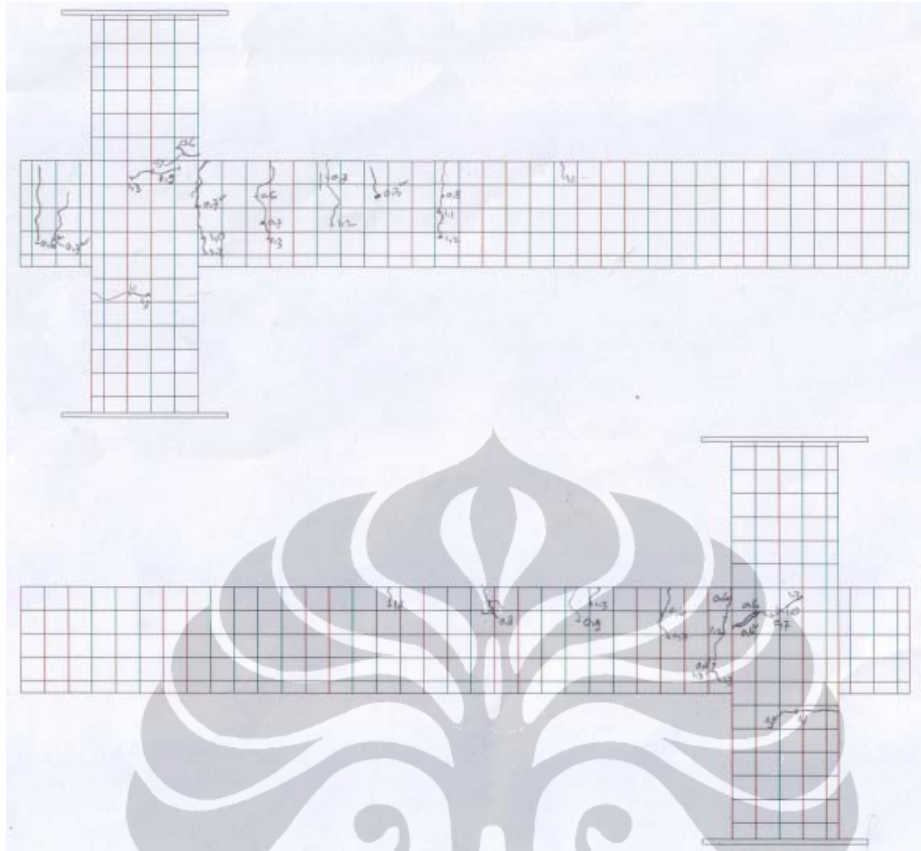
Gambar L131. Pola Retak Model-1.1. Sebelum perkuatan : $P=1,3$ kN



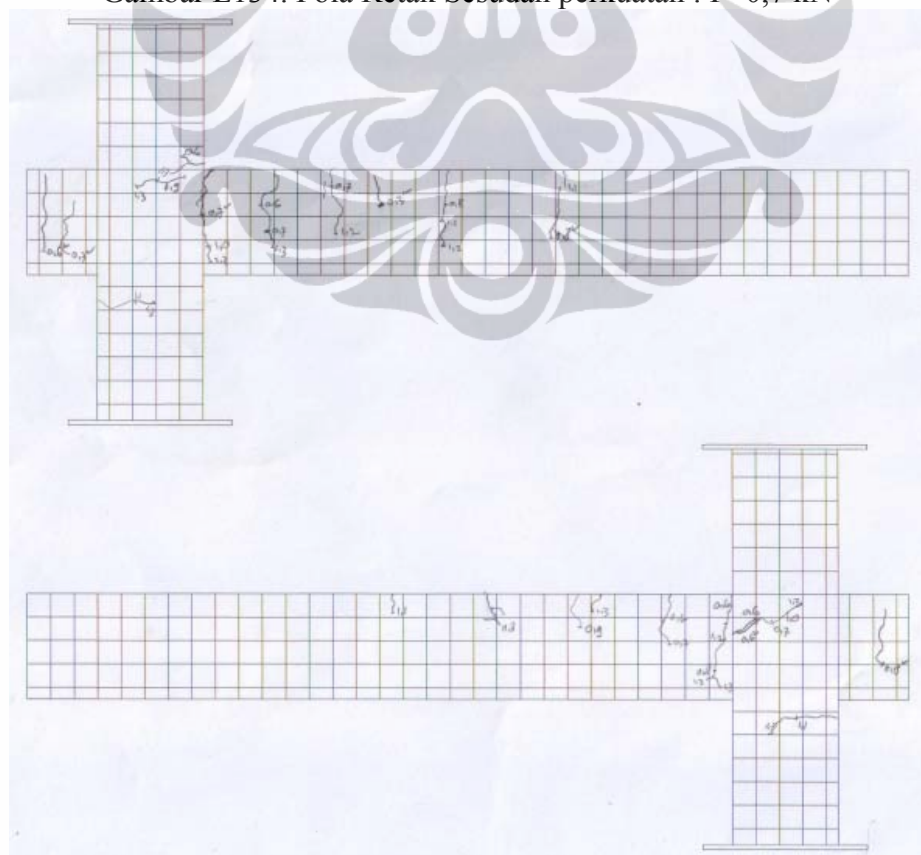
Gambar L132. Pola Retak Sesudah perkuatan : $P=0,3 \text{ kN}$



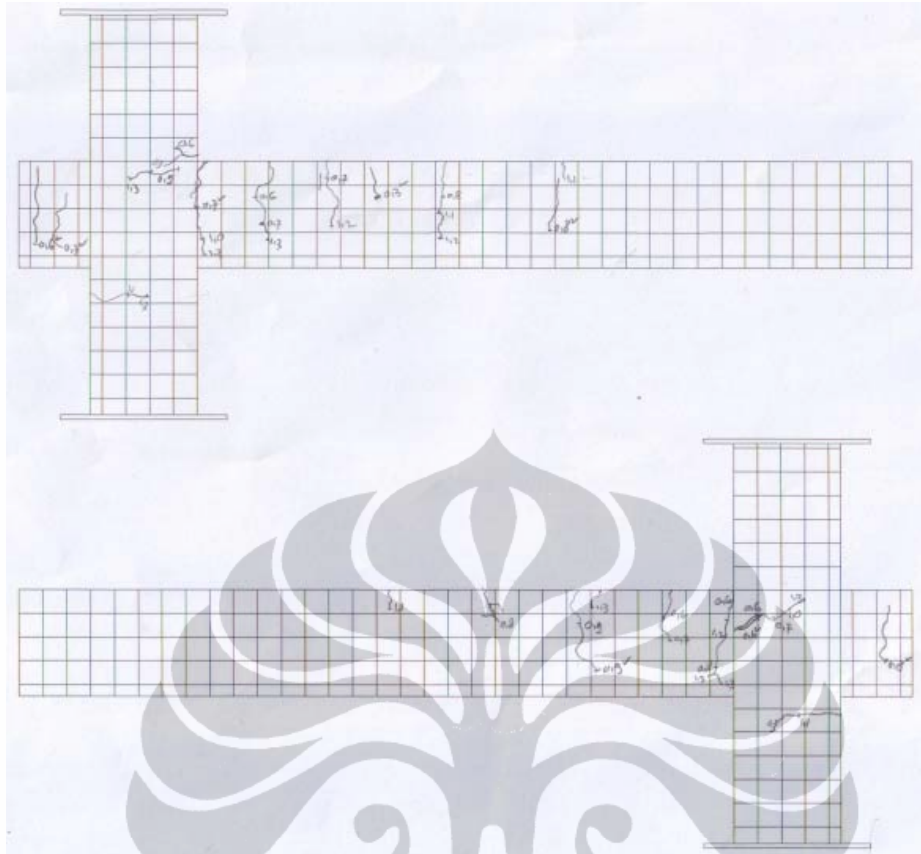
Gambar L133. Pola Retak Sesudah perkuatan : $P=0,6 \text{ kN}$



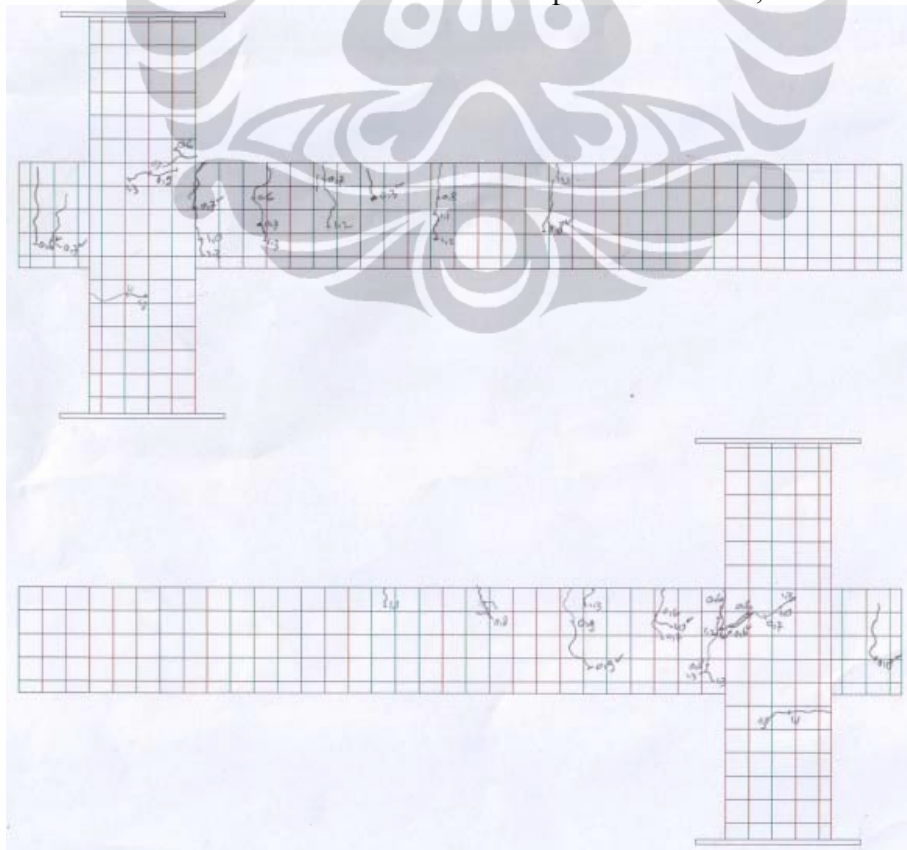
Gambar L134. Pola Retak Sesudah perkuatan : $P=0,7$ kN



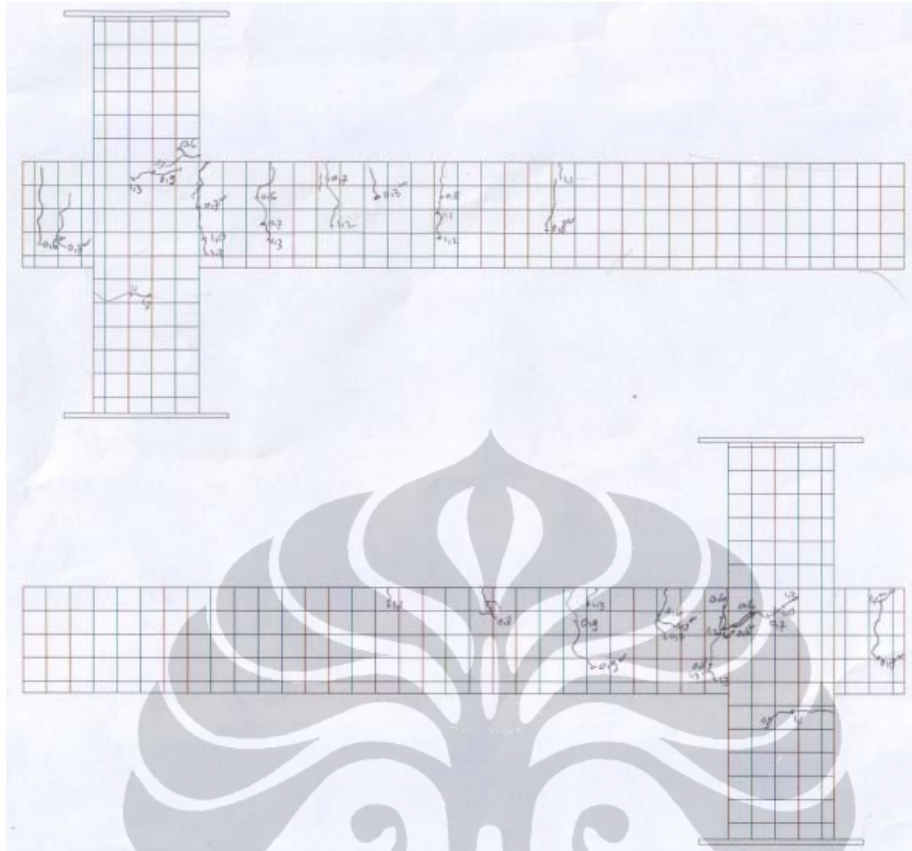
Gambar L135. Pola Retak Sesudah perkuatan : $P=0,8$ kN



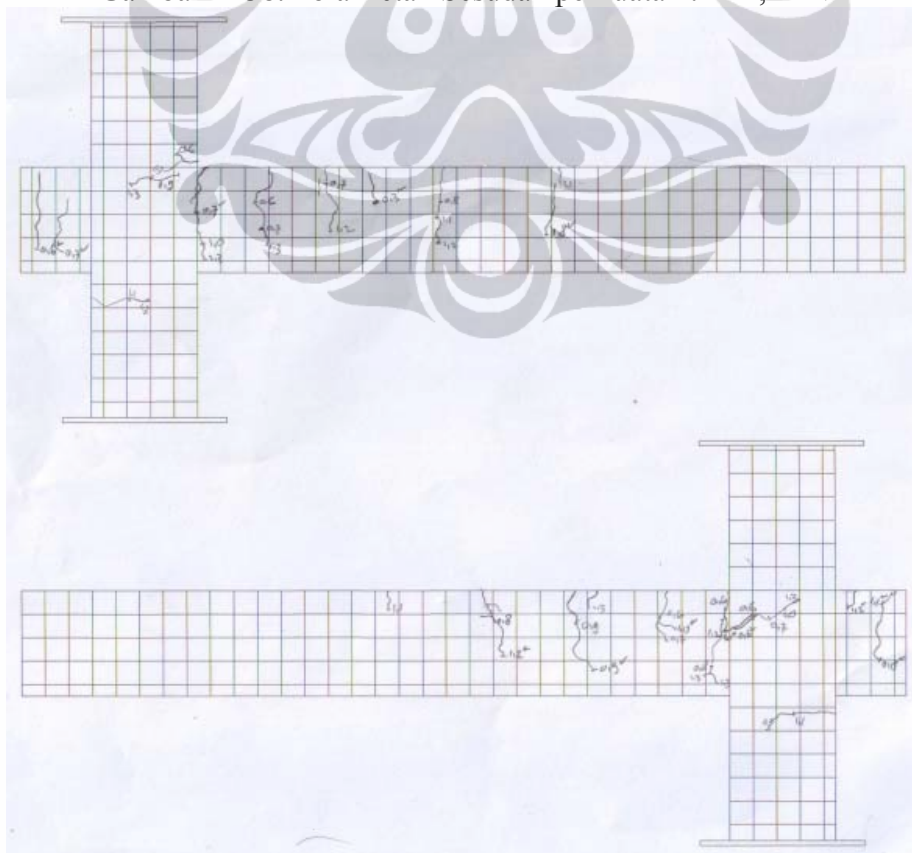
Gambar L136. Pola Retak Sesudah perkuatan : $P=0,9 \text{ kN}$



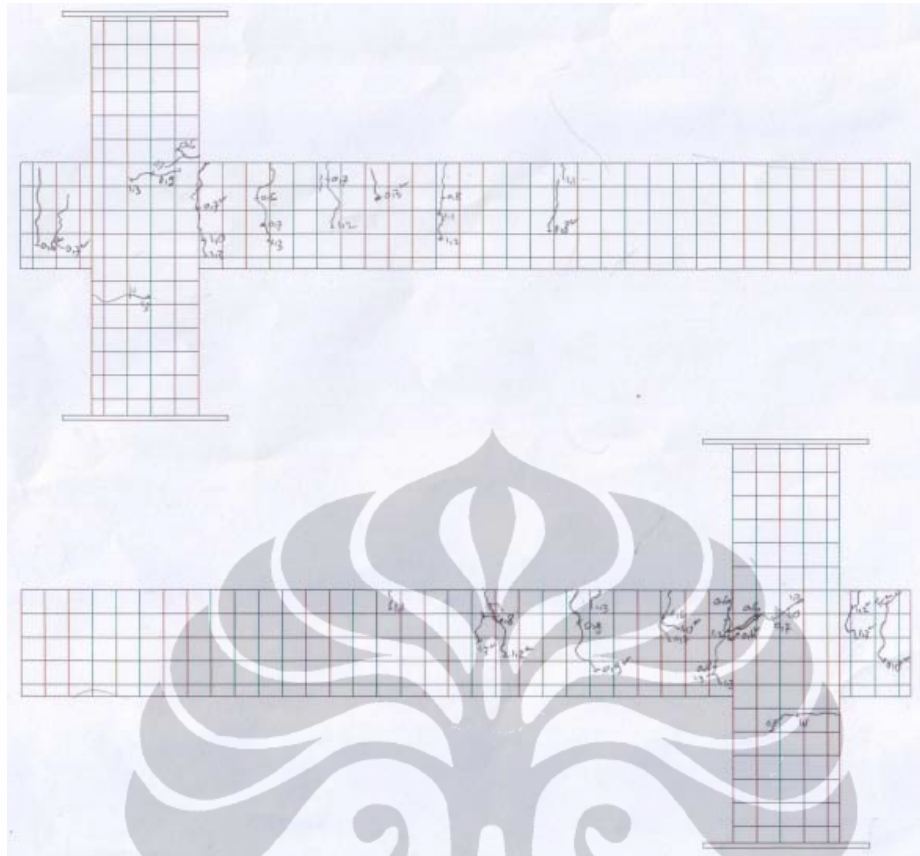
Gambar L137. Pola Retak Sesudah perkuatan : $P=1,0 \text{ kN}$



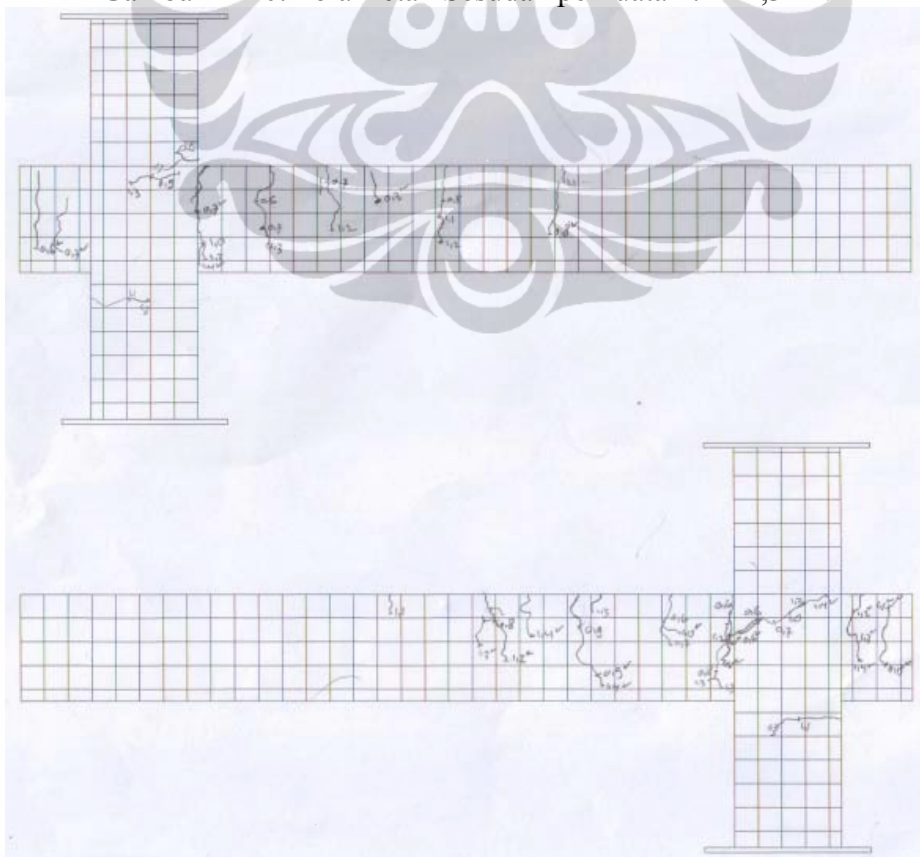
Gambar L138. Pola Retak Sesudah perkuatan : $P=1,1$ kN



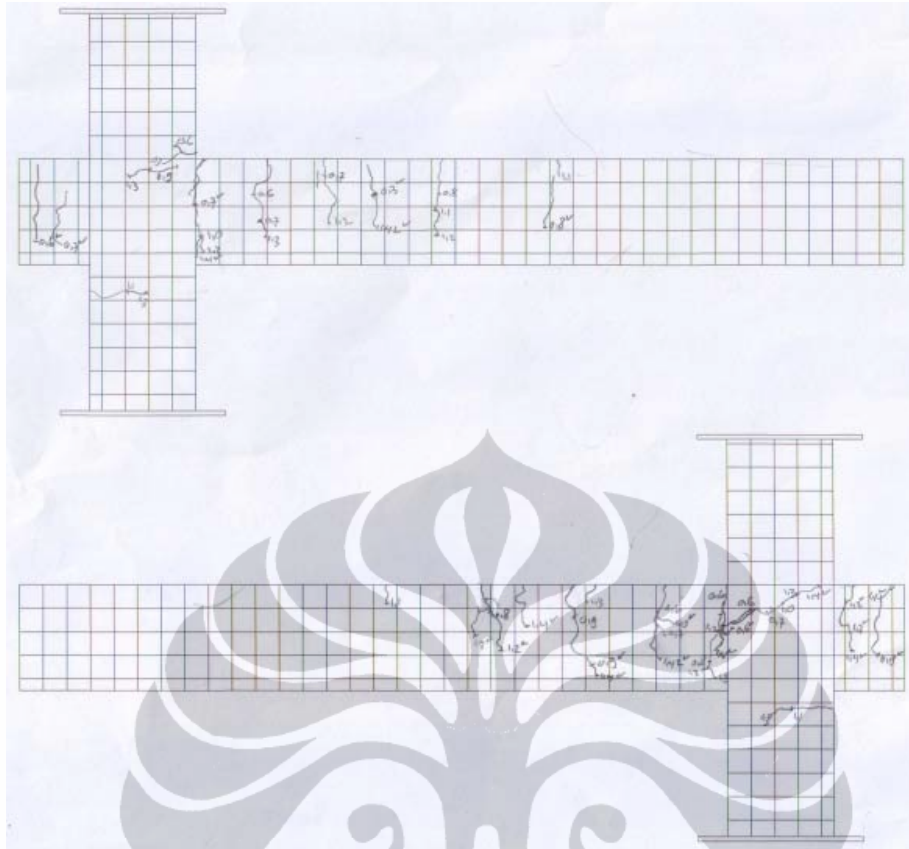
Gambar L139. Pola Retak Sesudah perkuatan : $P=1,2$ kN



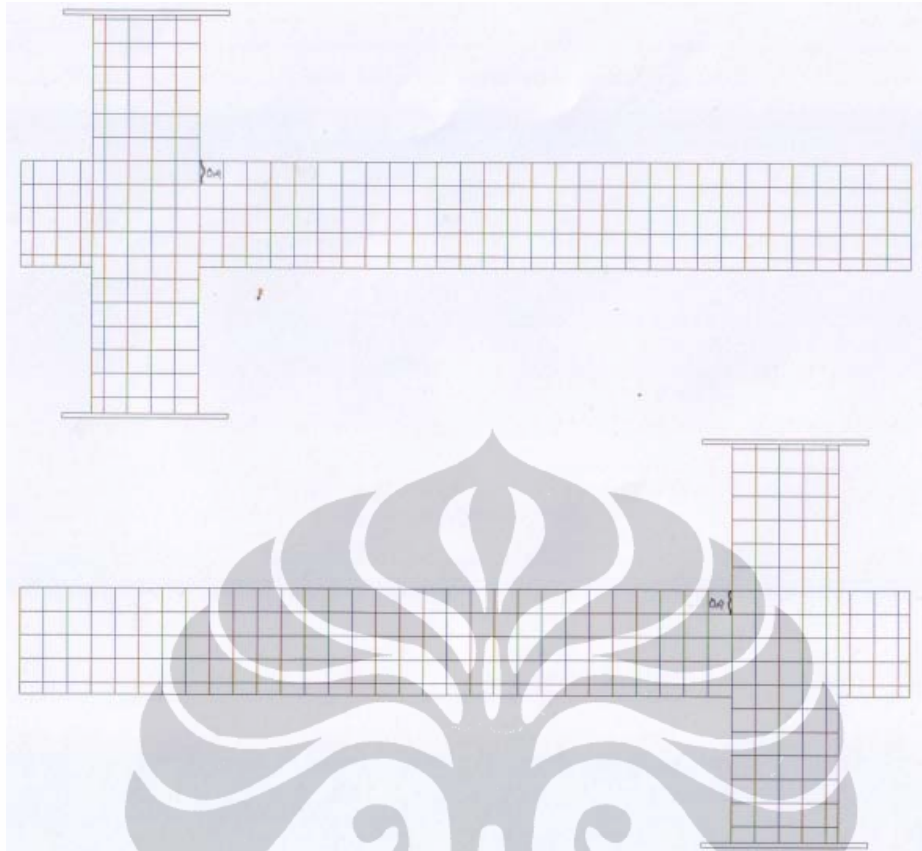
Gambar L140. Pola Retak Sesudah perkuatan : $P=1,3$ kN



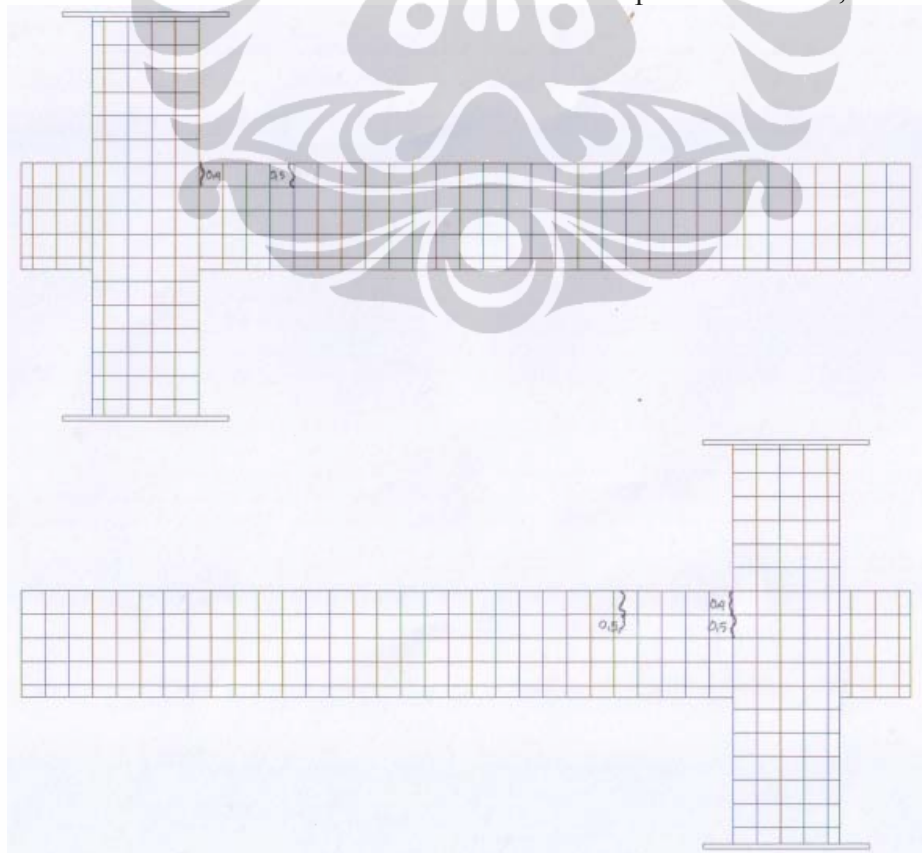
Gambar L141. Pola Retak Sesudah perkuatan : $P=1,4$ kN



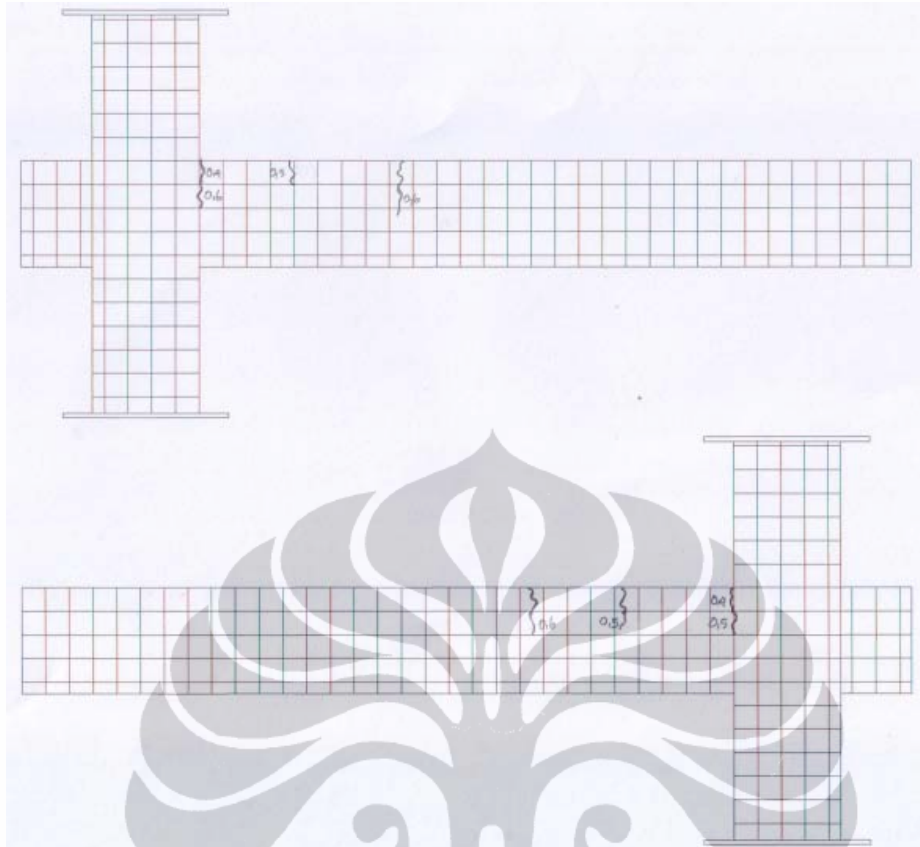
Gambar L142. Pola Retak Sesudah perkuatan : $P=1,42$ kN



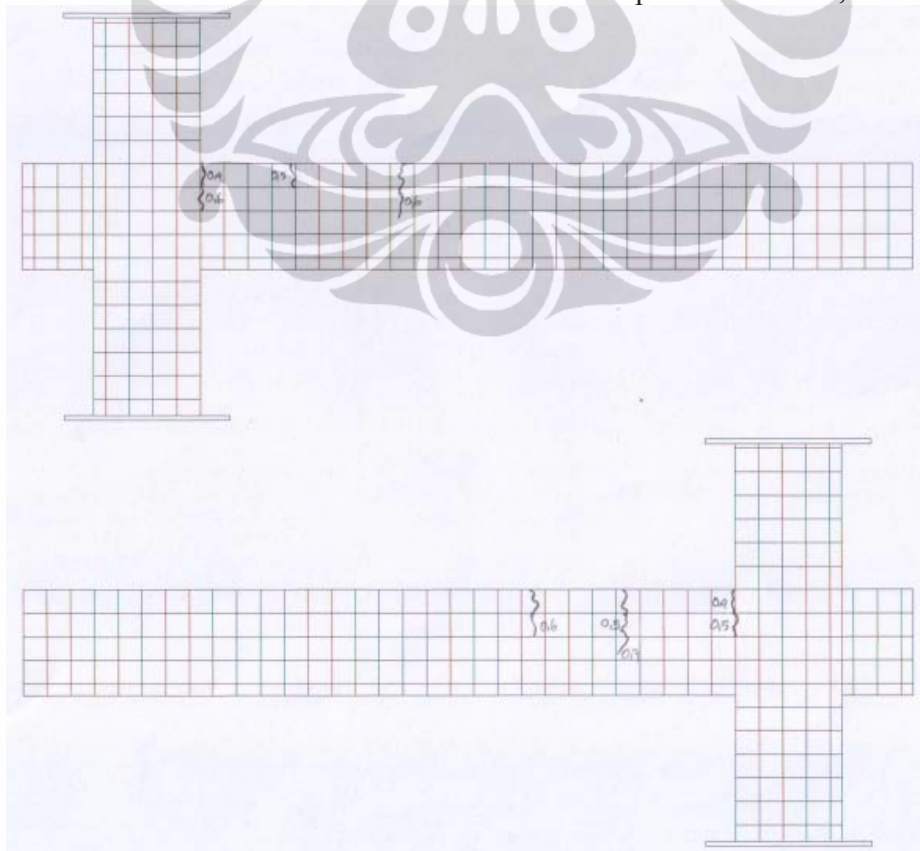
Gambar L143. Pola Retak Model-1.2. Sebelum perkuatan : $P=0,4$ kN



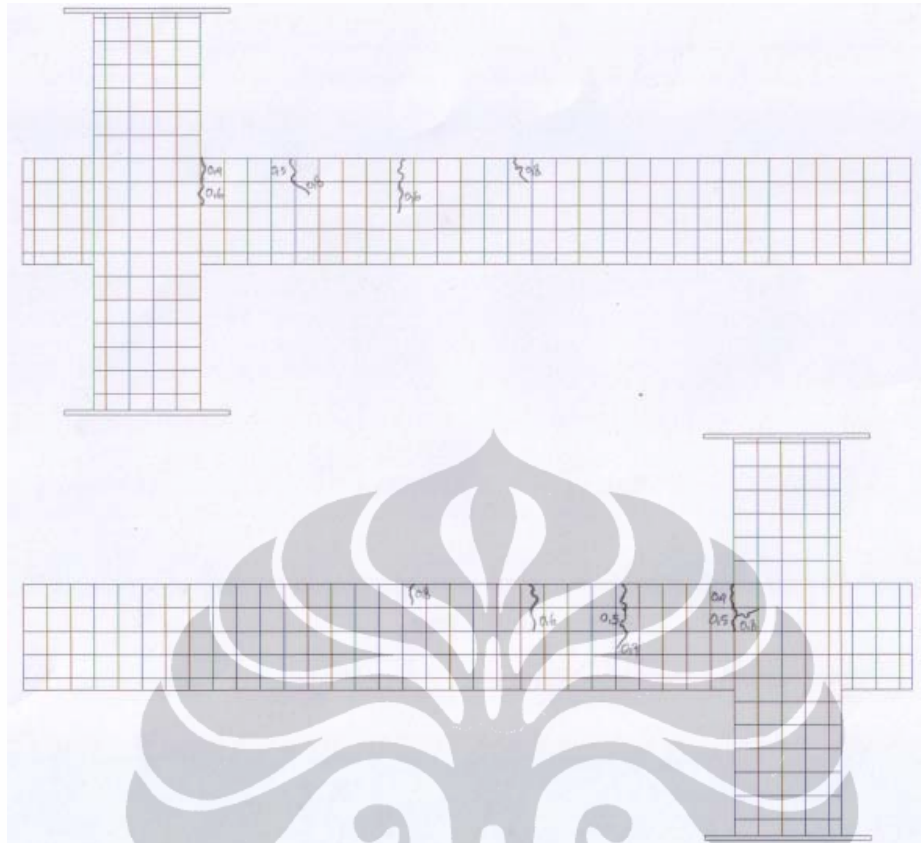
Gambar L144. Pola Retak Model-1.2. Sebelum perkuatan : $P=0,5$ kN



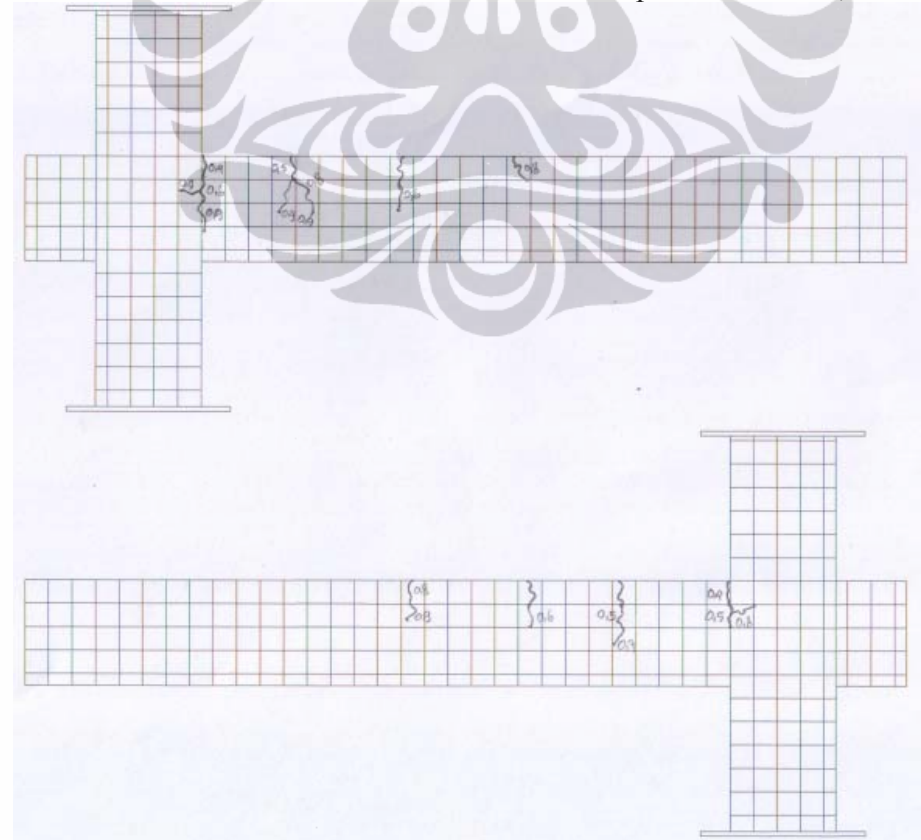
Gambar L145. Pola Retak Model-1.2. Sebelum perkuatan : $P=0,6$ kN



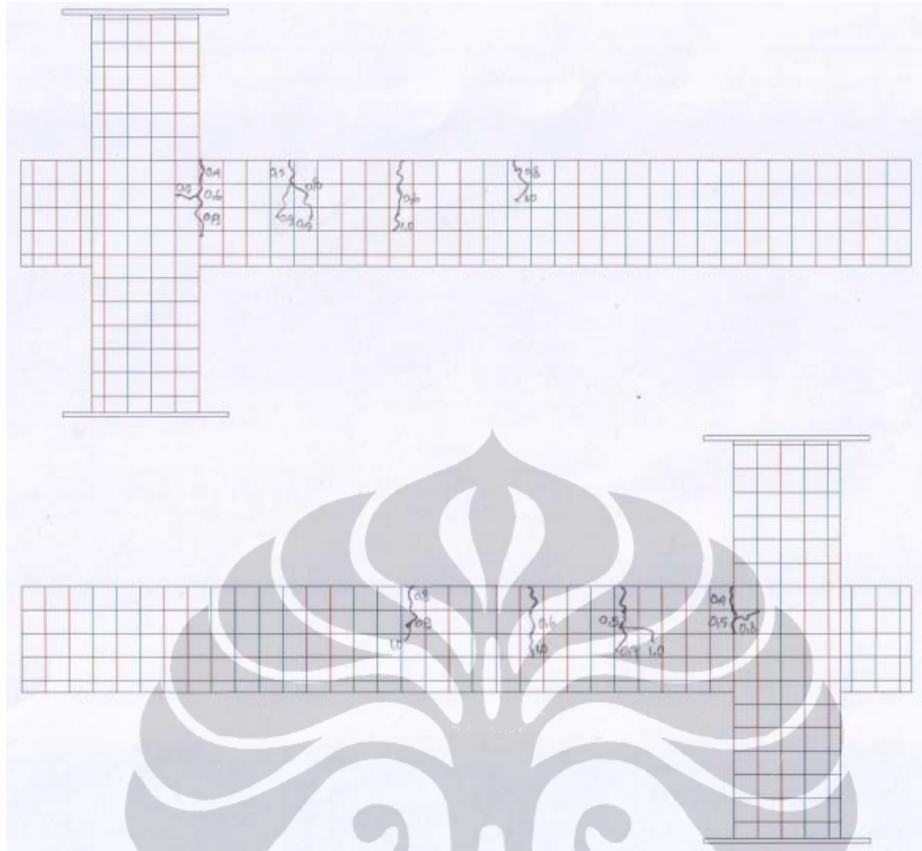
Gambar L146. Pola Retak Model-1.2. Sebelum perkuatan : $P=0,7$ kN



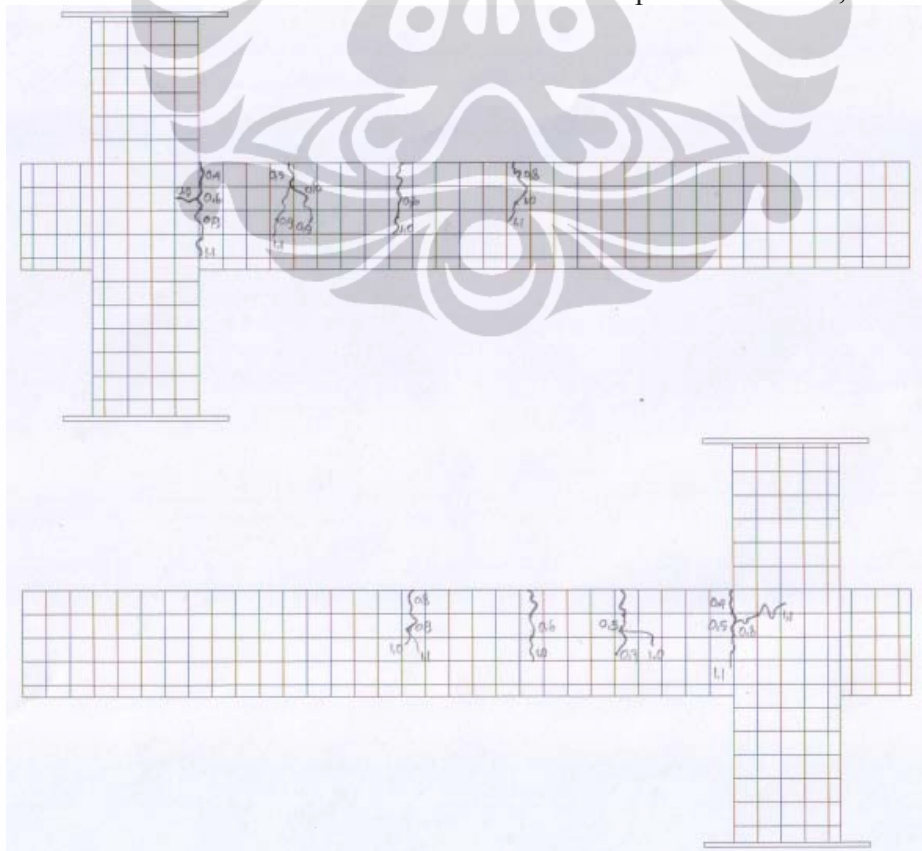
Gambar L147. Pola Retak Model-1.2. Sebelum perkuatan : $P=0,8$ kN



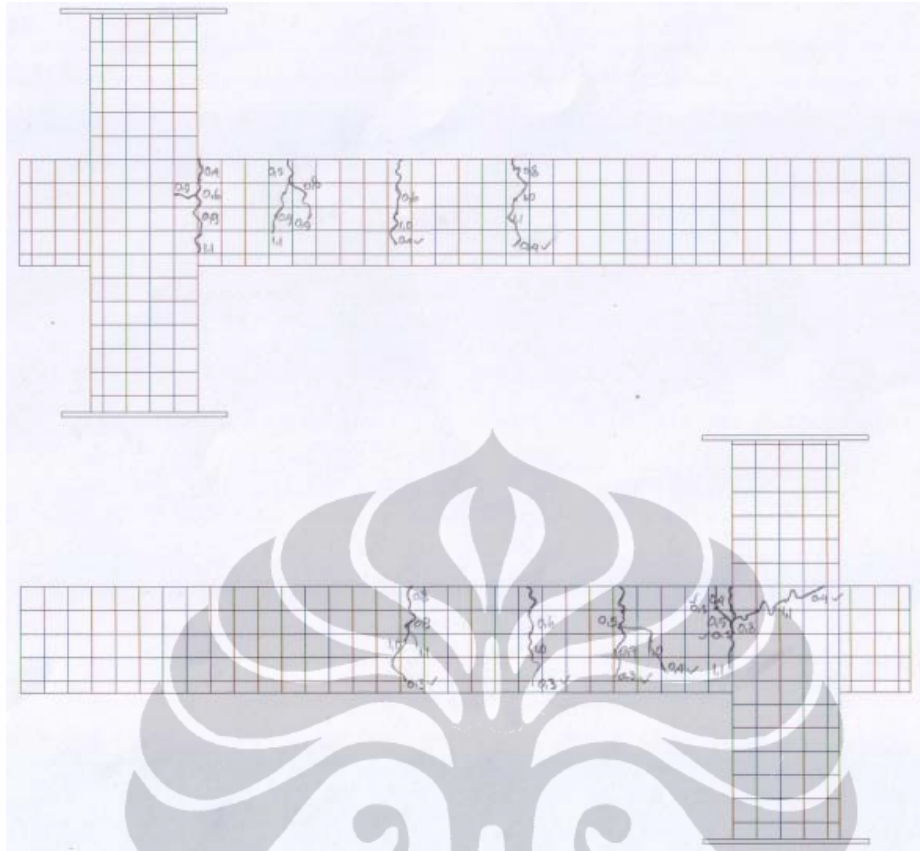
Gambar L148. Pola Retak Model-1.2. Sebelum perkuatan : $P=0,9$ kN



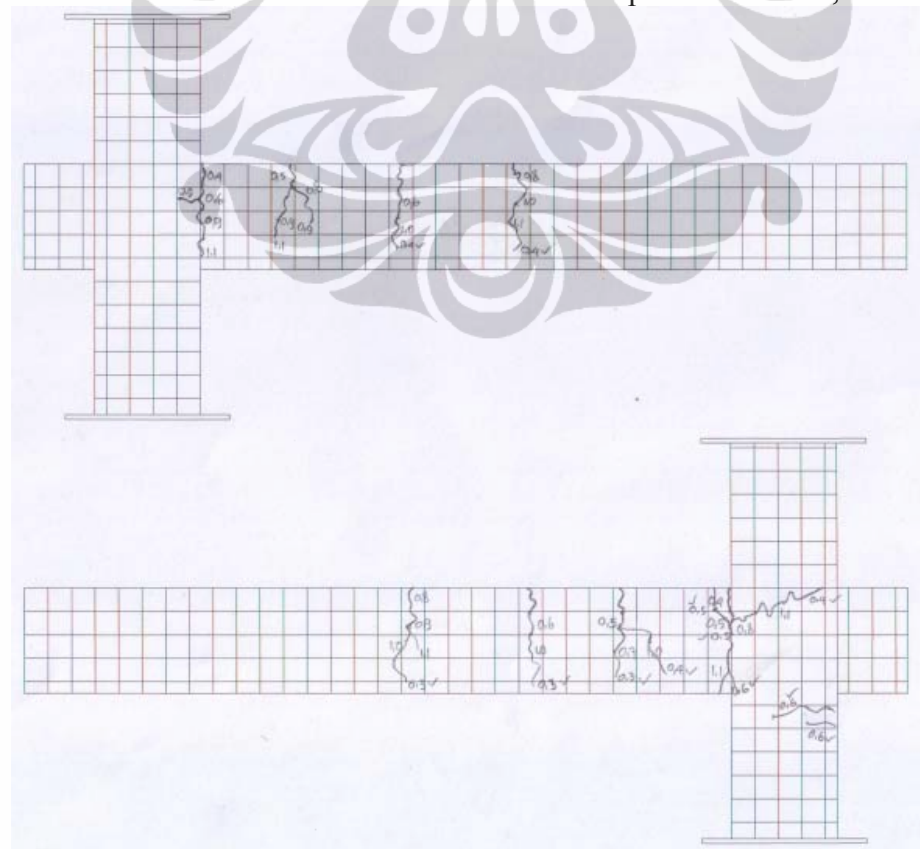
Gambar L149. Pola Retak Model-1.2. Sebelum perkuatan : $P=1,0$ kN



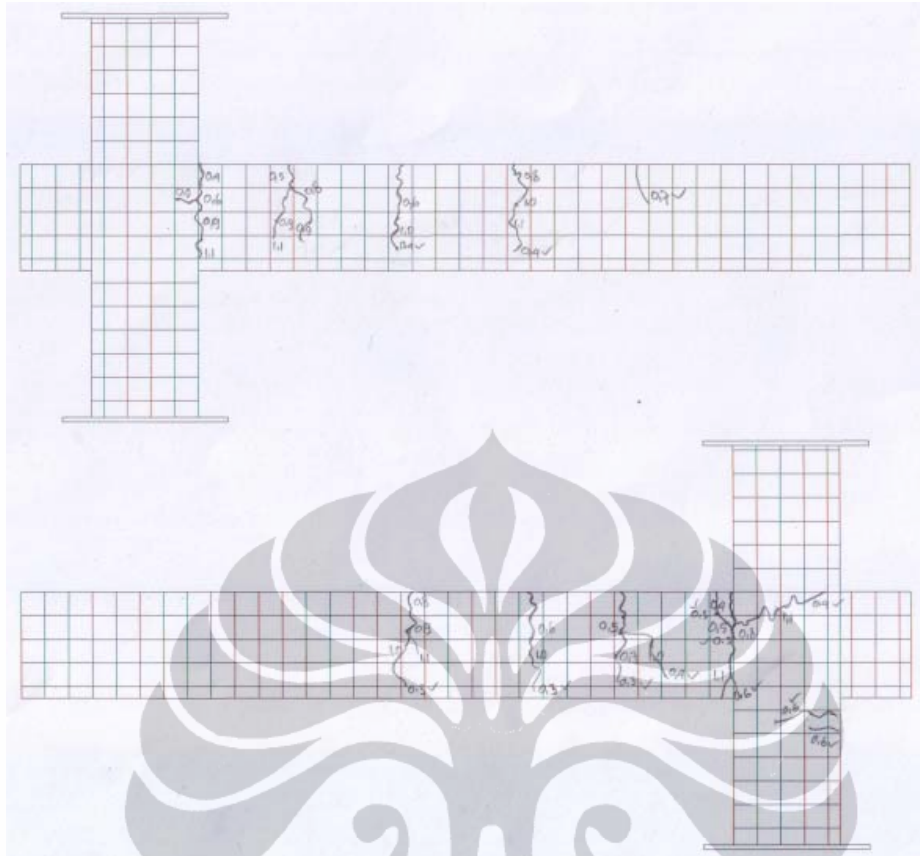
Gambar L150. Pola Retak Model-1.2. Sebelum perkuatan : $P=1,1$ kN



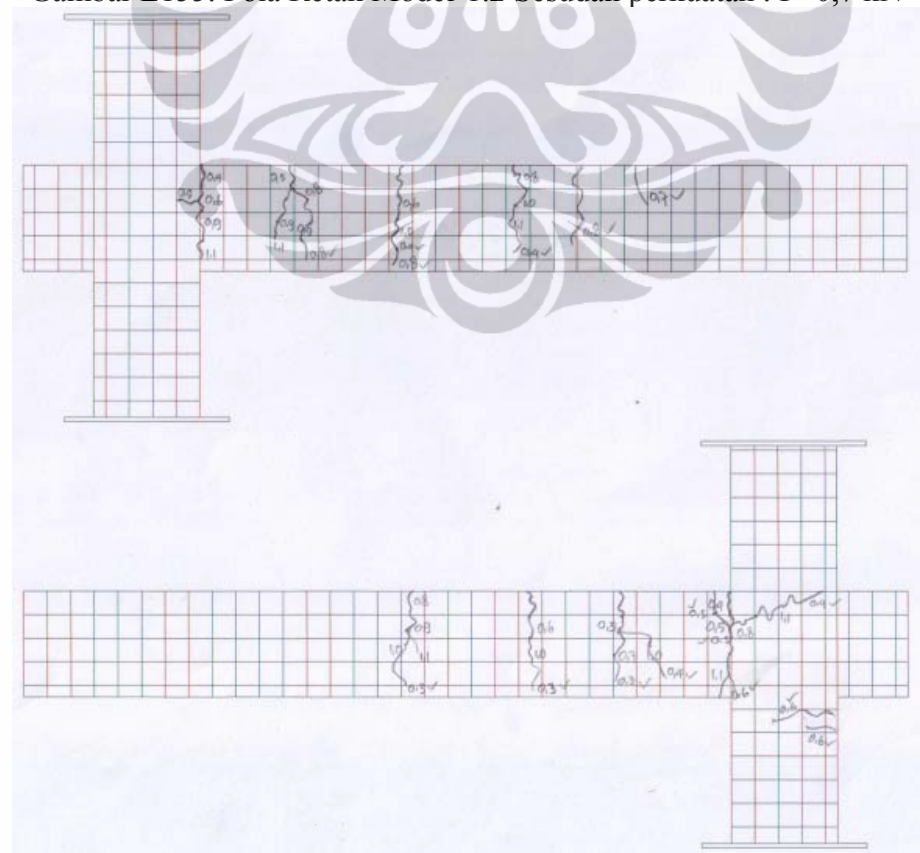
Gambar L153. Pola Retak Model-1.2 Sesudah perkuatan : $P=0,5$ kN



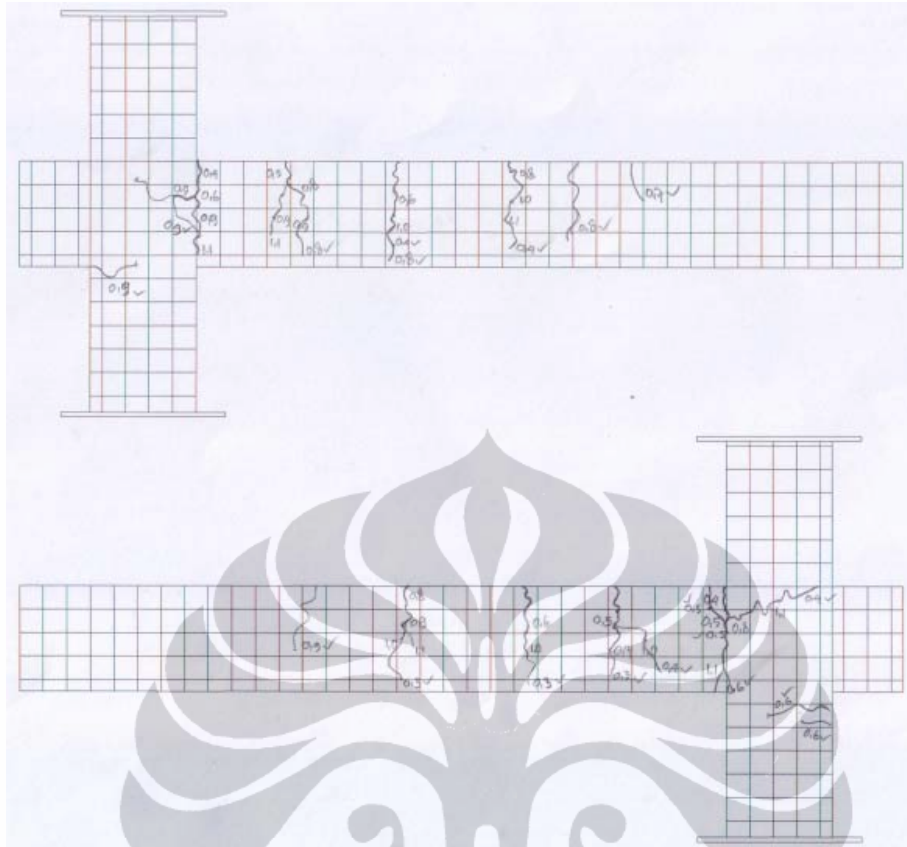
Gambar L154. Pola Retak Model-1.2 Sesudah perkuatan : $P=0,6$ kN



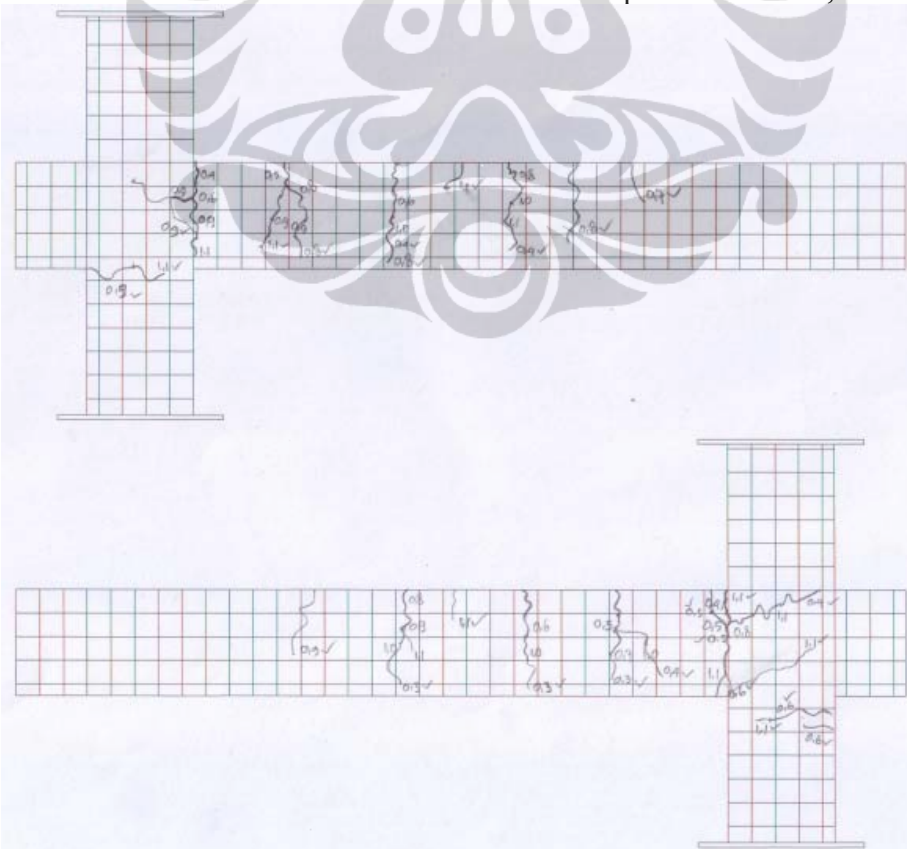
Gambar L155. Pola Retak Model-1.2 Sesudah perkuatan : $P=0,7$ kN



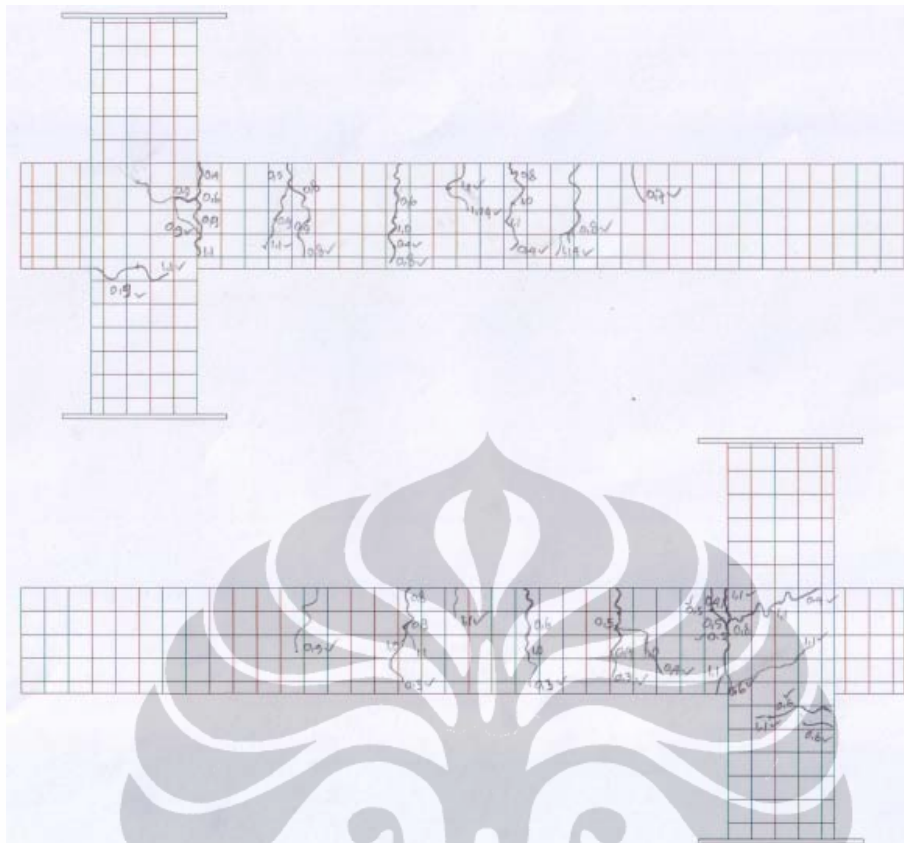
Gambar L156. Pola Retak Model-1.2 Sesudah perkuatan : $P=0,8$ kN

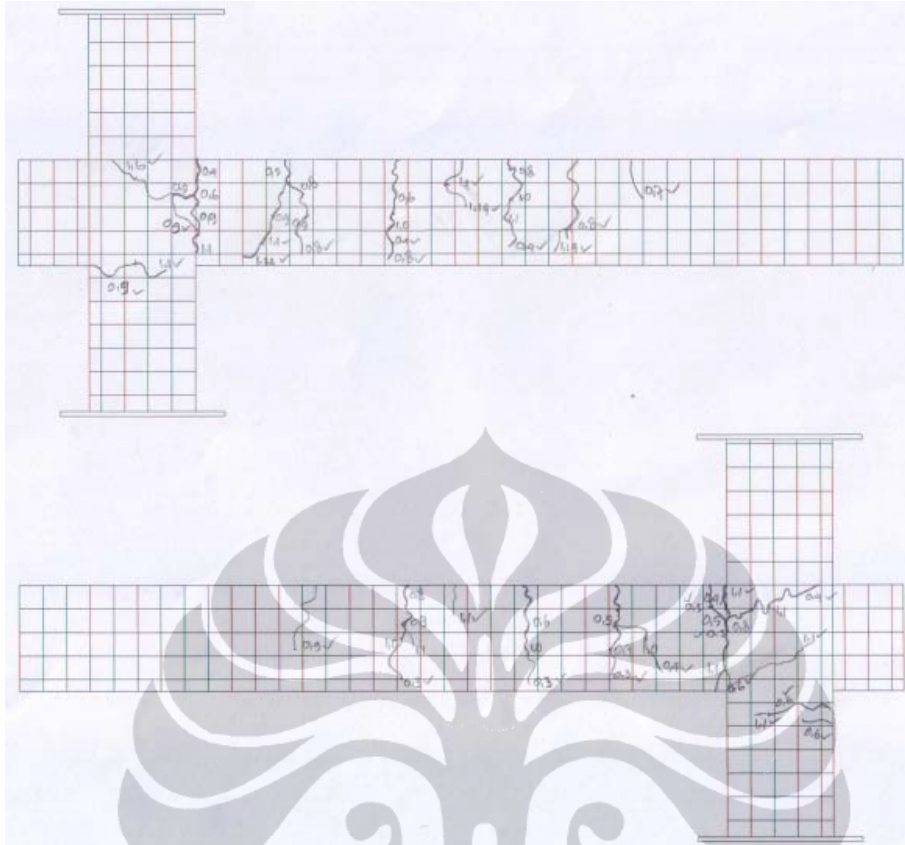


Gambar L157. Pola Retak Model-1.2 Sesudah perkuatan : $P=0,9$ kN

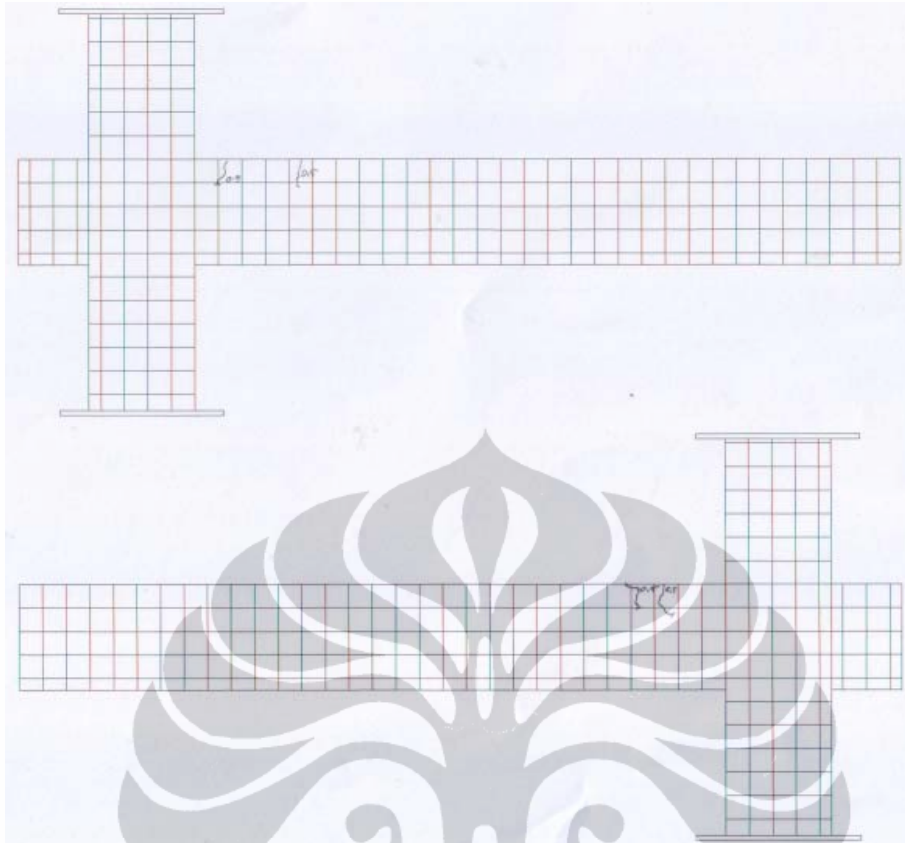


Gambar L158. Pola Retak Model-1.2 Sesudah perkuatan : $P=1,1$ kN

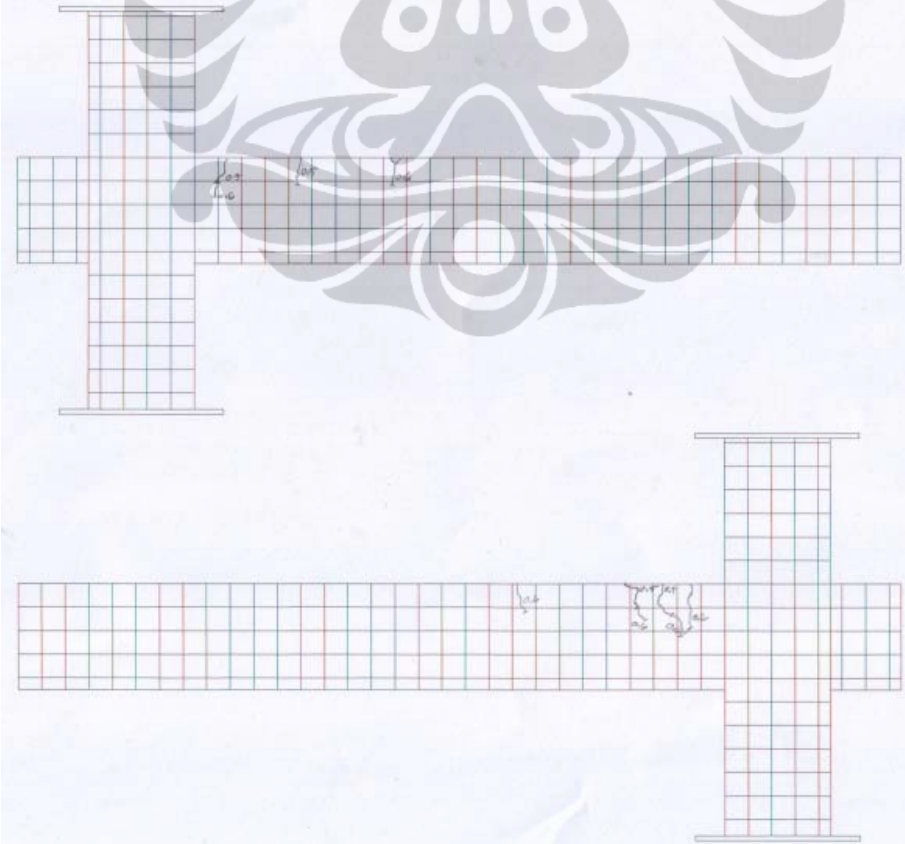




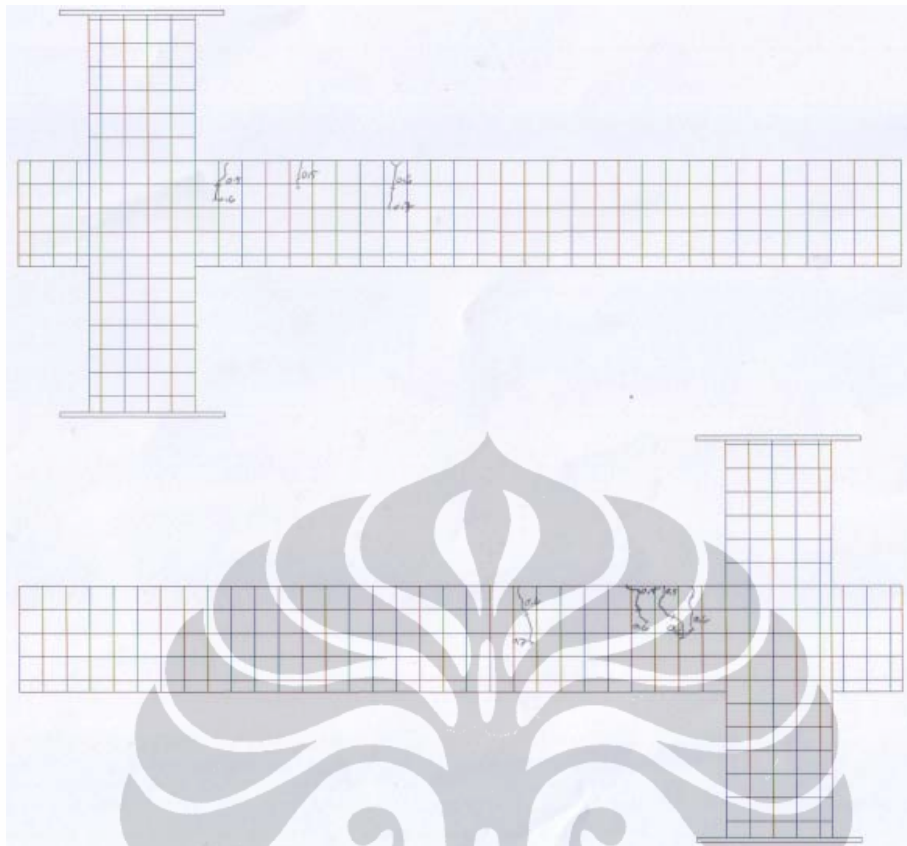
Gambar L161. Pola Retak Model-1.2 Sesudah perkuatan : $P=1,6$ kN



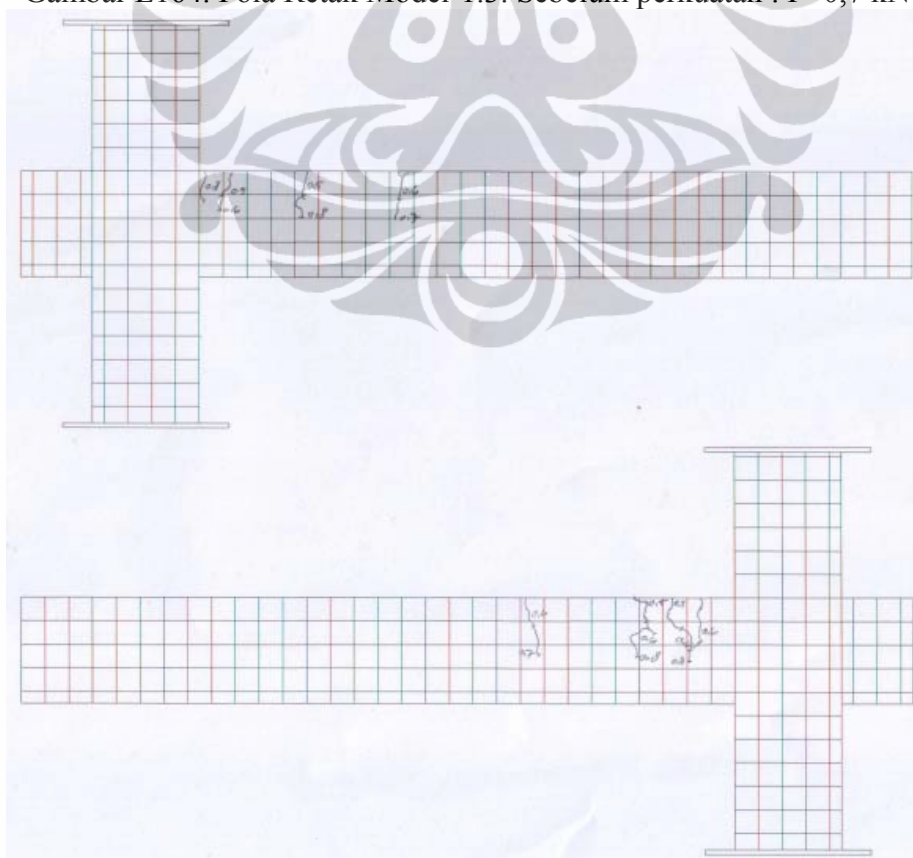
Gambar L162. Pola Retak Model-1.3. Sebelum perkuatan : $P=0,5$ kN



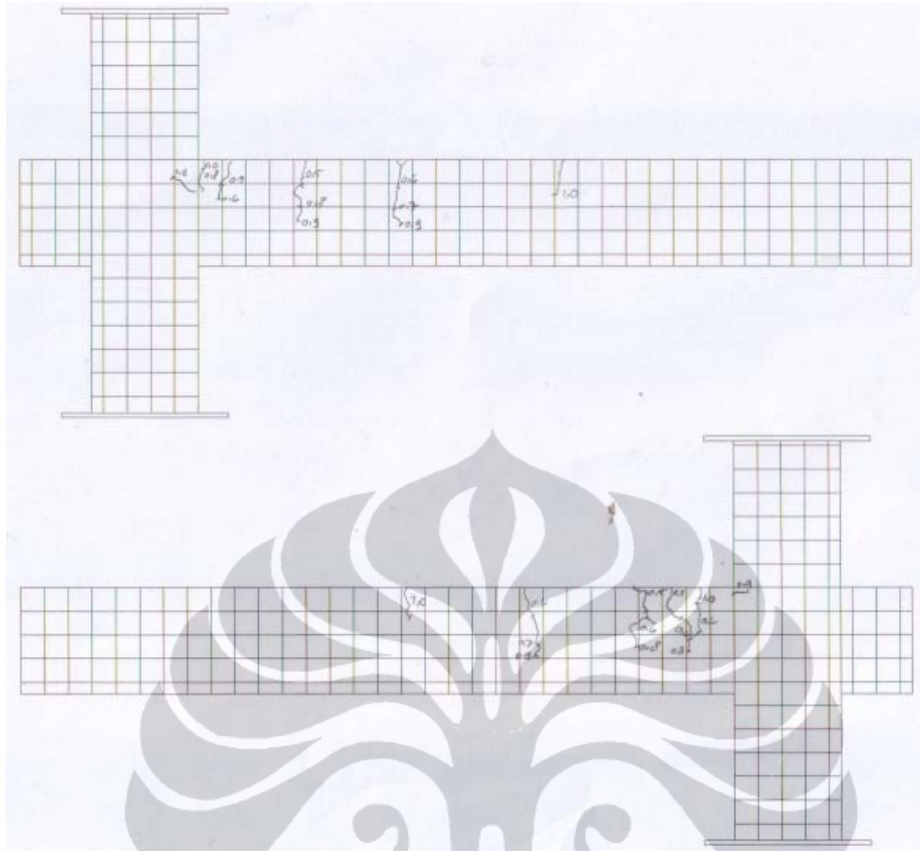
Gambar L163. Pola Retak Model-1.3. Sebelum perkuatan : $P=0,6$ kN



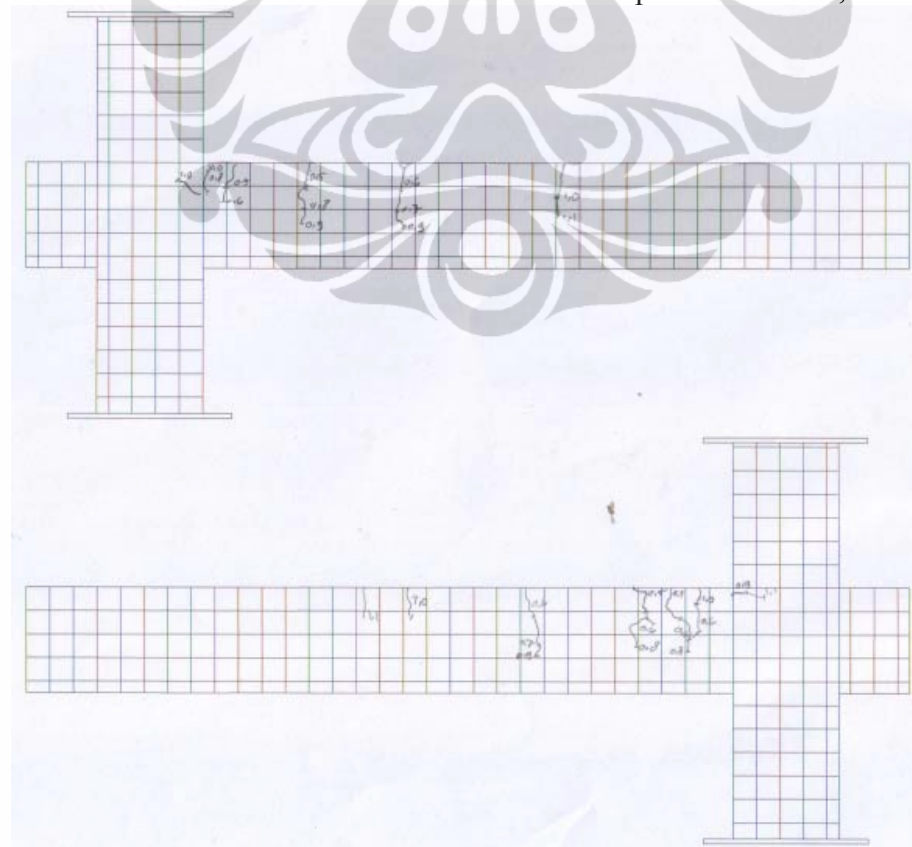
Gambar L164. Pola Retak Model-1.3. Sebelum perkuatan : $P=0,7$ kN



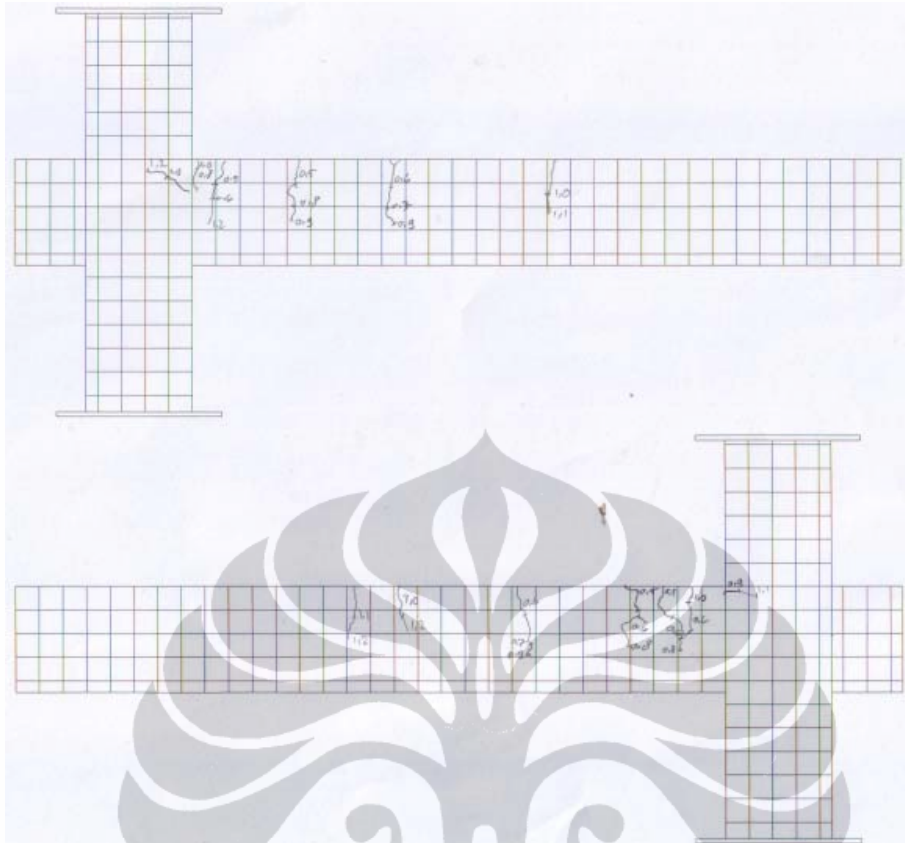
Gambar L165. Pola Retak Model-1.3. Sebelum perkuatan : $P=0,8$ kN



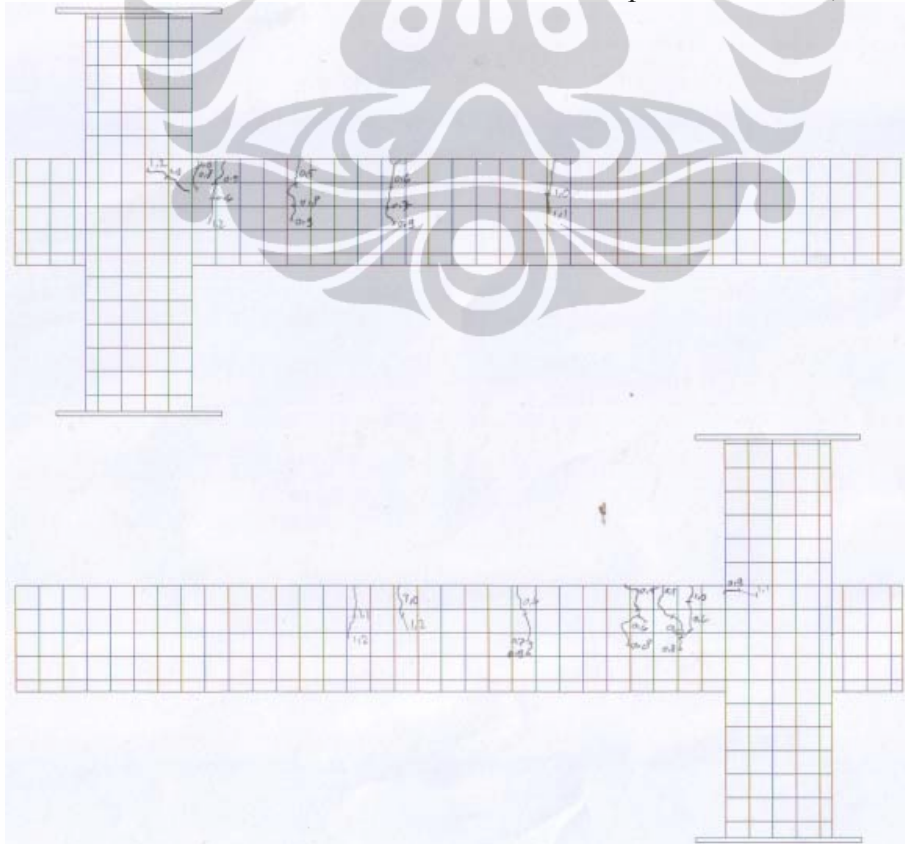
Gambar L166. Pola Retak Model-1.3. Sebelum perkuatan : $P=1,0$ kN



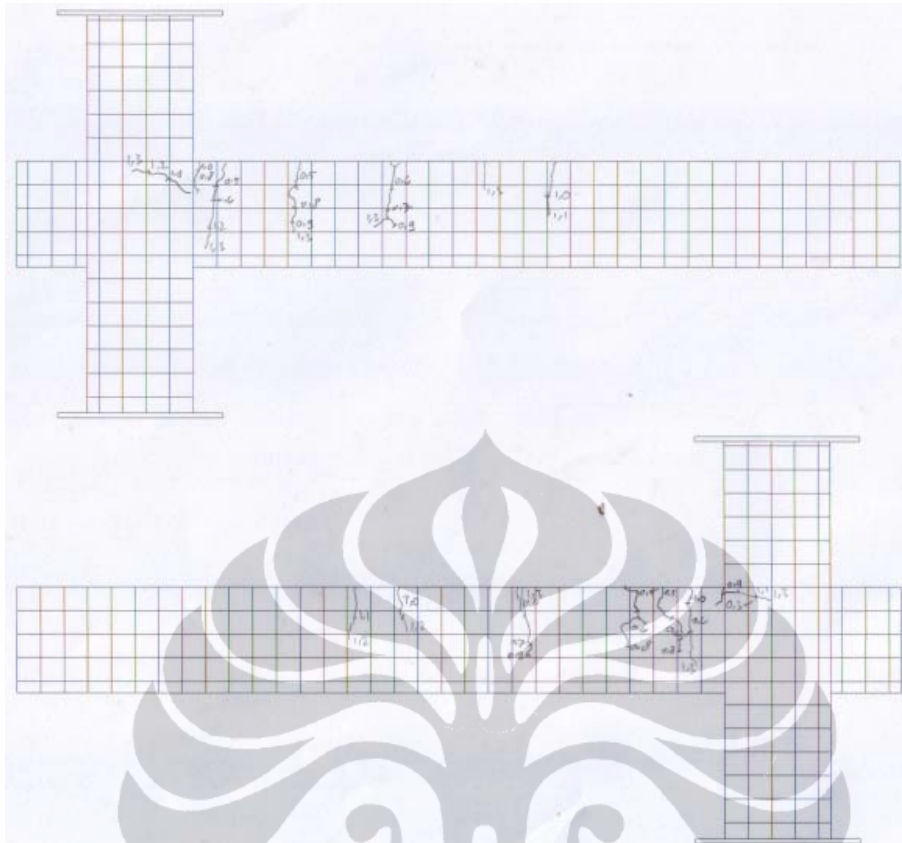
Gambar L167. Pola Retak Model-1.3. Sebelum perkuatan : $P=1,1$ kN



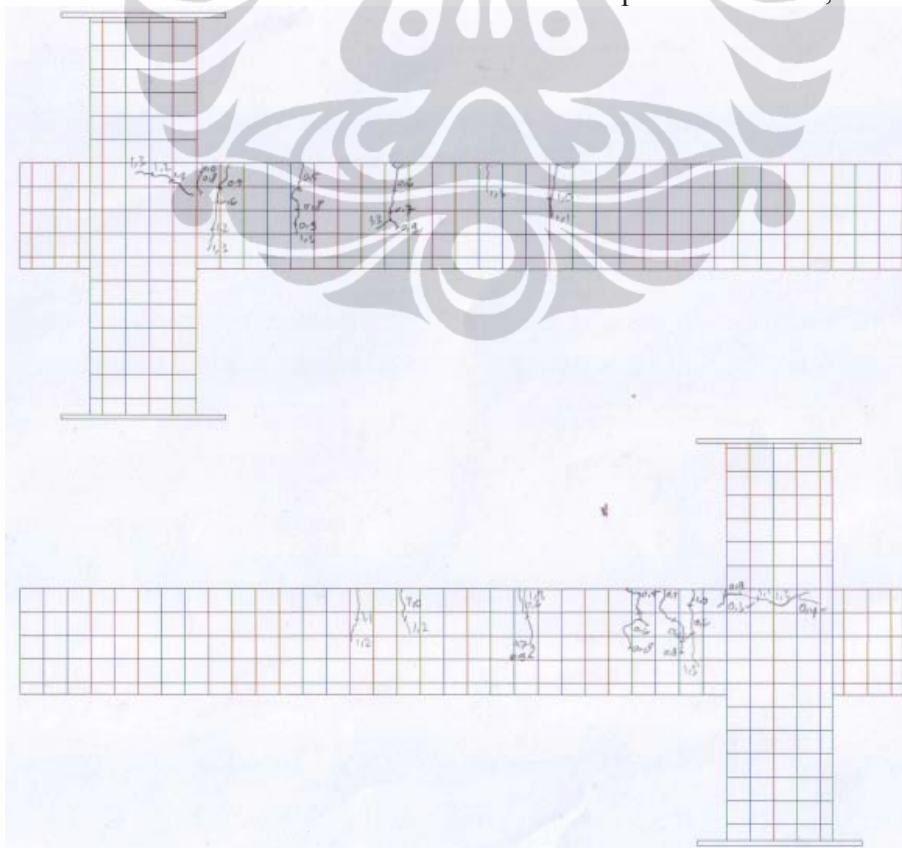
Gambar L168. Pola Retak Model-1.3. Sebelum perkuatan : $P=1,2$ kN



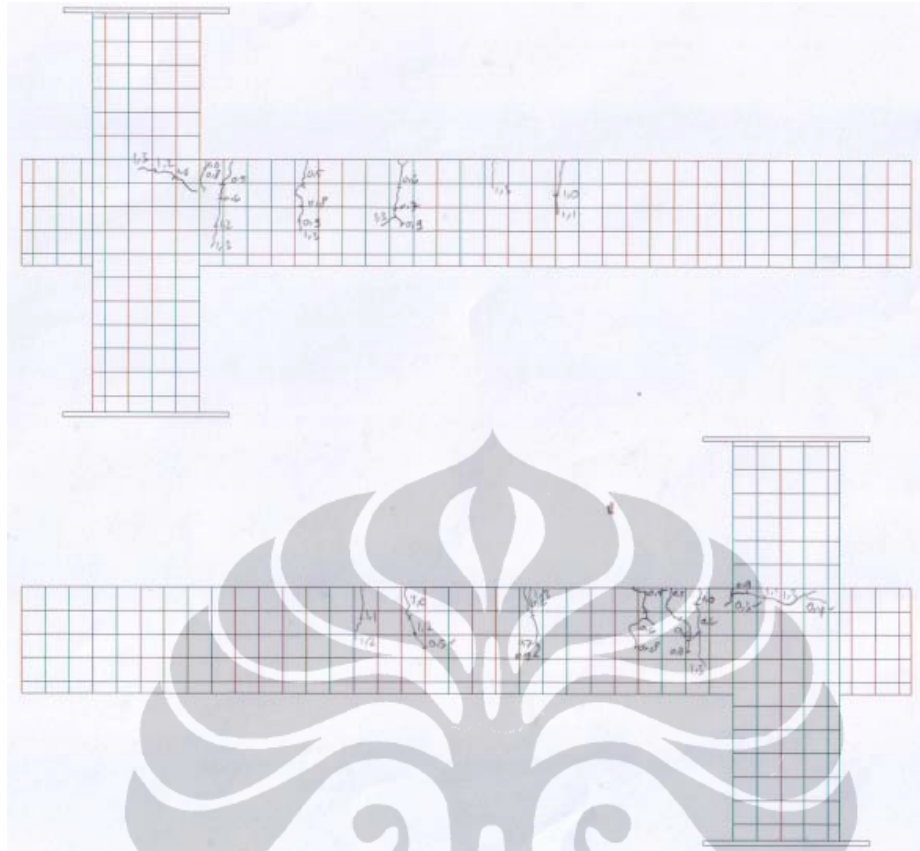
Gambar L169. Pola Retak Model-1.3. Sebelum perkuatan : $P=1,3$ kN



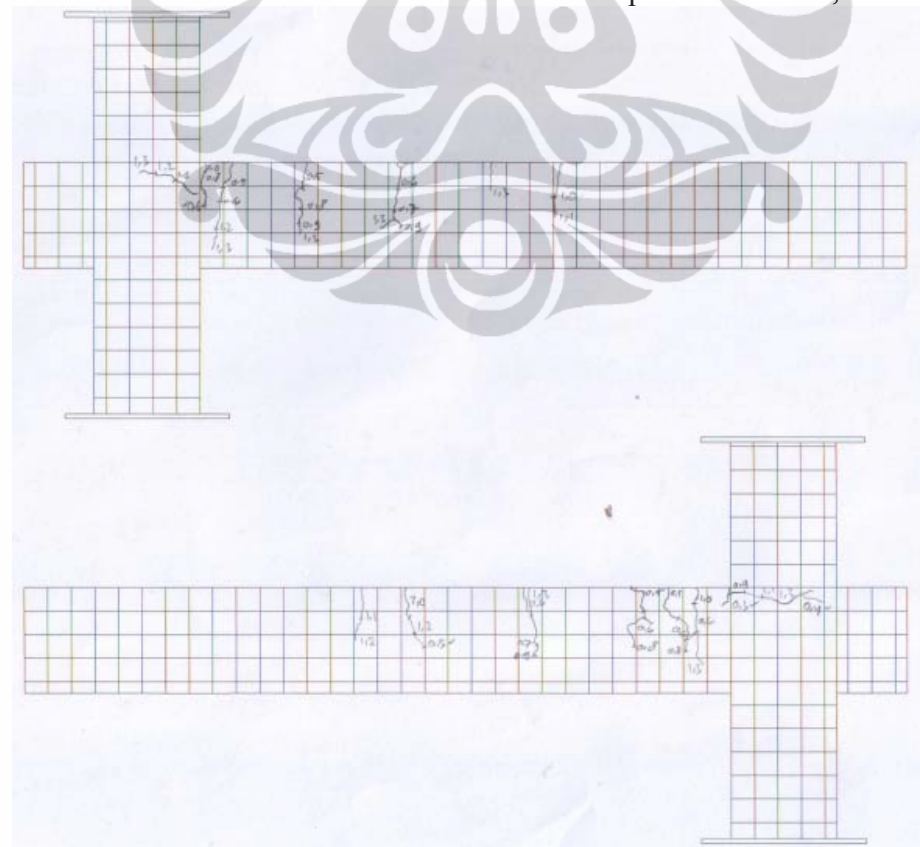
Gambar L170. Pola Retak Model-1.3 Sesudah perkuatan : $P=0,3$ kN



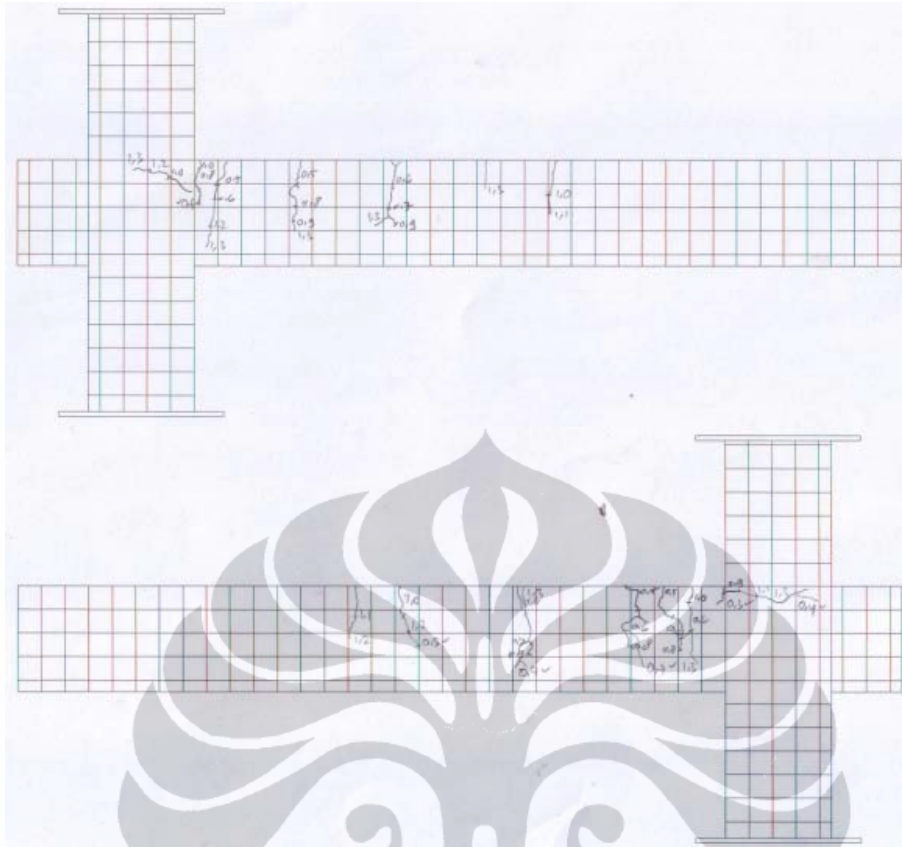
Gambar L171. Pola Retak Model-1.3 Sesudah perkuatan : $P=0,4$ kN



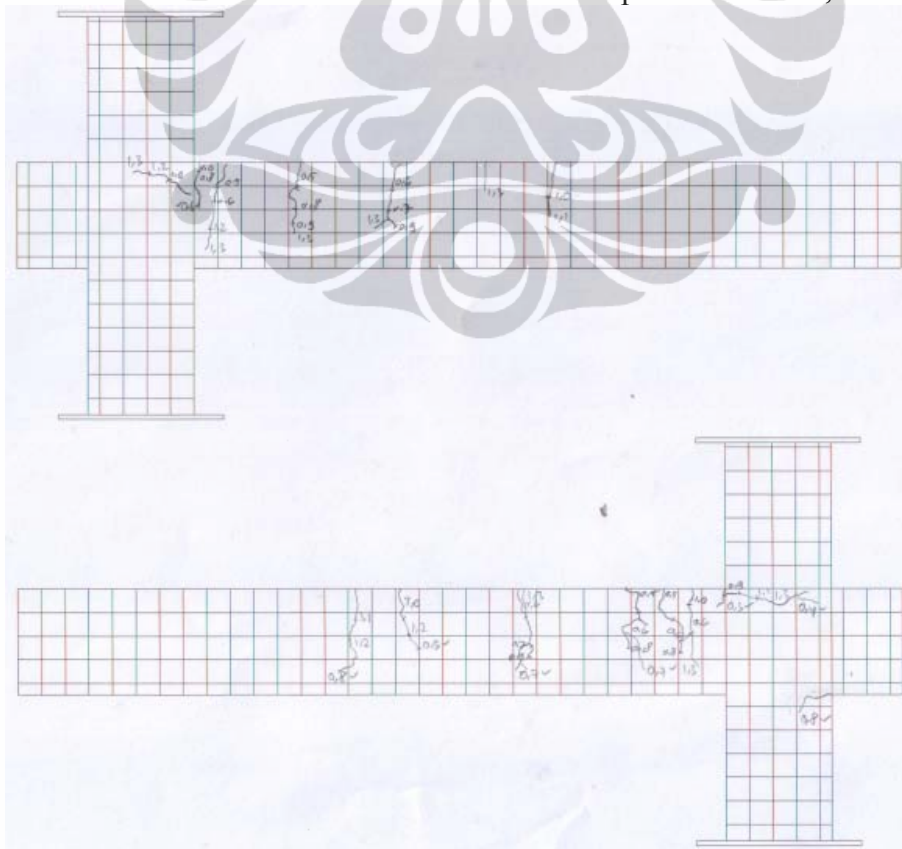
Gambar L172. Pola Retak Model-1.3 Sesudah perkuatan : $P=0,5$ kN



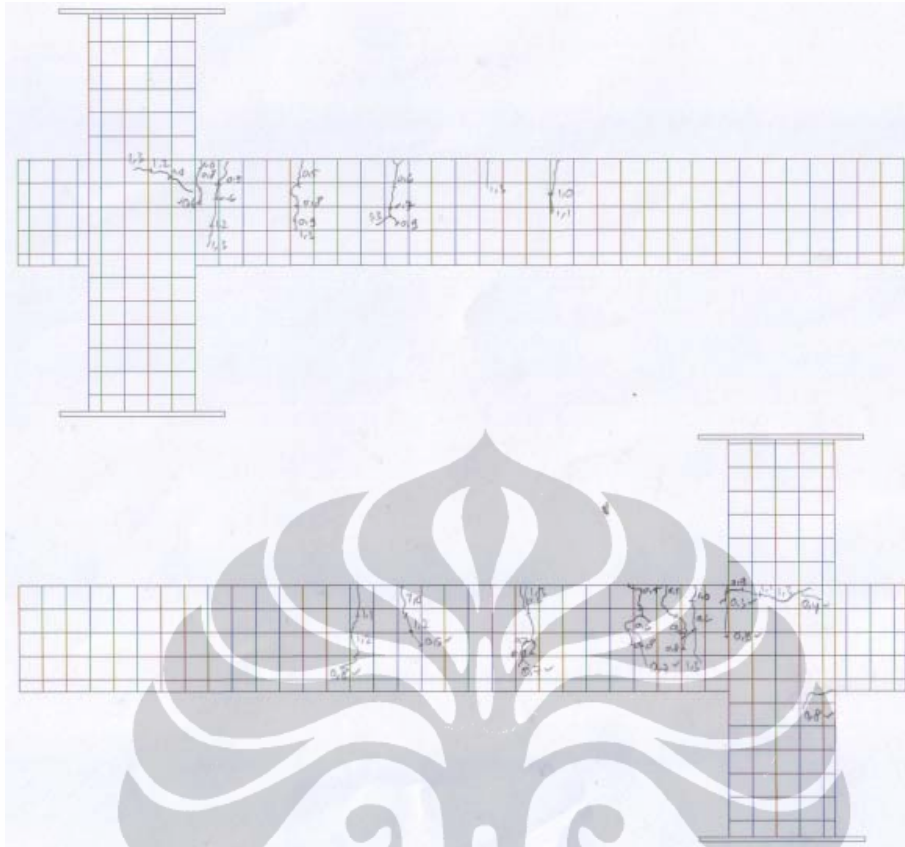
Gambar L173. Pola Retak Model-1.3 Sesudah perkuatan : $P=0,6$ kN



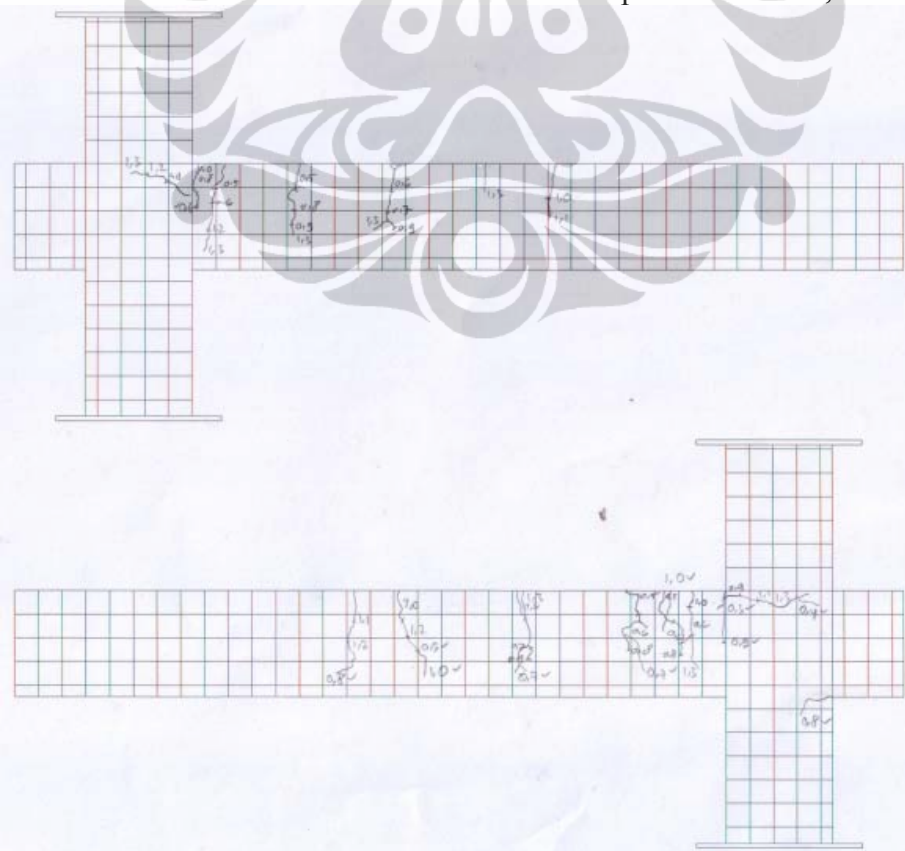
Gambar L174. Pola Retak Model-1.3 Sesudah perkuatan : $P=0,7$ kN



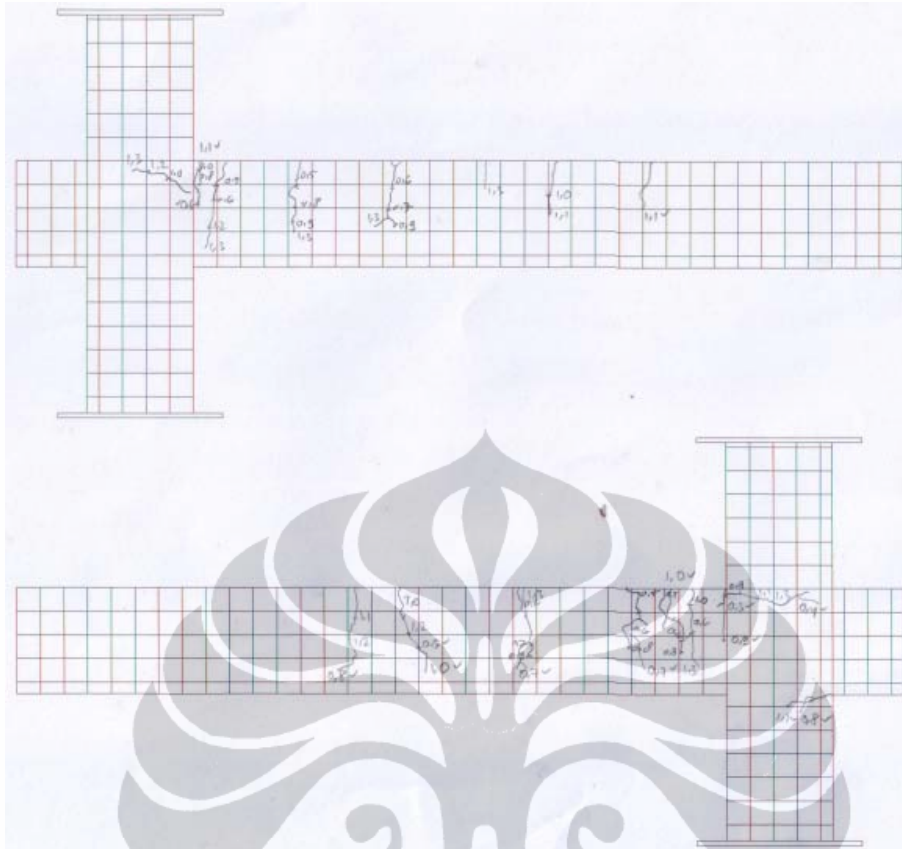
Gambar L175. Pola Retak Model-1.3 Sesudah perkuatan : $P=0,8$ kN



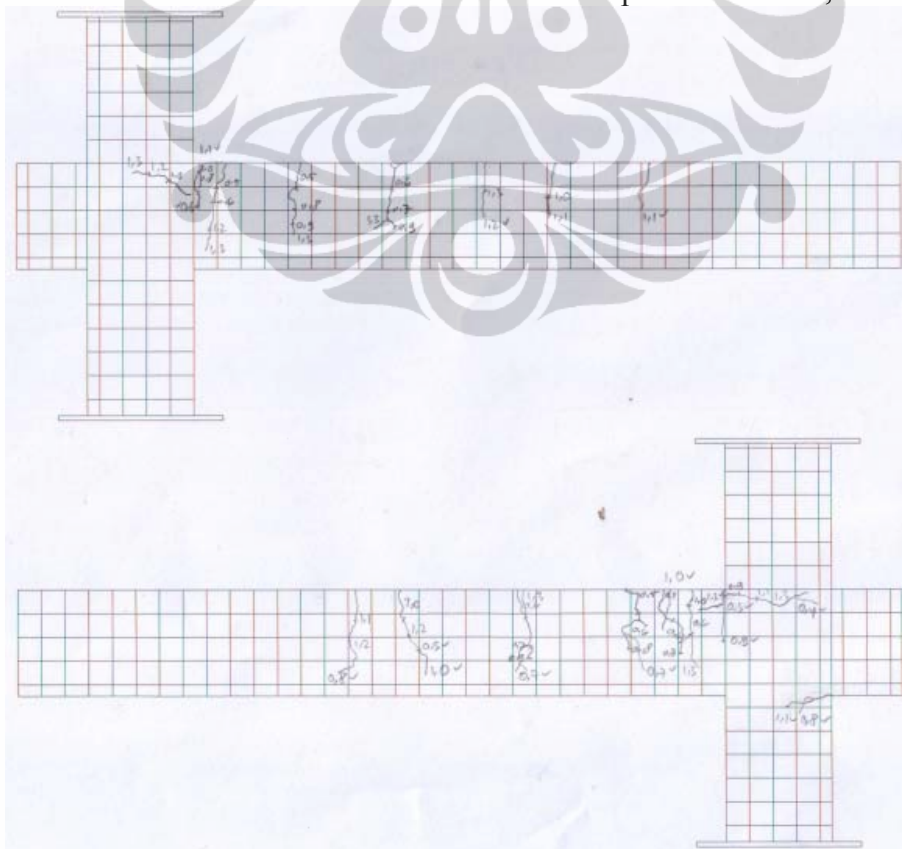
Gambar L176. Pola Retak Model-1.3 Sesudah perkuatan : $P=0,9$ kN



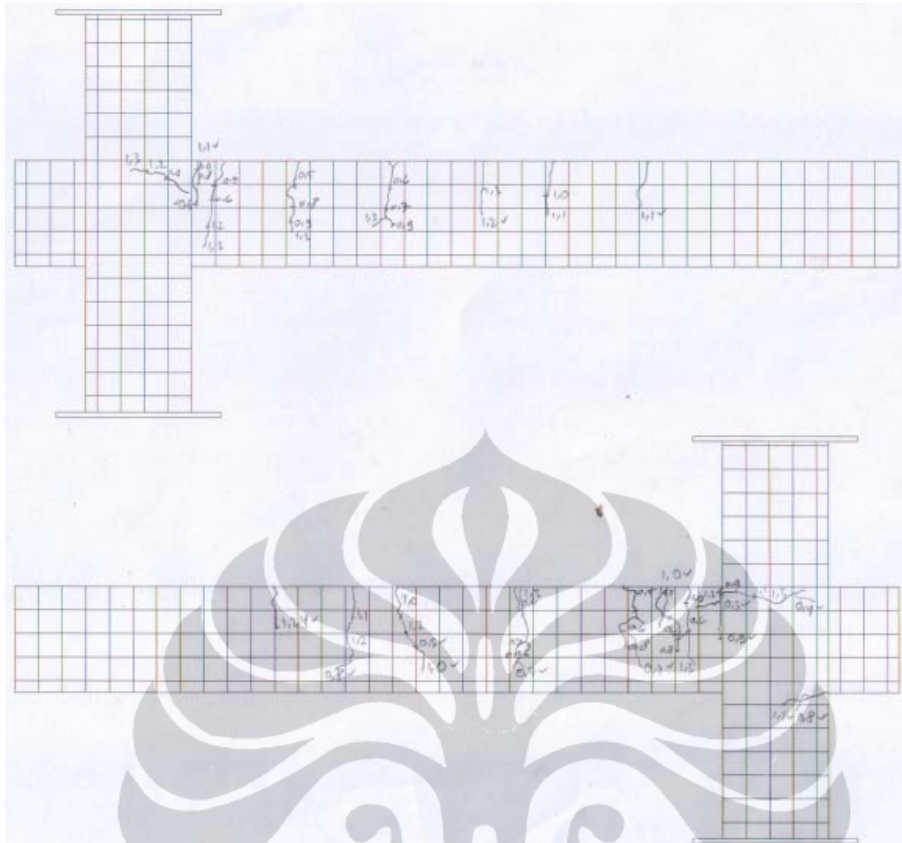
Gambar L177. Pola Retak Model-1.3 Sesudah perkuatan : $P=1,0$ kN



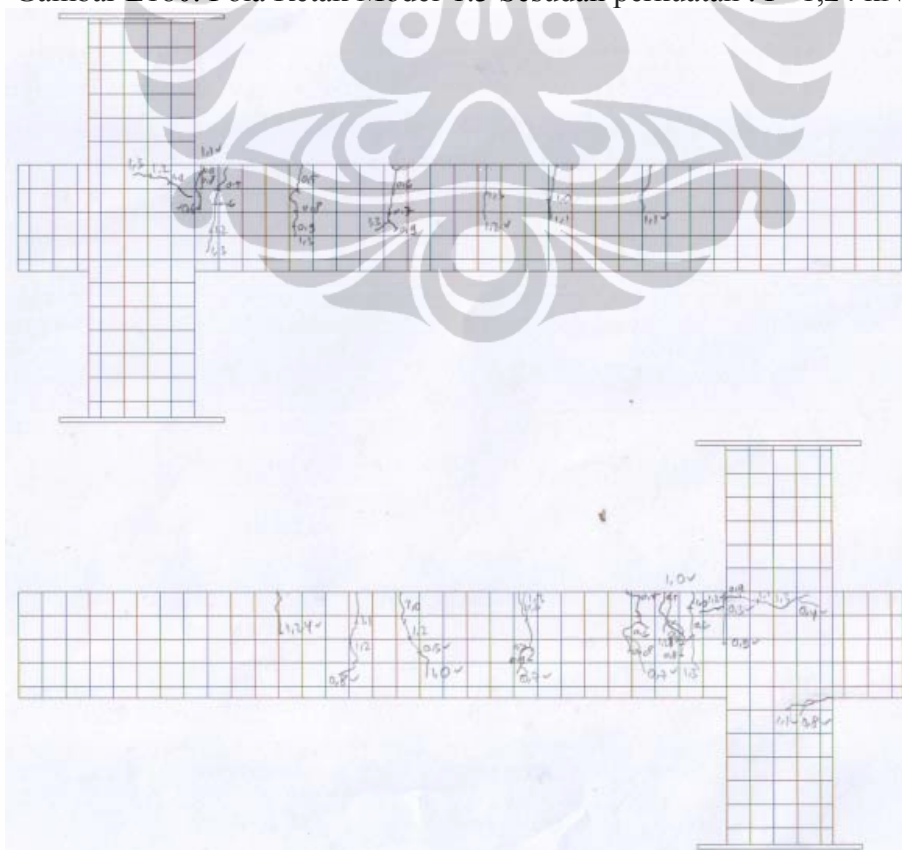
Gambar L178. Pola Retak Model-1.3 Sesudah perkuatan : $P=1,1$ kN



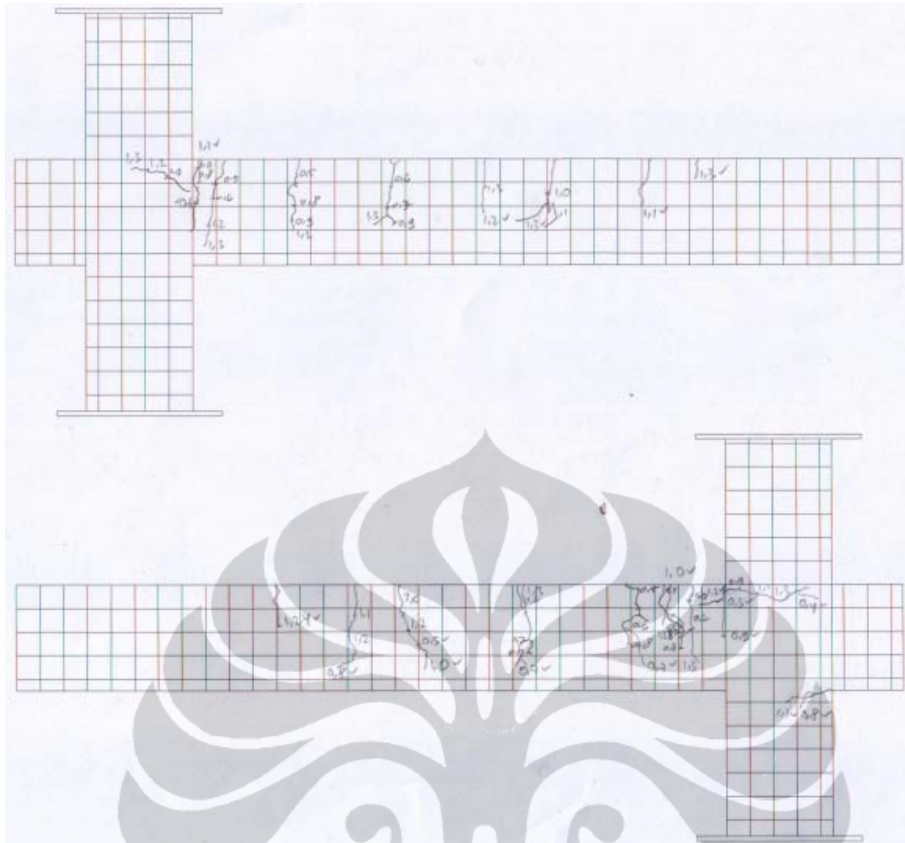
Gambar L179. Pola Retak Model-1.3 Sesudah perkuatan : $P=1,2$ kN



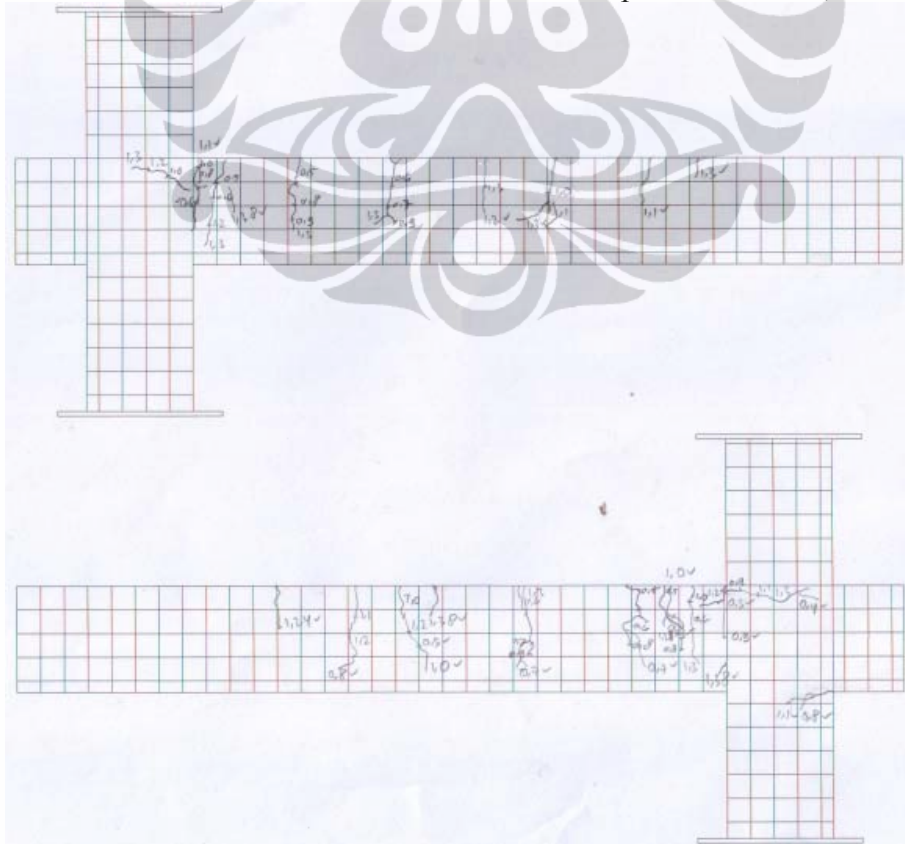
Gambar L180. Pola Retak Model-1.3 Sesudah perkuatan : $P=1,24$ kN



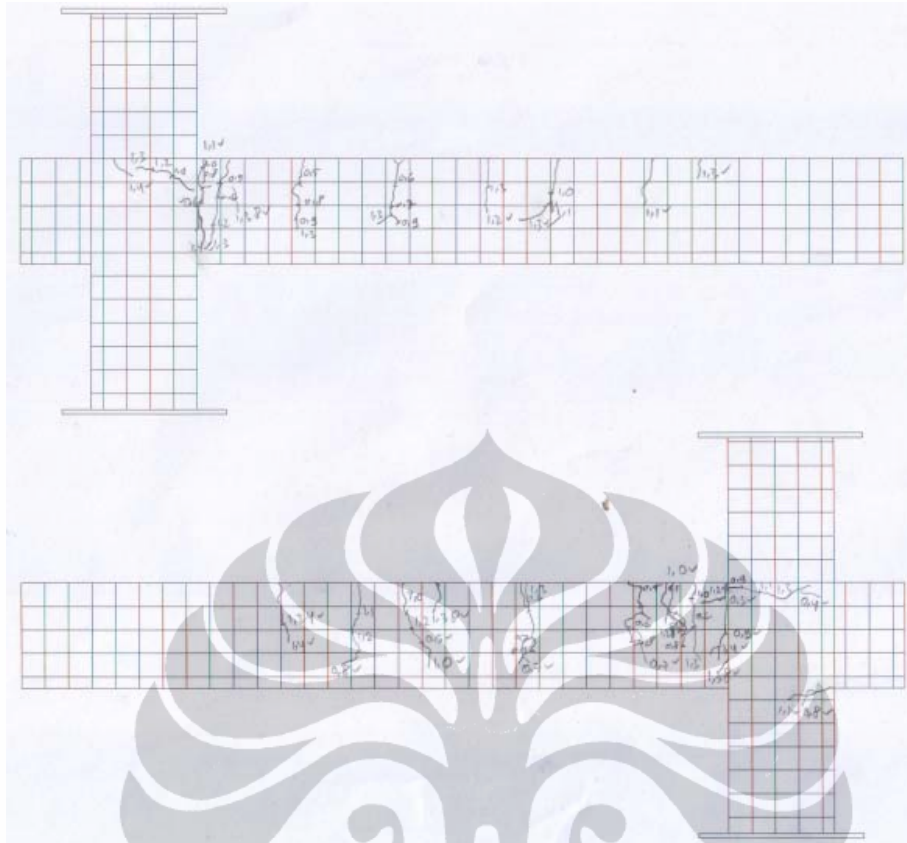
Gambar L181. Pola Retak Model-1.3 Sesudah perkuatan : $P=1,28$ kN



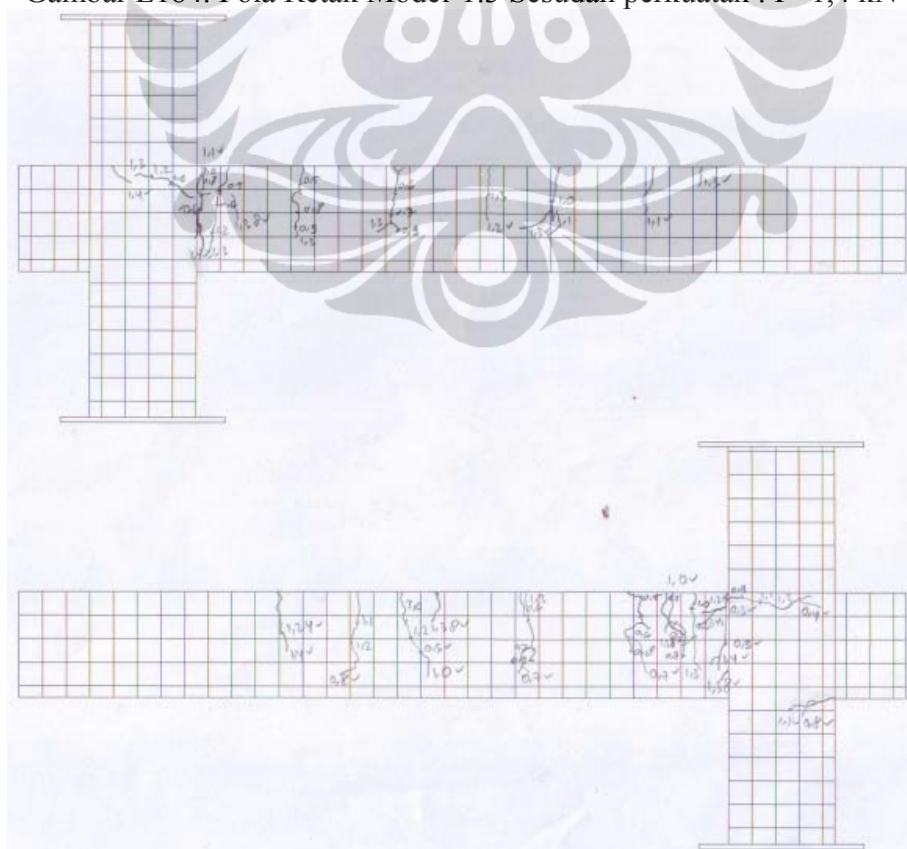
Gambar L182. Pola Retak Model-1.3 Sesudah perkuatan : $P=1,3$ kN



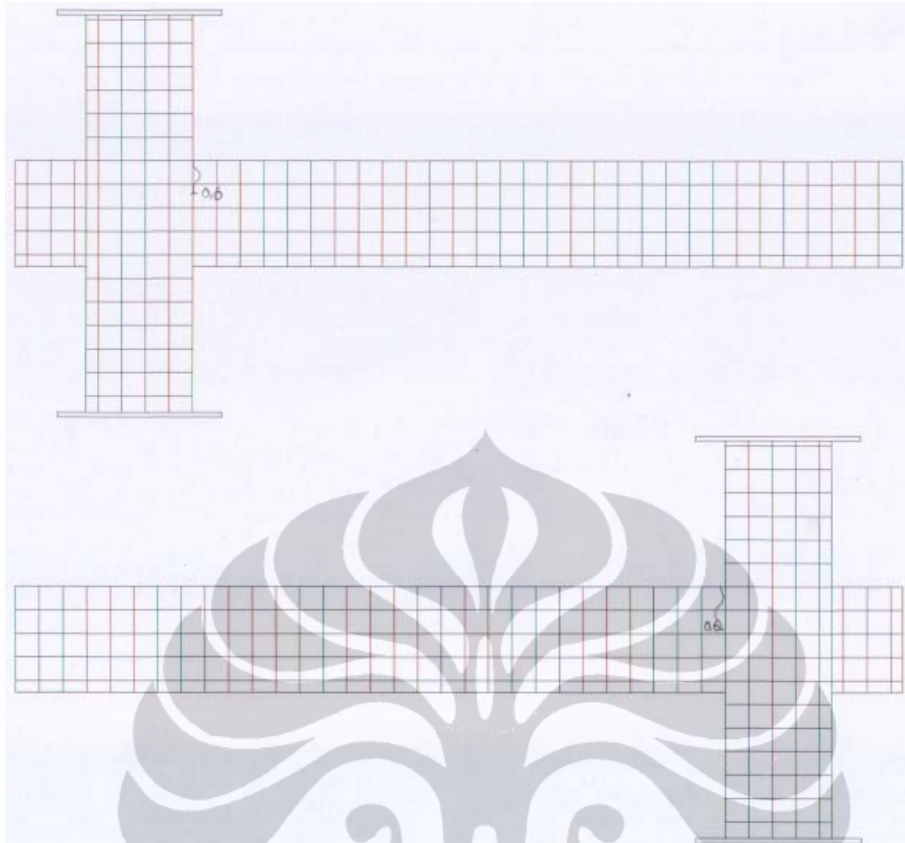
Gambar L183. Pola Retak Model-1.3 Sesudah perkuatan : $P=1,38$ kN



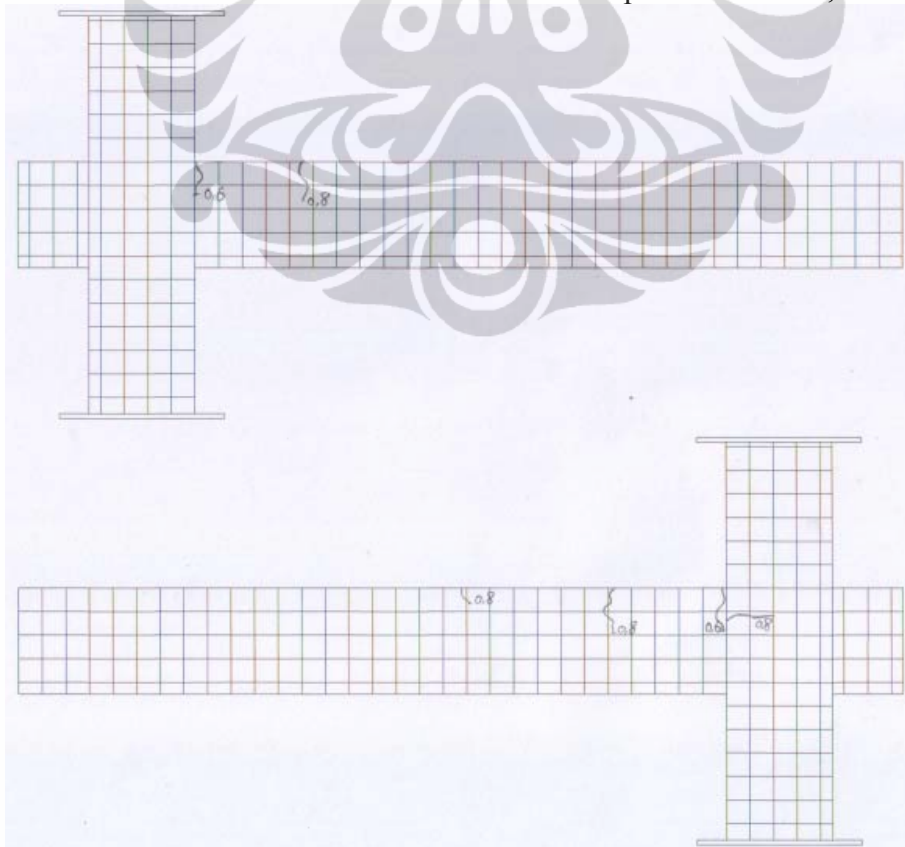
Gambar L184. Pola Retak Model-1.3 Sesudah perkuatan : $P=1,4$ kN



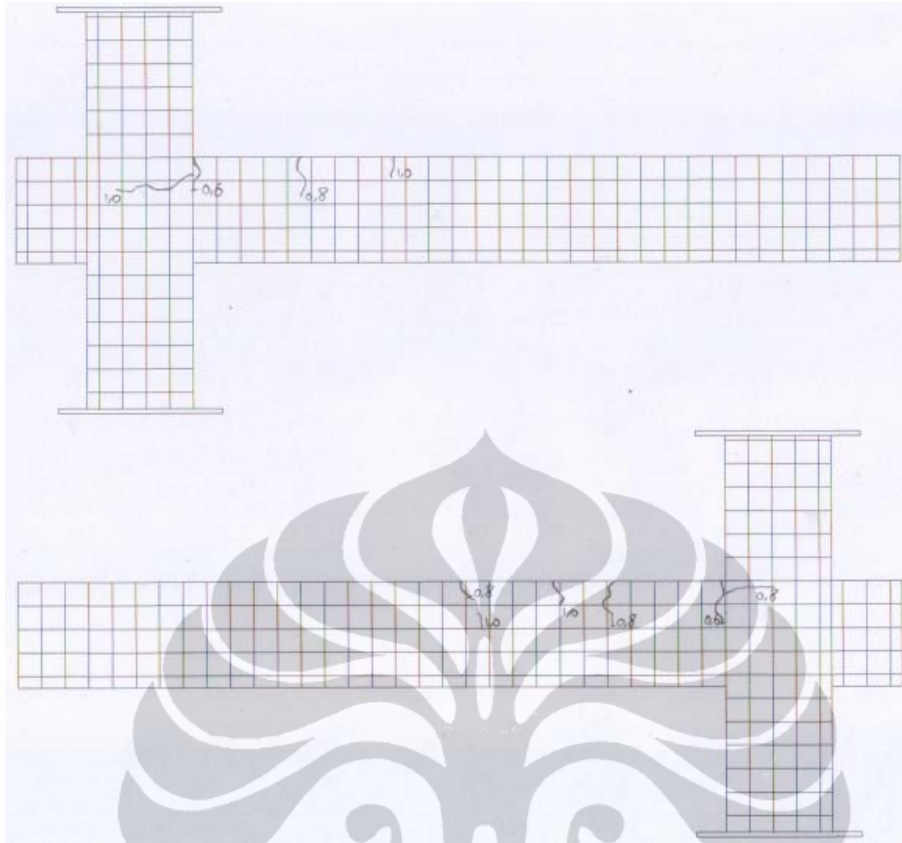
Gambar L185. Pola Retak Model-1.3 Sesudah perkuatan : $P=1,42$ kN



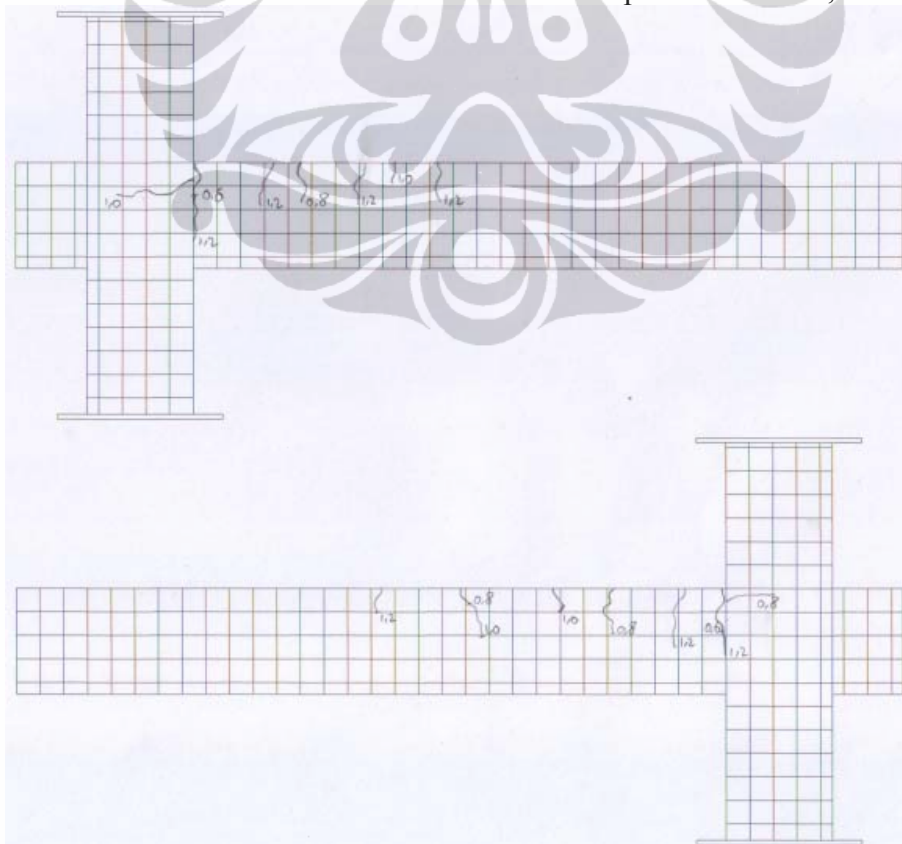
Gambar L186. Pola Retak Model-2.1 Sebelum perkuatan : $P=0,6$ kN



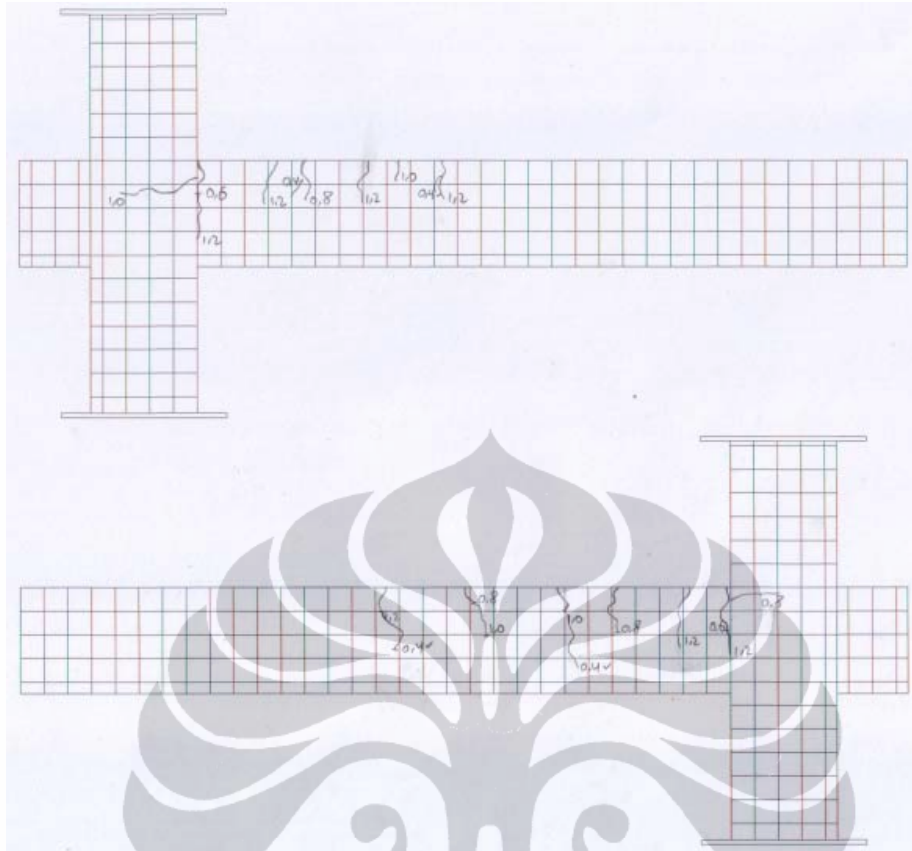
Gambar L187. Pola Retak Model-2.1 Sebelum perkuatan : $P=0,8$ kN



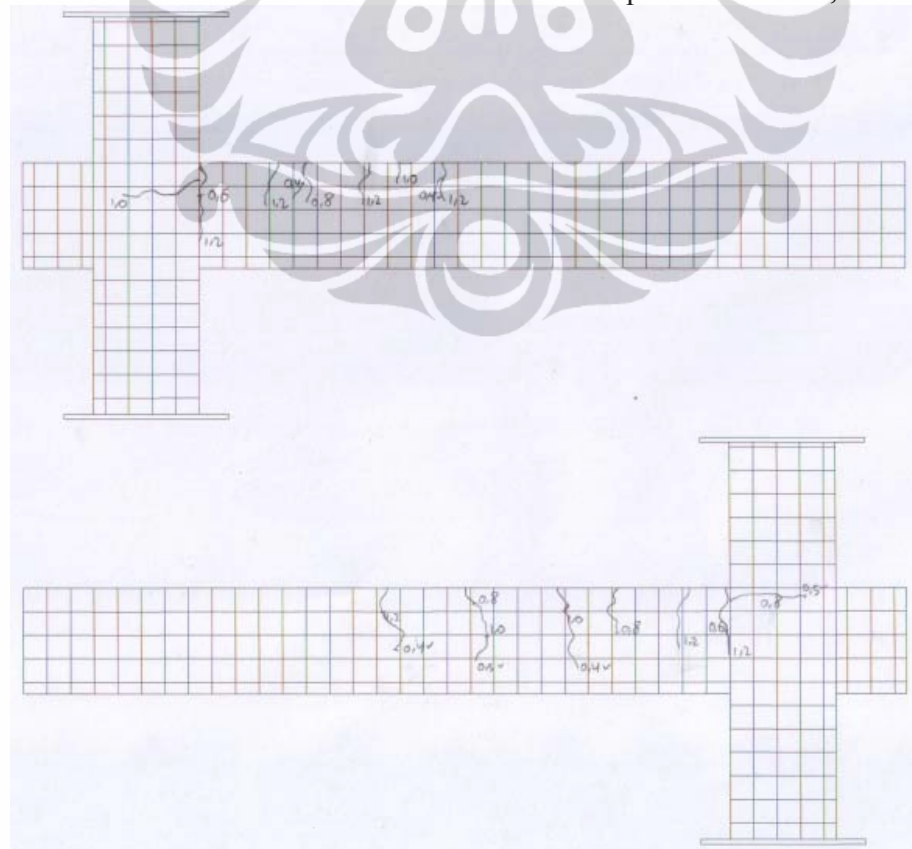
Gambar L188. Pola Retak Model-2.1 Sebelum perkuatan : $P=1,0$ kN



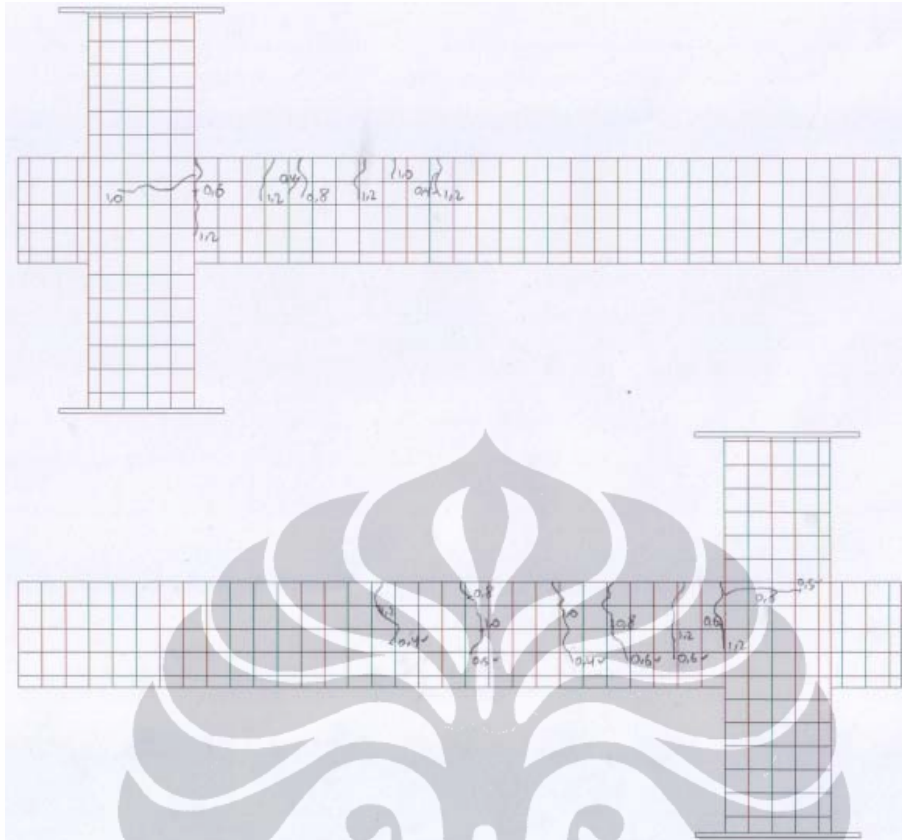
Gambar L189. Pola Retak Model-2.1 Sebelum perkuatan : $P=1,2$ kN



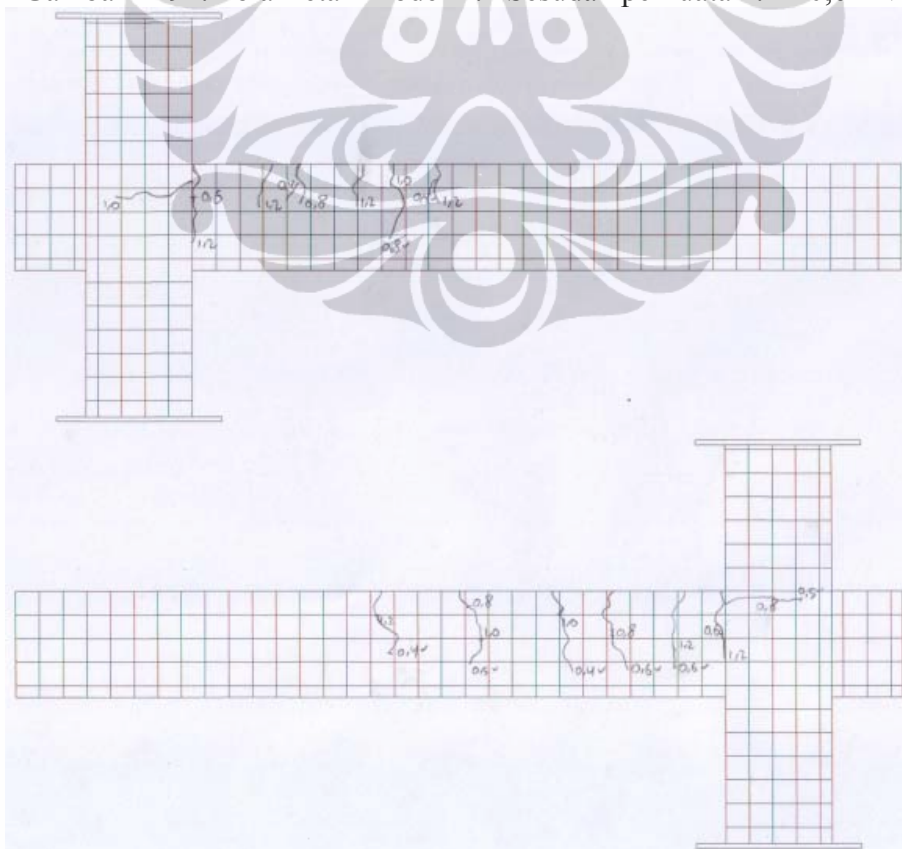
Gambar L190. Pola Retak Model-2.1 Sesudah perkuatan : $P=0,4$ kN



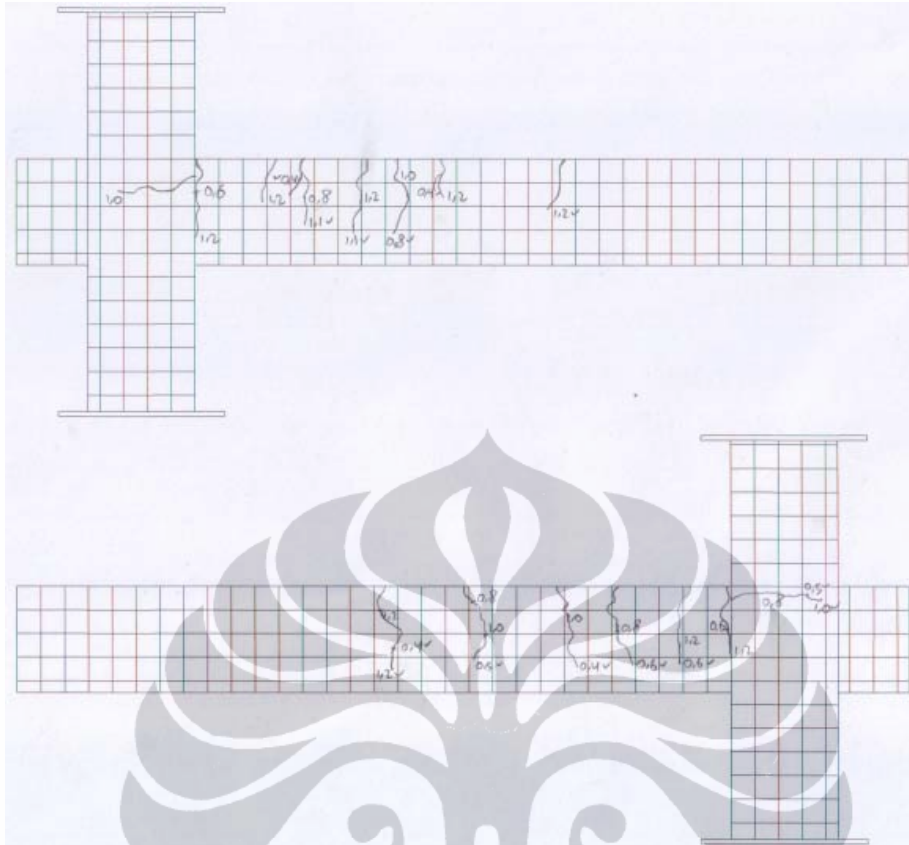
Gambar L191. Pola Retak Model-2.1 Sesudah perkuatan : $P=0,5$ kN



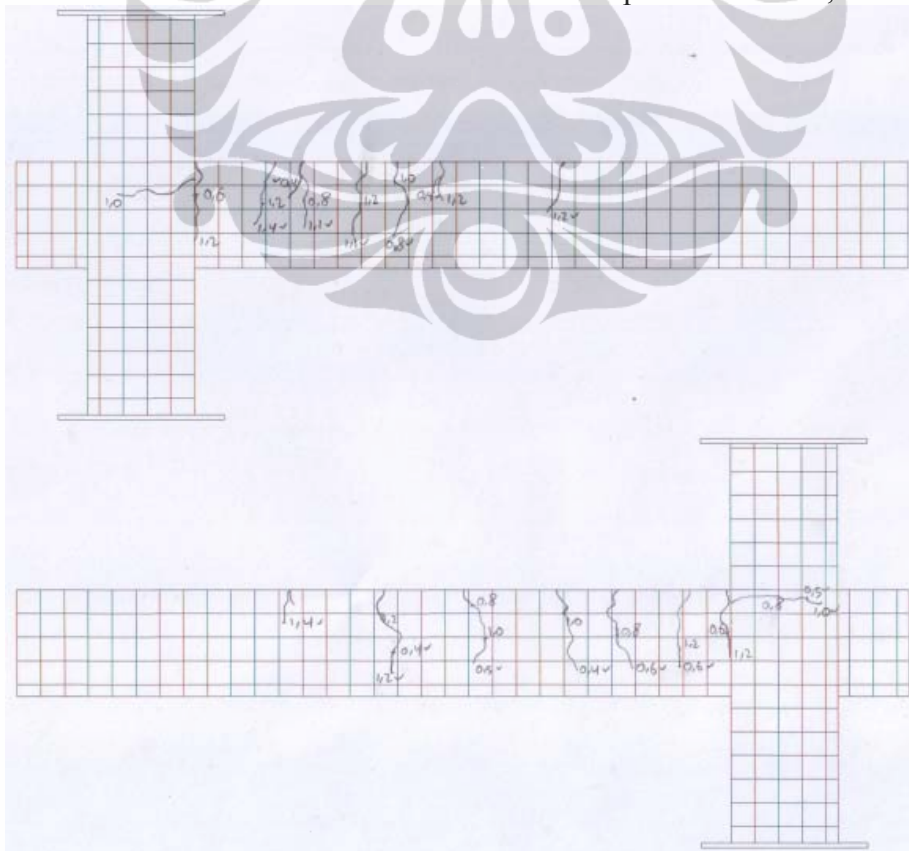
Gambar L192. Pola Retak Model-2.1 Sesudah perkuatan : $P=0,6$ kN



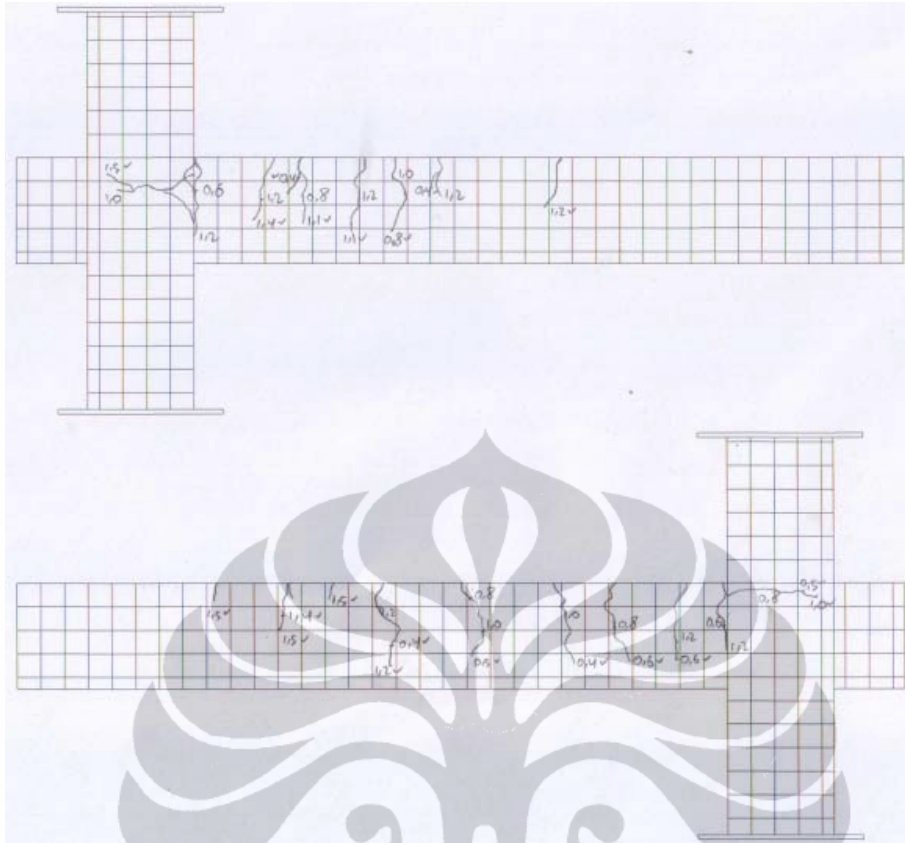
Gambar L193. Pola Retak Model-2.1 Sesudah perkuatan : $P=0,8$ kN



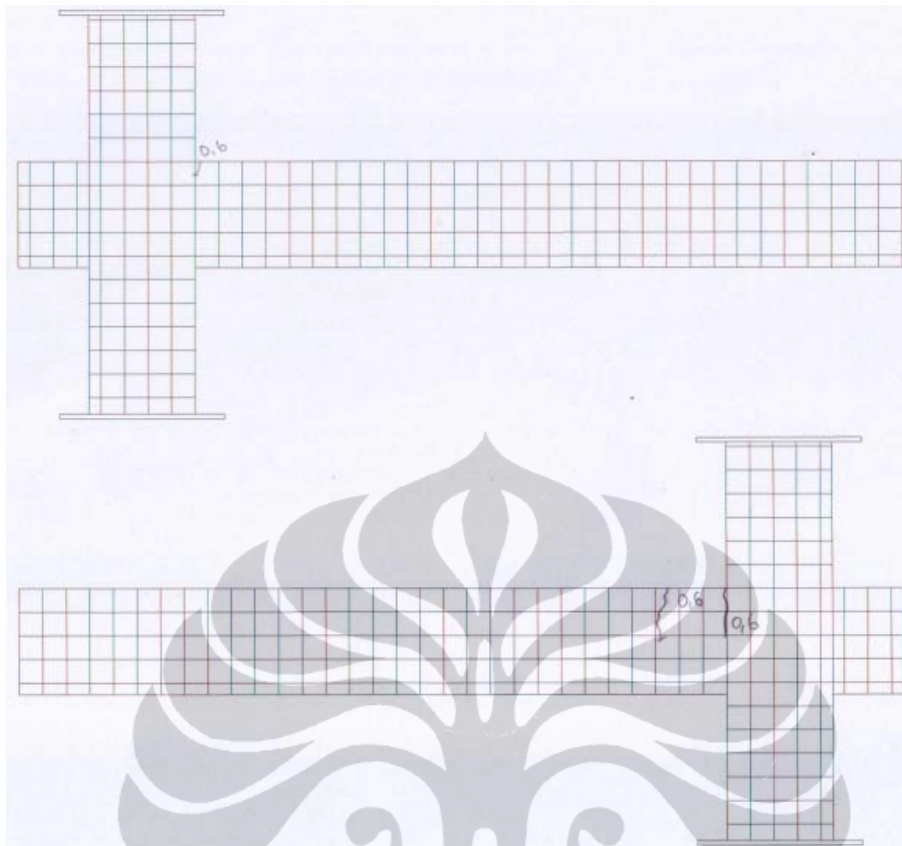
Gambar L196. Pola Retak Model-2.1 Sesudah perkuatan : $P=1,2$ kN



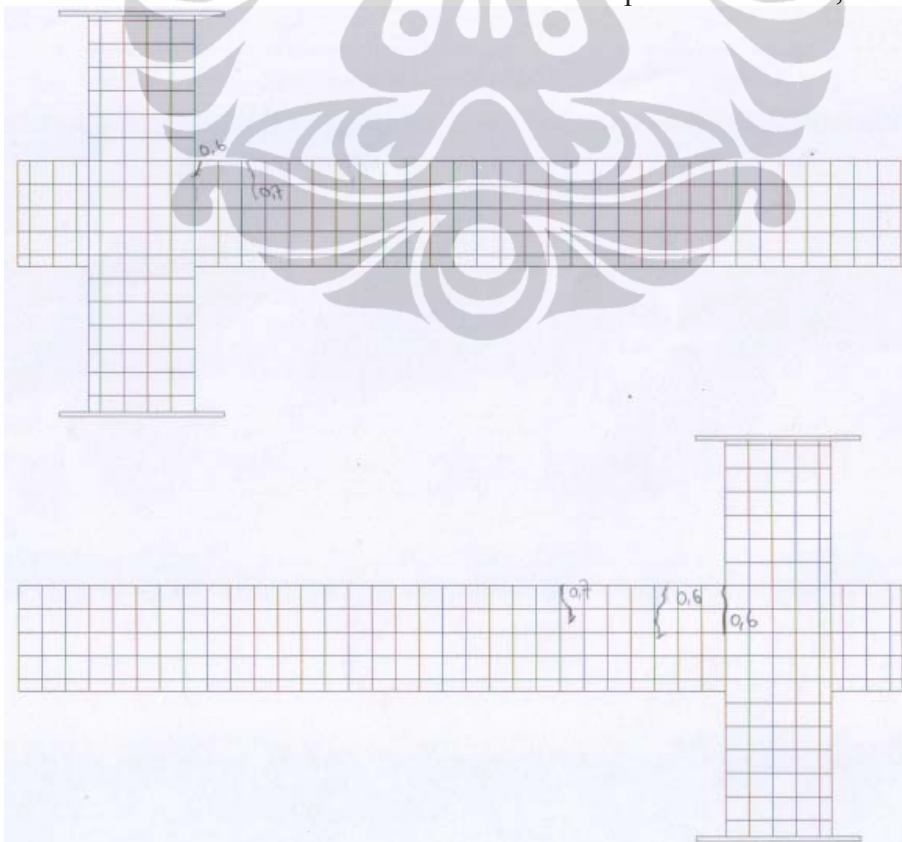
Gambar L197. Pola Retak Model-2.1 Sesudah perkuatan : $P=1,4$ kN



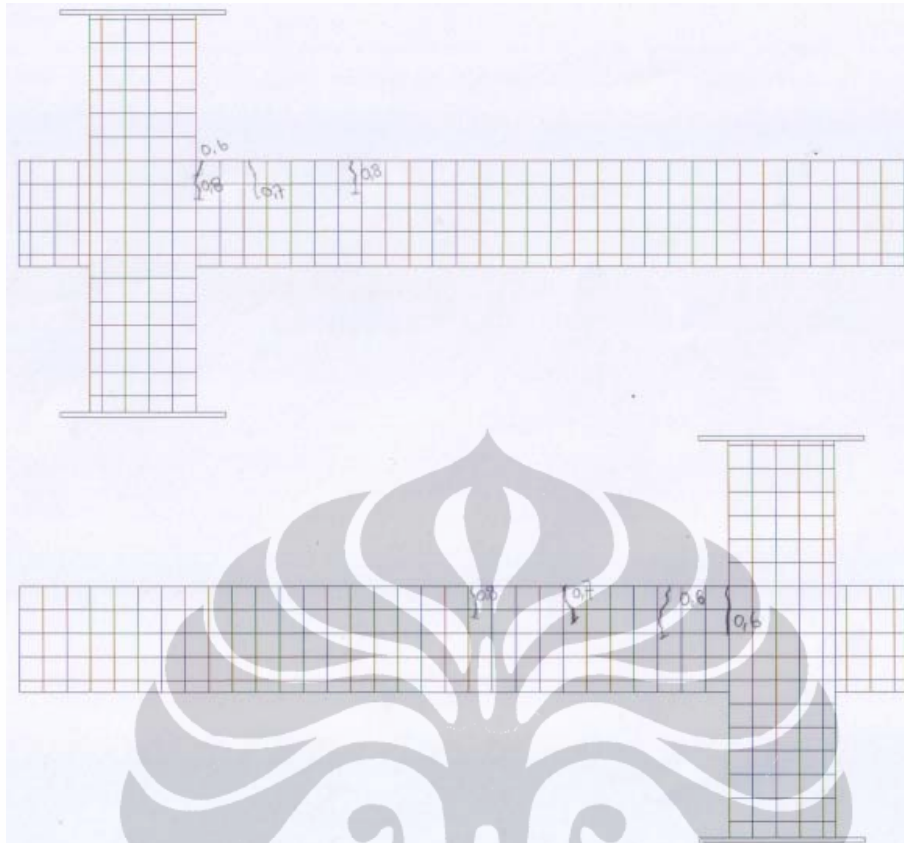
Gambar L198. Pola Retak Model-2.1 Sesudah perkuatan : $P=1,5$ kN



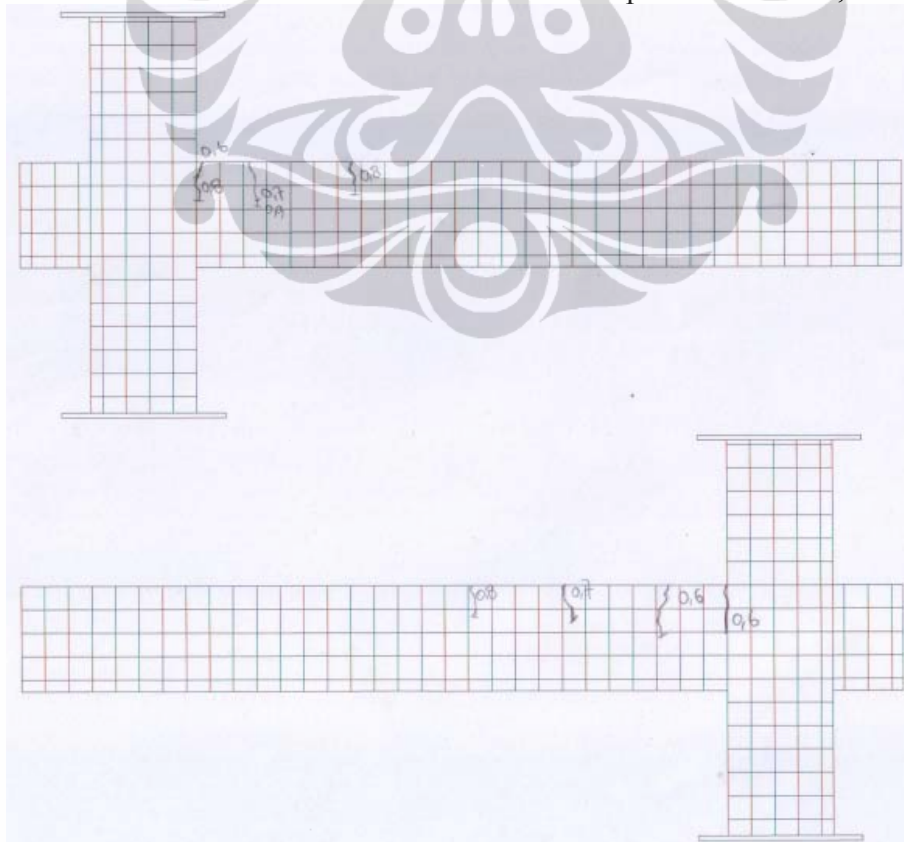
Gambar L199. Pola Retak Model-2.2. Sebelum perkuatan : $P= 0,6 \text{ kN}$



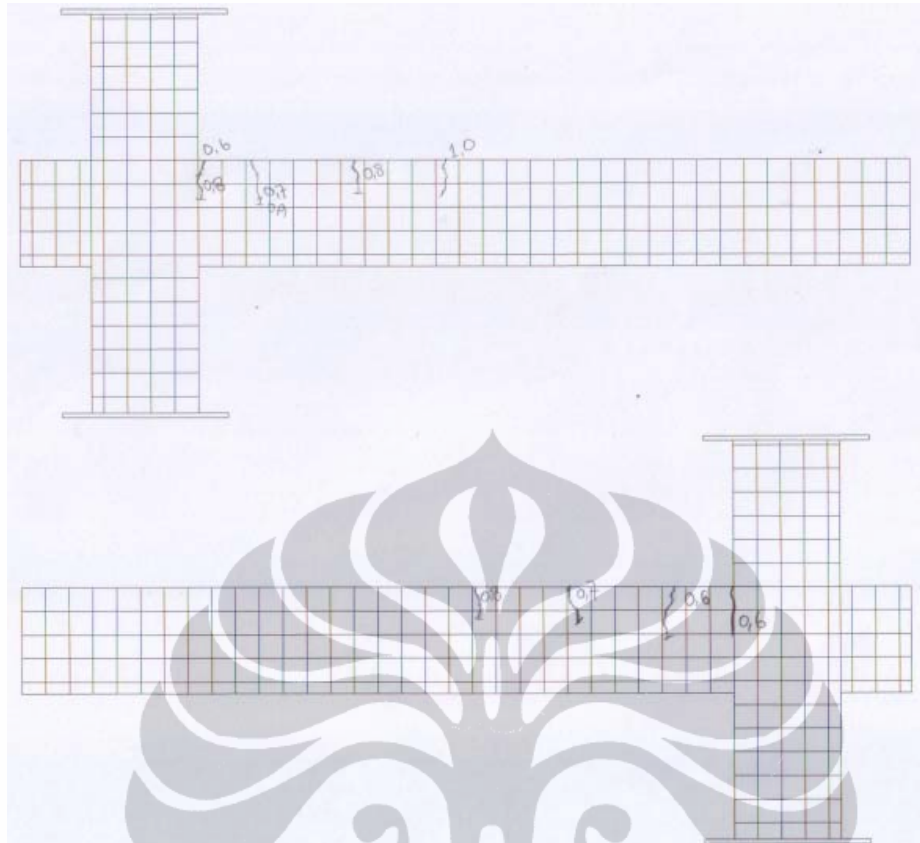
Gambar L200. Pola Retak Model-2.2. Sebelum perkuatan : $P= 0,7 \text{ kN}$



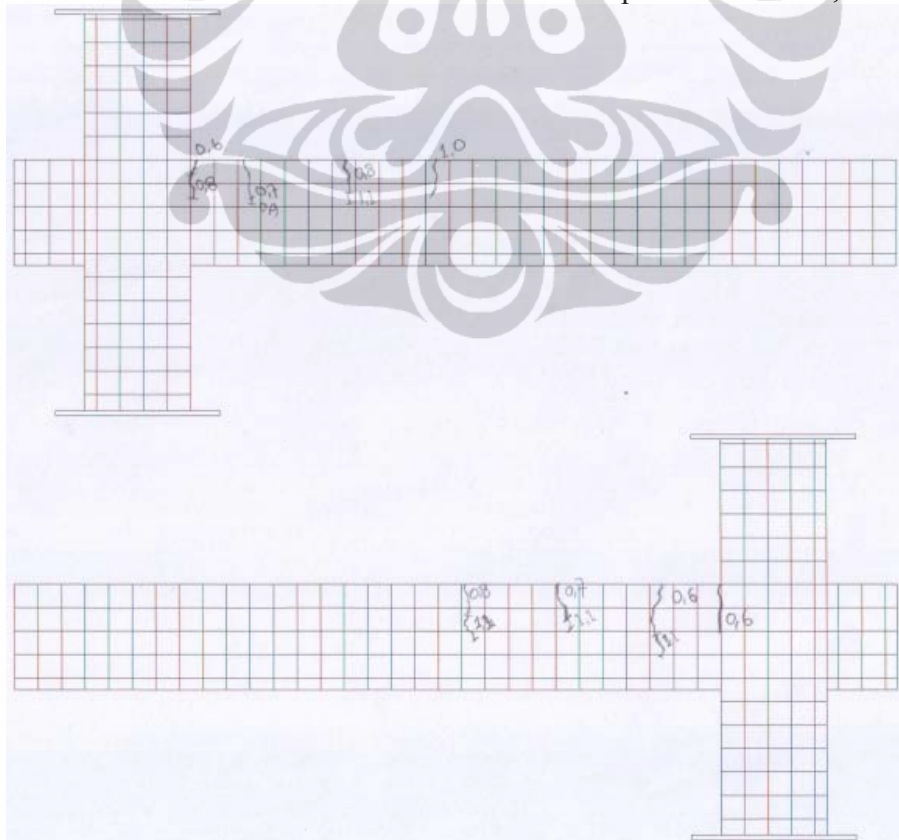
Gambar L201. Pola Retak Model-2.2. Sebelum perkuatan : $P= 0,8 \text{ kN}$



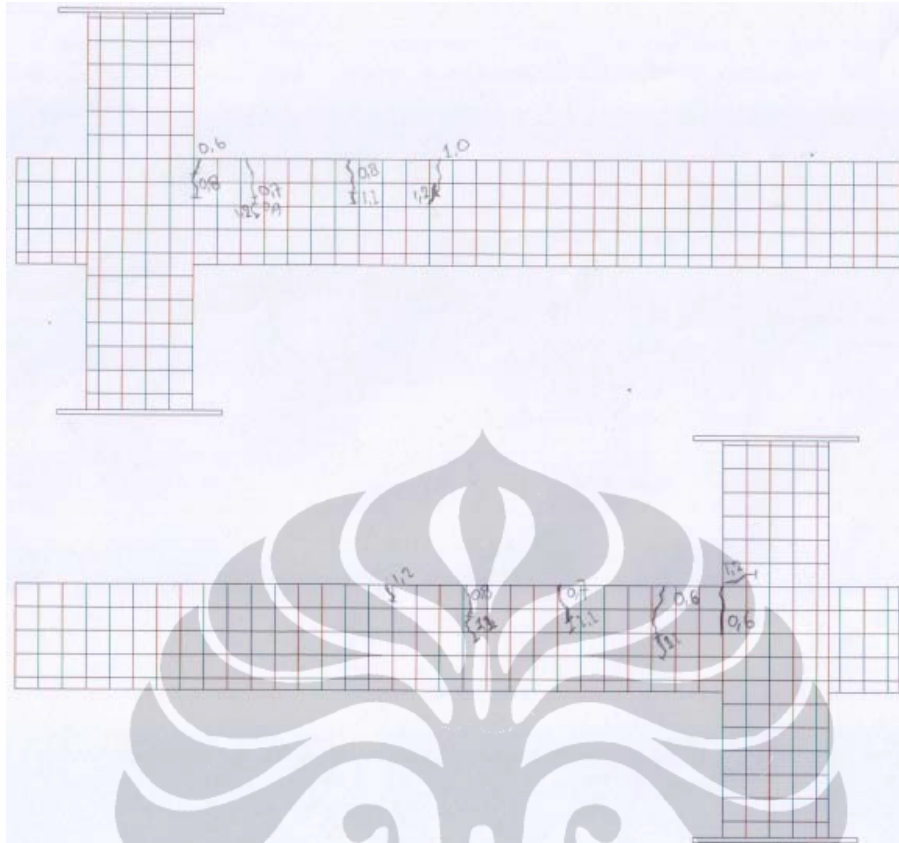
Gambar L202. Pola Retak Model-2.2. Sebelum perkuatan : $P= 0,9 \text{ kN}$



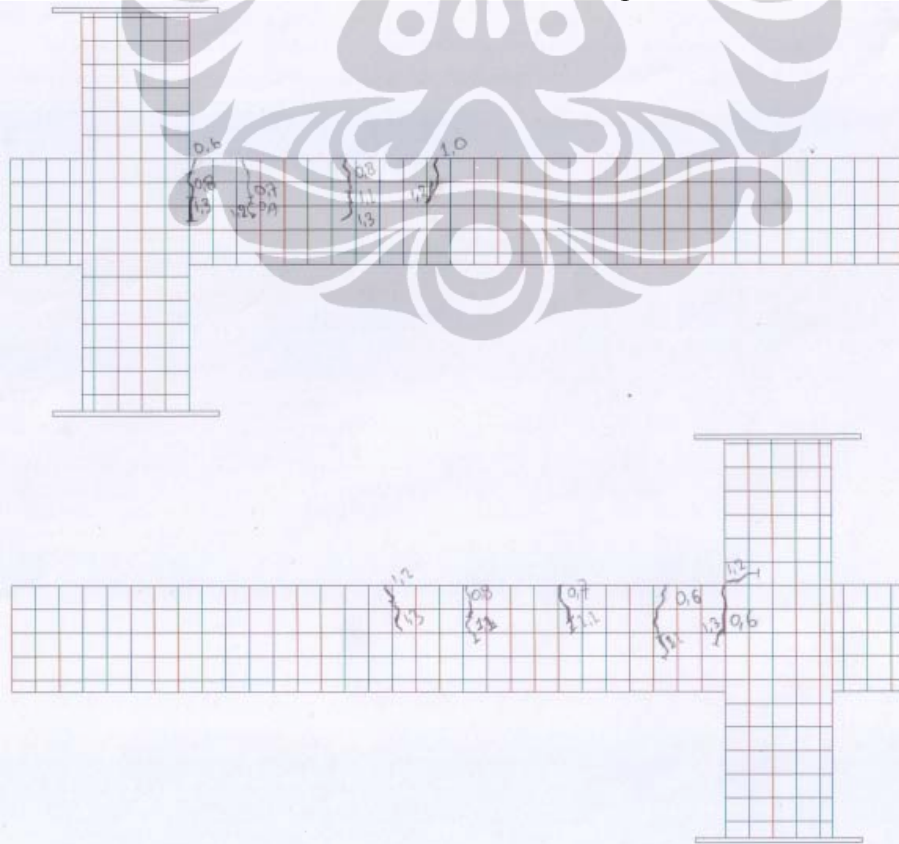
Gambar L203. Pola Retak Model-2.2. Sebelum perkuatan : $P= 1,0$ kN



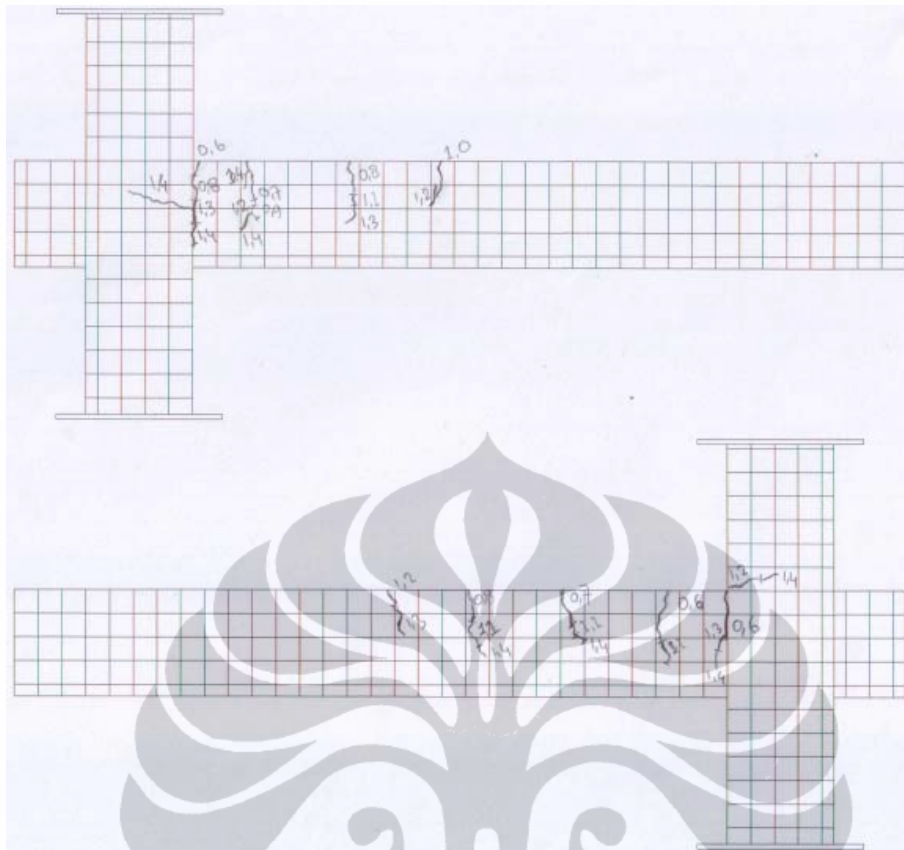
Gambar L204. Pola Retak Model-2.2. Sebelum perkuatan : $P= 1,1$ kN



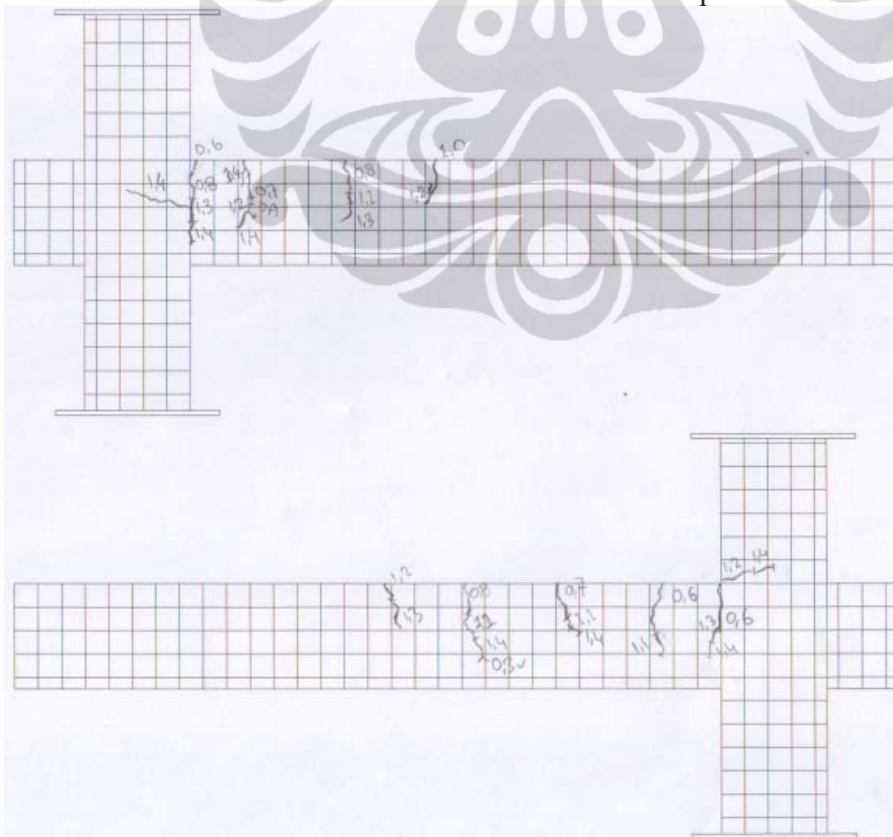
Gambar L205. Pola Retak Model-2.2. Sebelum perkuatan : $P= 1,2 \text{ kN}$



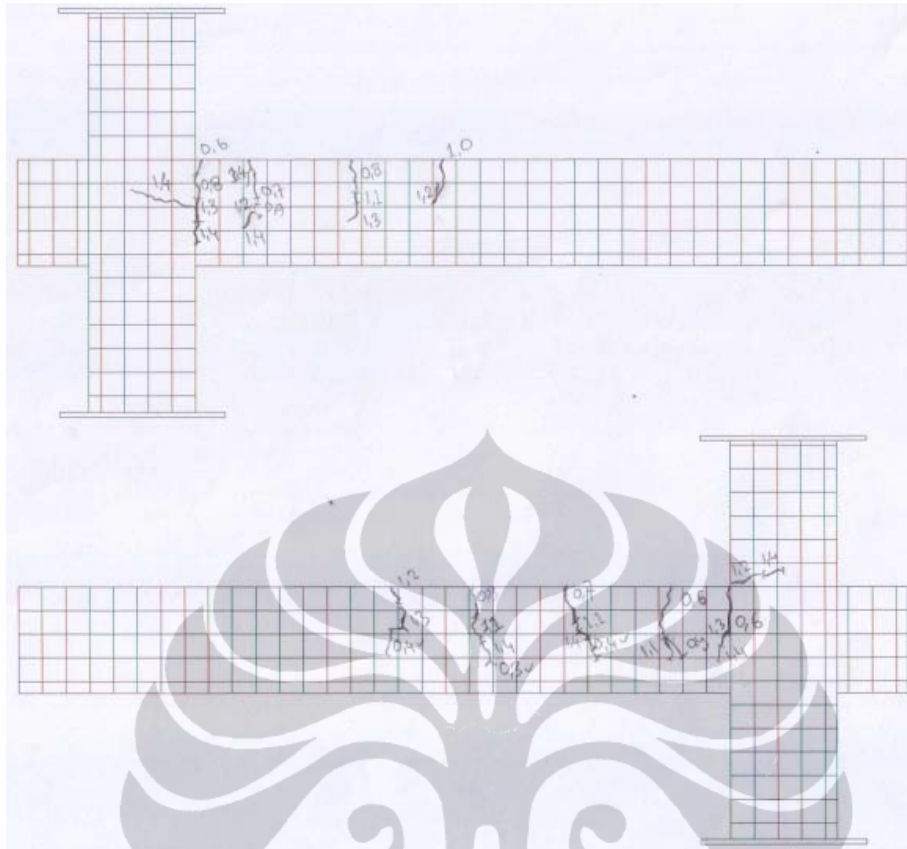
Gambar L206. Pola Retak Model-2.2. Sebelum perkuatan : $P= 1,3 \text{ kN}$



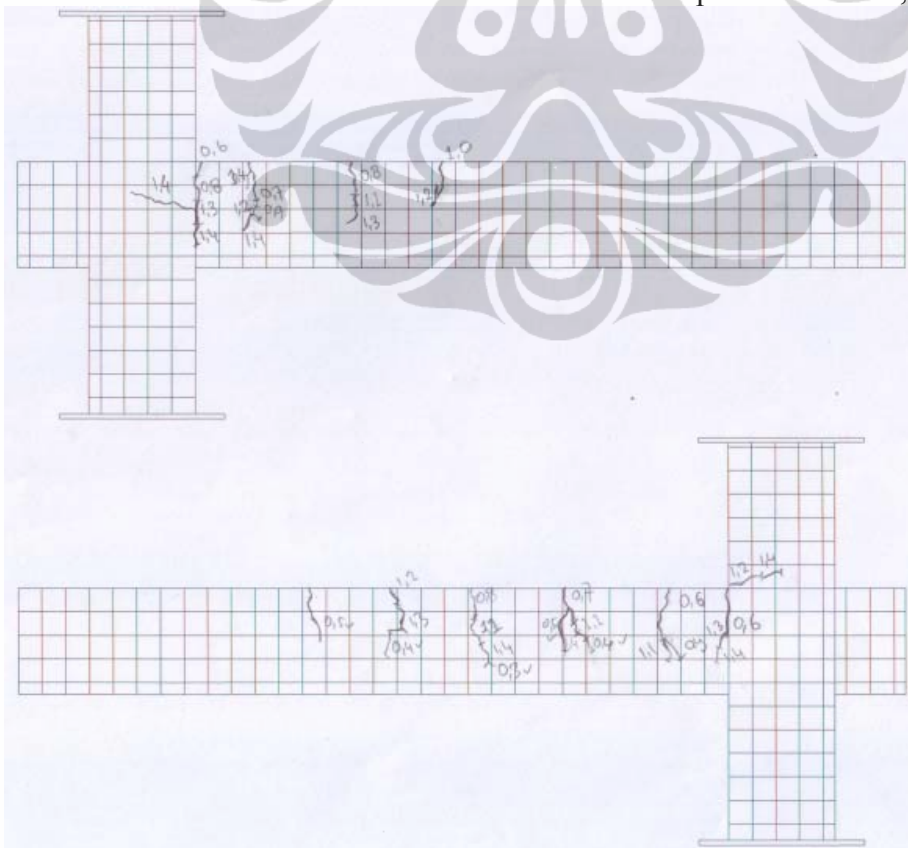
Gambar L207. Pola Retak Model-2.2. Sebelum perkuatan : $P=1,4$ kN



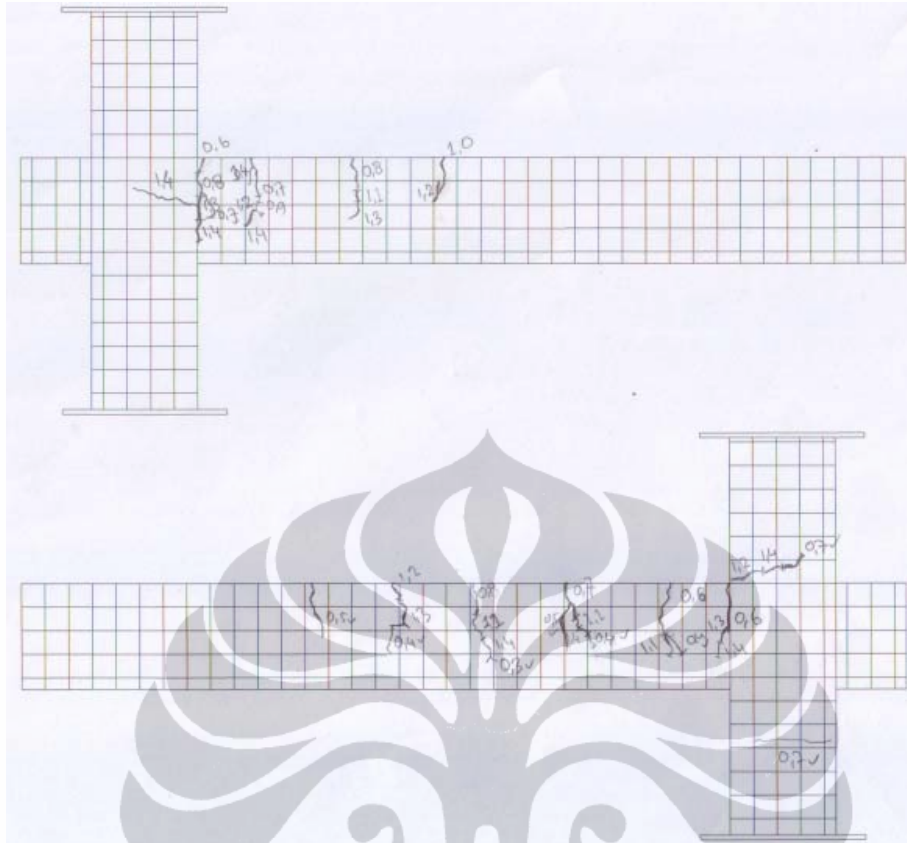
Gambar L208. Pola Retak Model-2.2 Sesudah perkuatan : $P=0,3$ kN



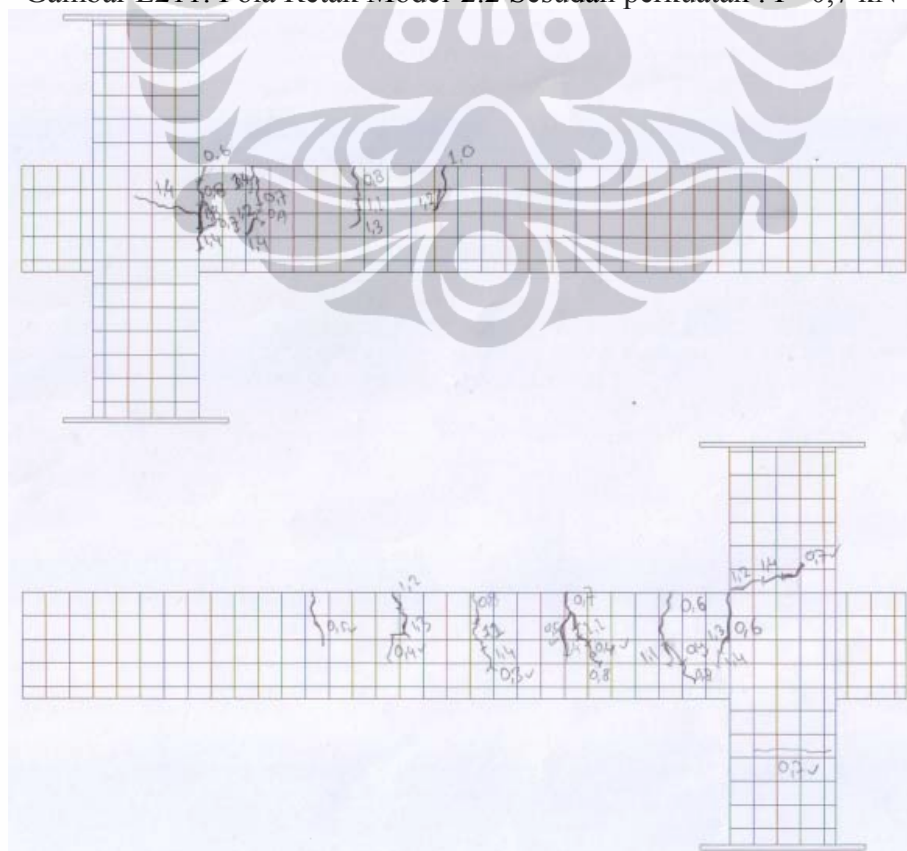
Gambar L209. Pola Retak Model-2.2 Sesudah perkuatan : $P=0,4$ kN



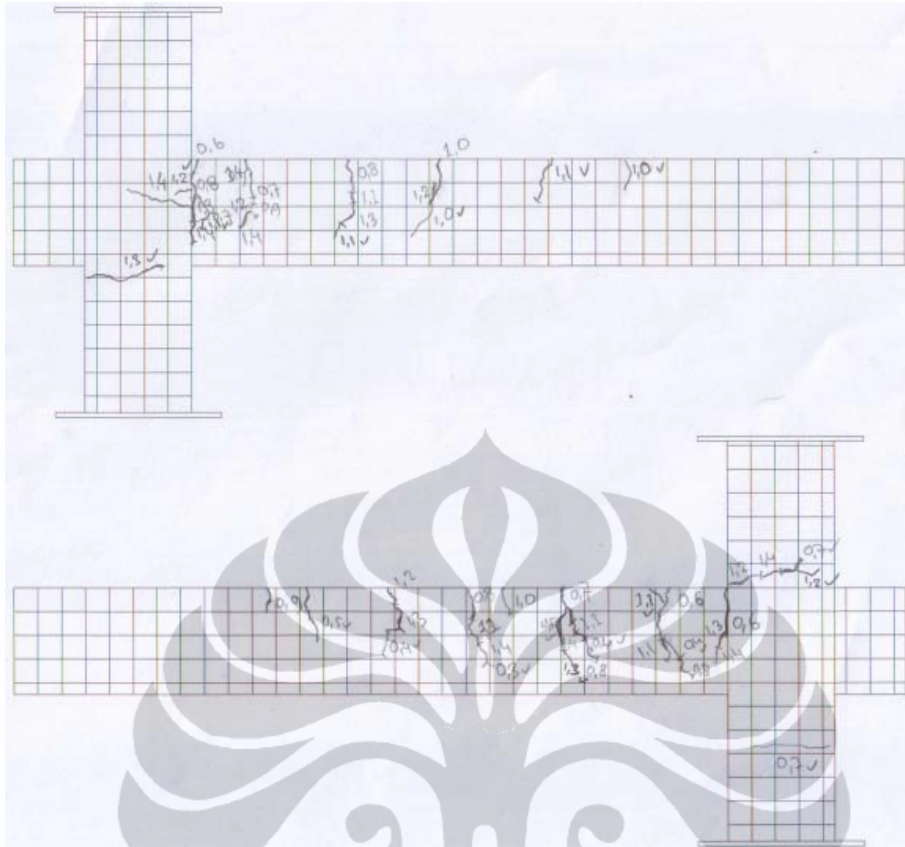
Gambar L210. Pola Retak Model-2.2 Sesudah perkuatan : $P=0,5$ kN



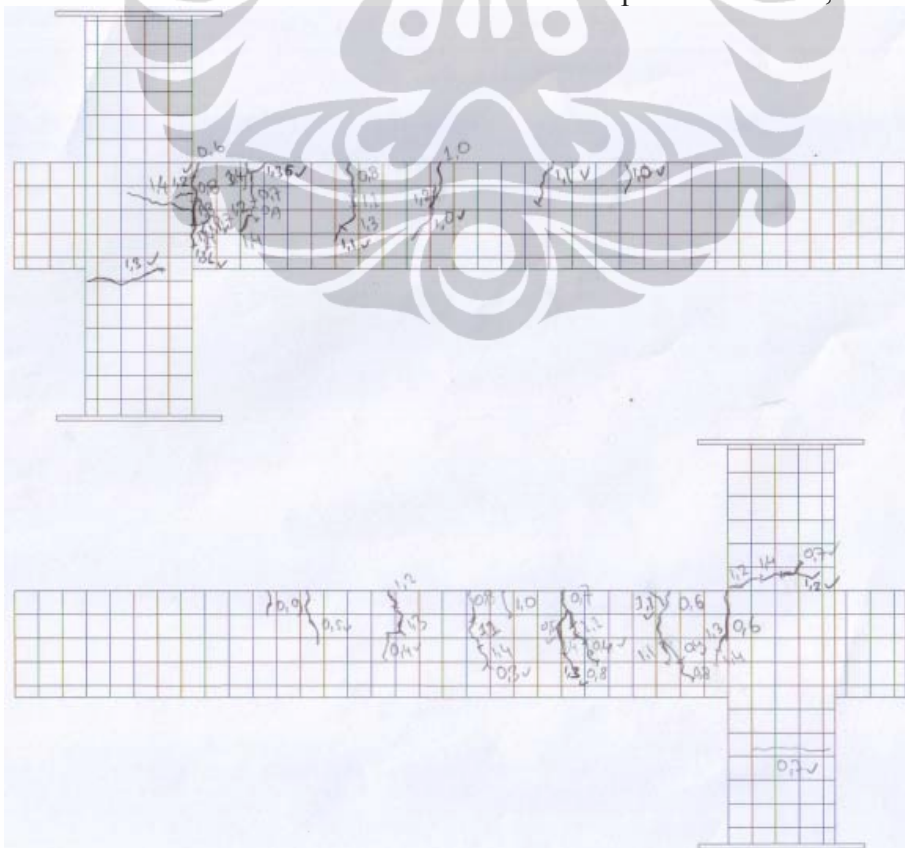
Gambar L211. Pola Retak Model-2.2 Sesudah perkuatan : $P=0,7$ kN



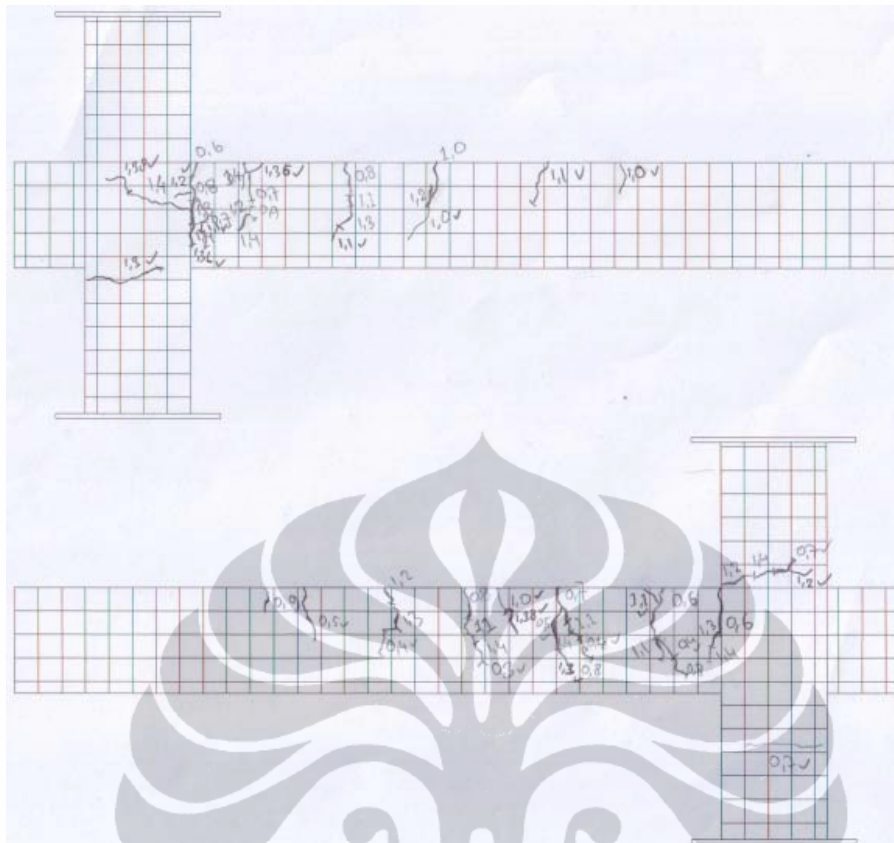
Gambar L212. Pola Retak Model-2.2 Sesudah perkuatan : $P=0,8$ kN



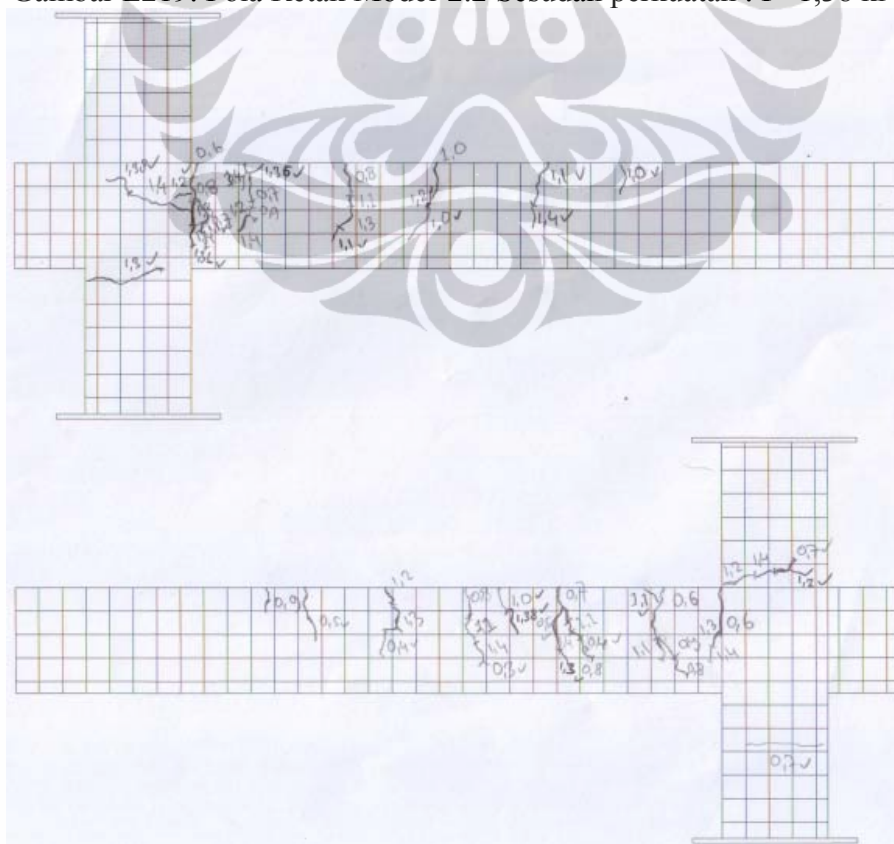
Gambar L217. Pola Retak Model-2.2 Sesudah perkuatan : $P=1,3$ kN



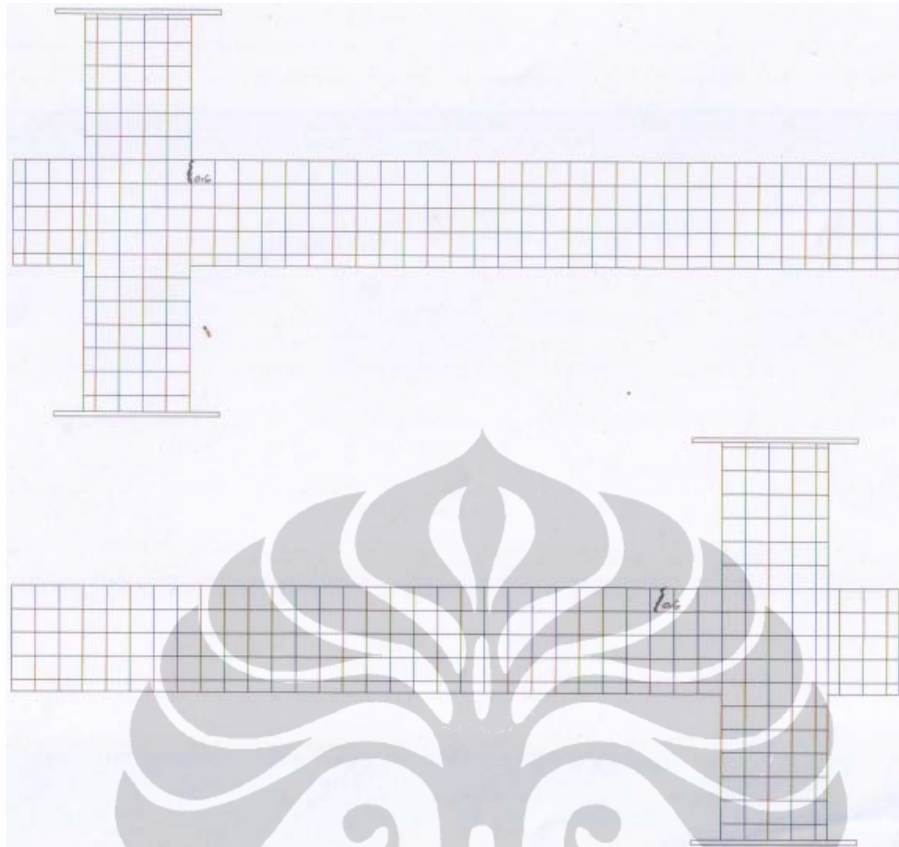
Gambar L218. Pola Retak Model-2.2 Sesudah perkuatan : $P=1,36$ kN



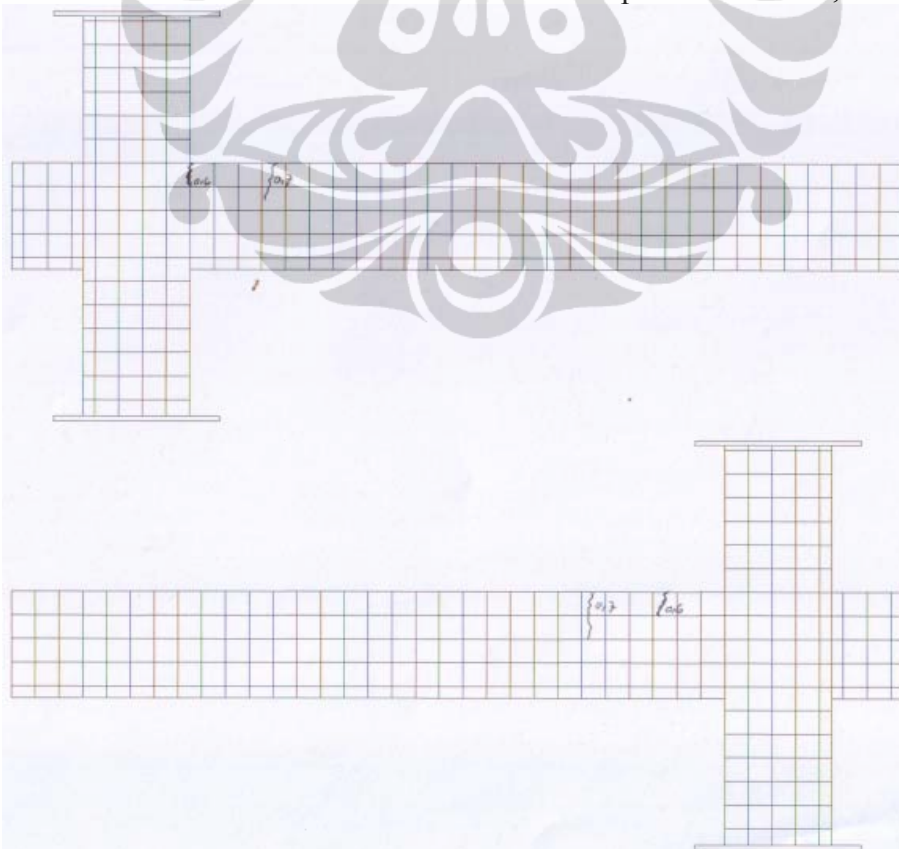
Gambar L219. Pola Retak Model-2.2 Sesudah perkuatan : $P=1,38$ kN



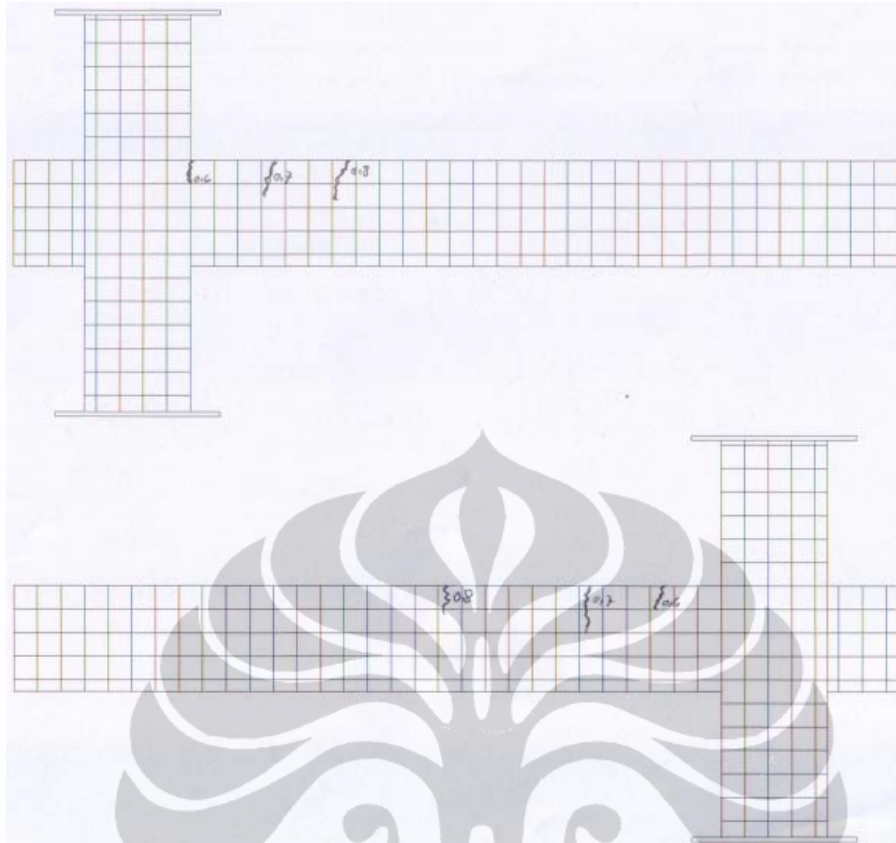
Gambar L220. Pola Retak Model-2.2 Sesudah perkuatan : $P=1,4$ kN



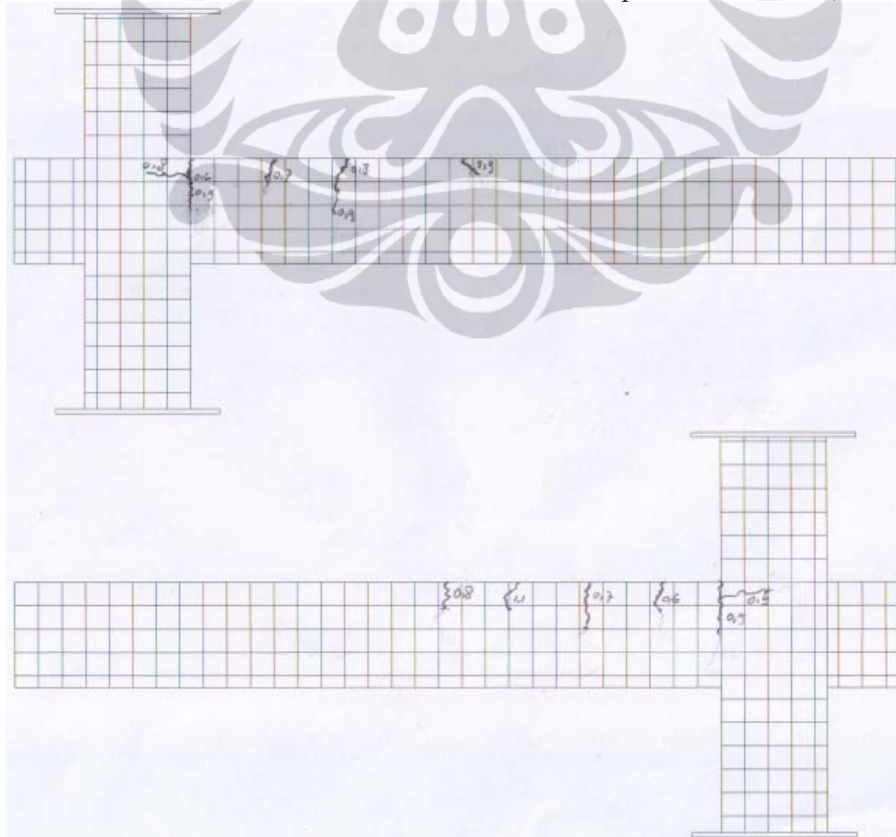
Gambar L223. Pola Retak Model-2.3. Sebelum perkuatan : $P= 0,6$ kN



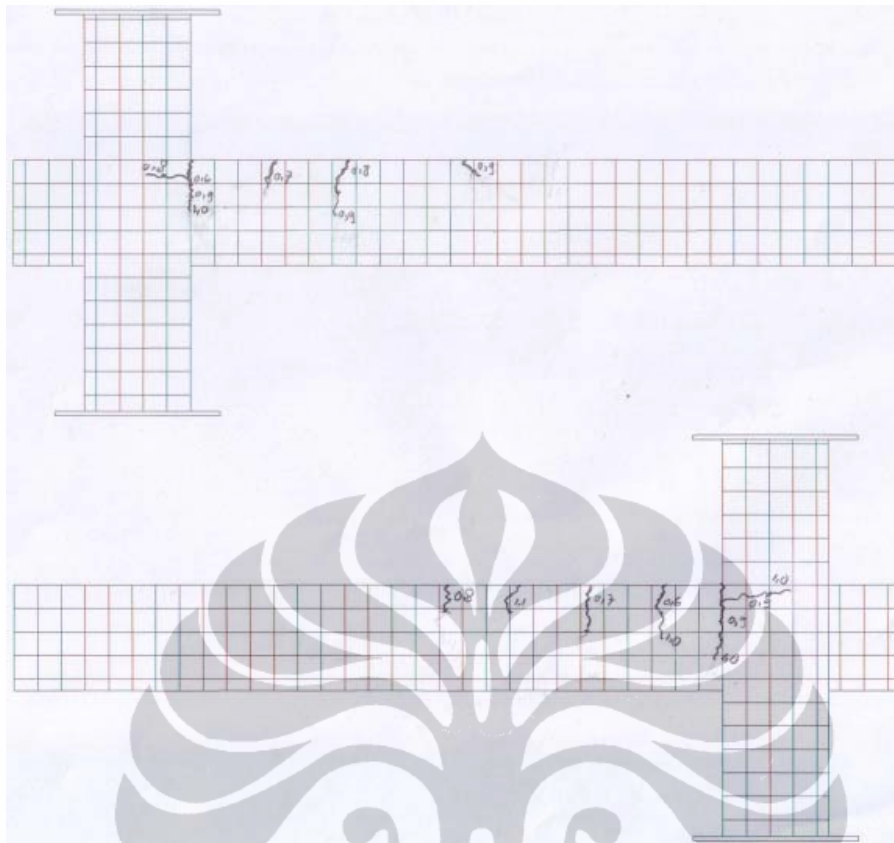
Gambar L224. Pola Retak Model-2.3. Sebelum perkuatan : $P= 0,7$ kN



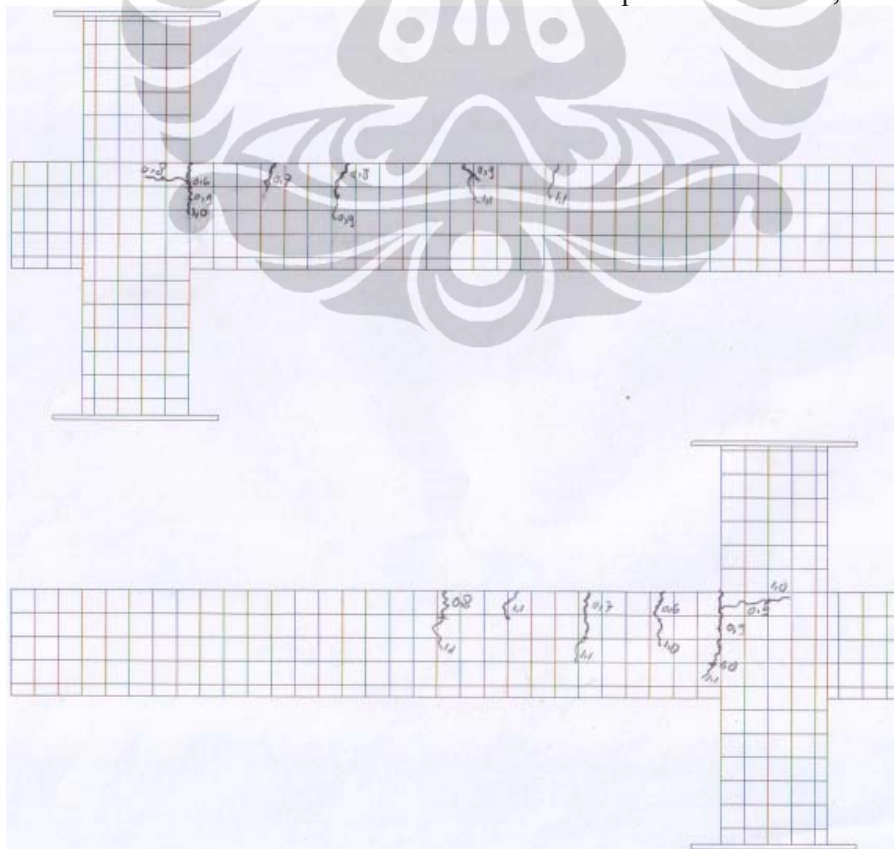
Gambar L225. Pola Retak Model-2.3. Sebelum perkuatan : $P= 0,8 \text{ kN}$



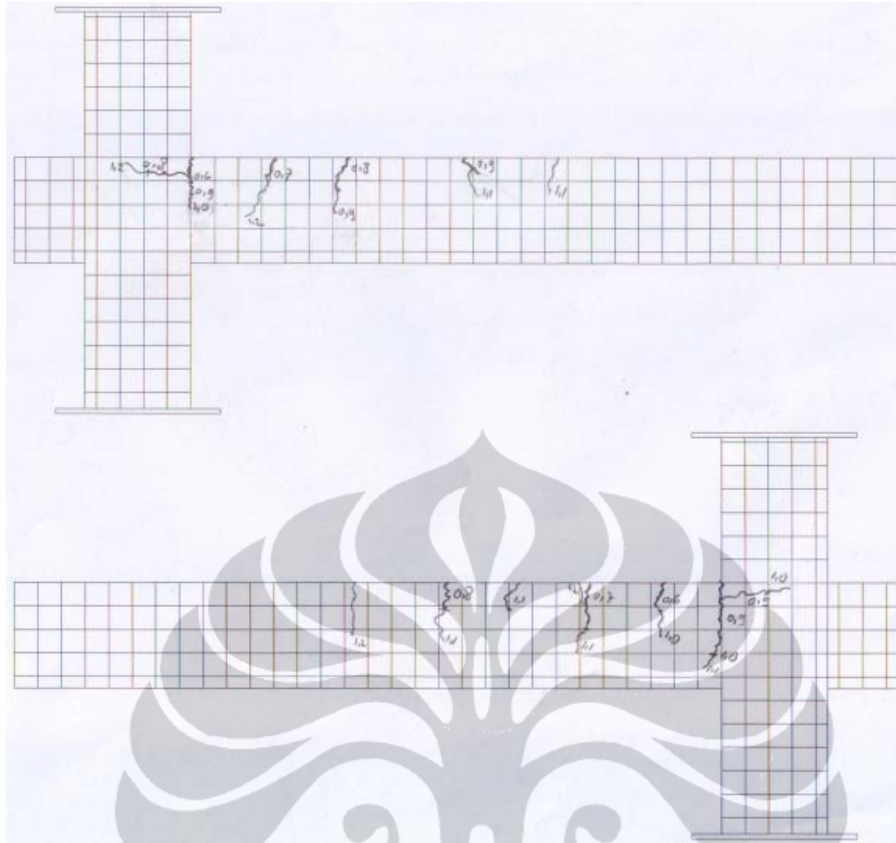
Gambar L226. Pola Retak Model-2.3. Sebelum perkuatan : $P= 0,9 \text{ kN}$



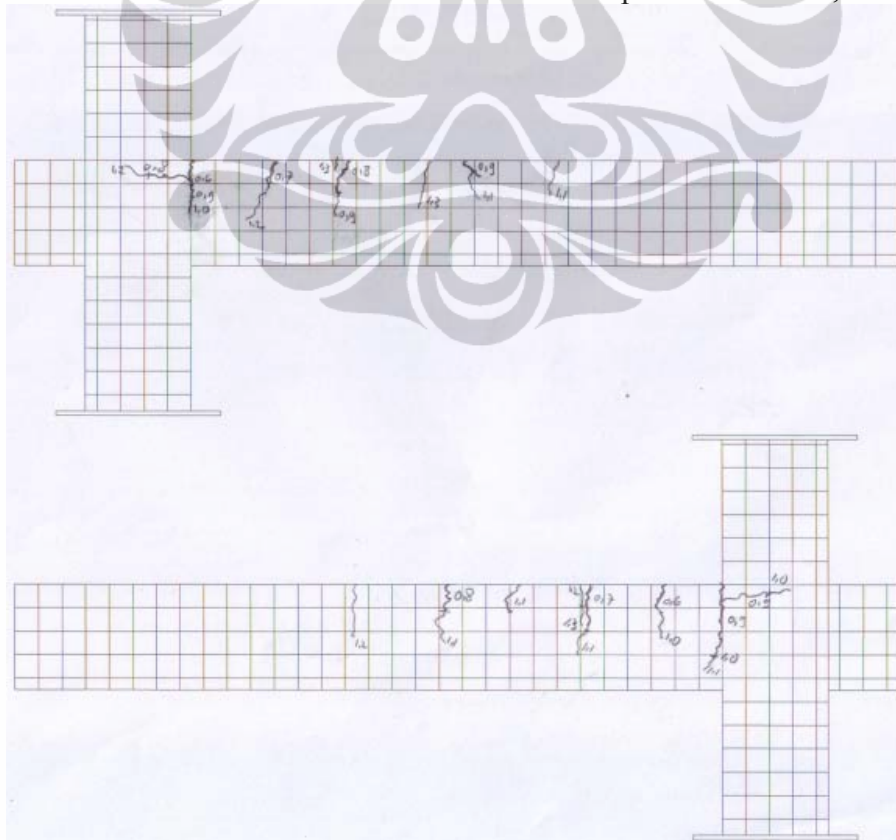
Gambar L227. Pola Retak Model-2.3. Sebelum perkuatan : $P= 1,0$ kN



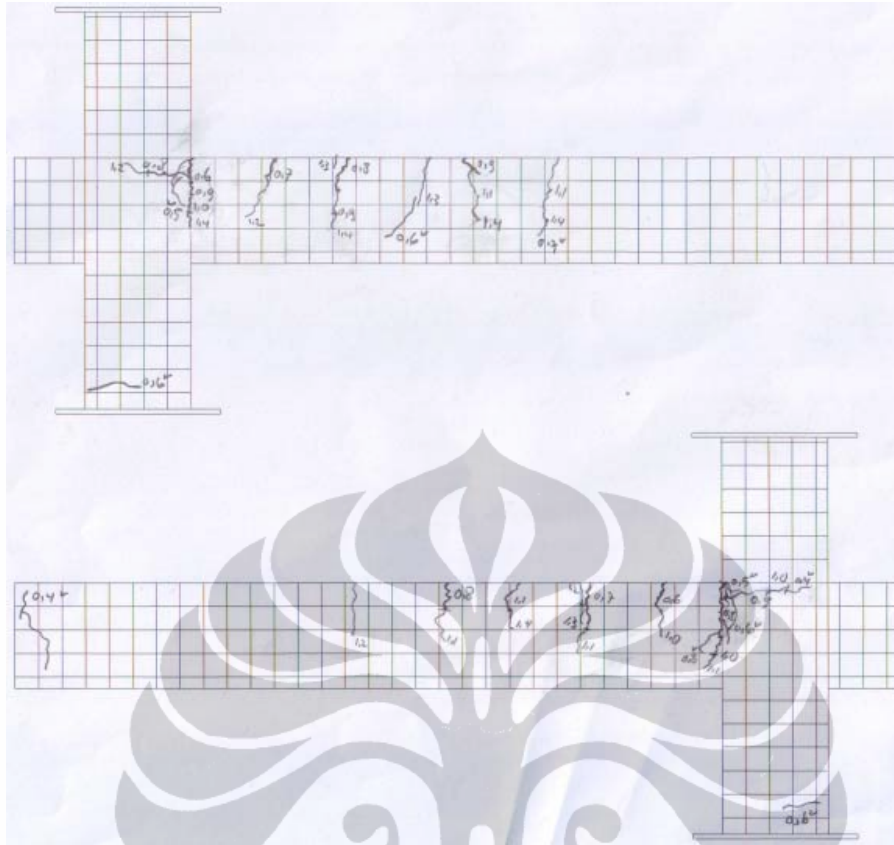
Gambar L228. Pola Retak Model-2.3. Sebelum perkuatan : $P= 1,1$ kN



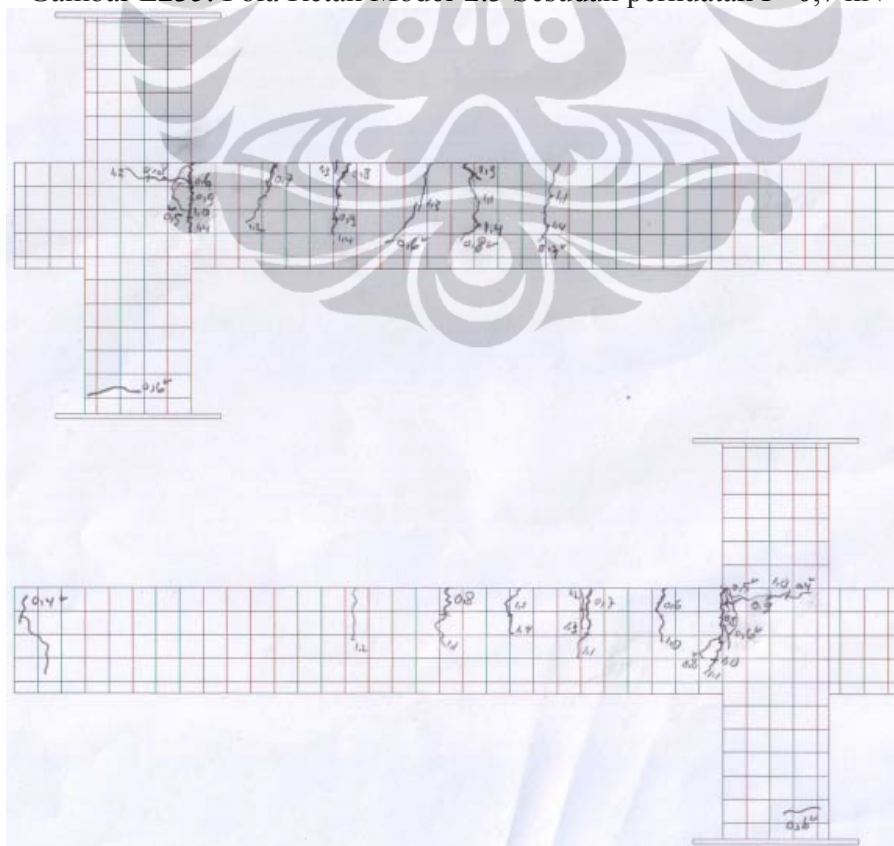
Gambar L229. Pola Retak Model-2.3. Sebelum perkuatan : $P= 1,2 \text{ kN}$



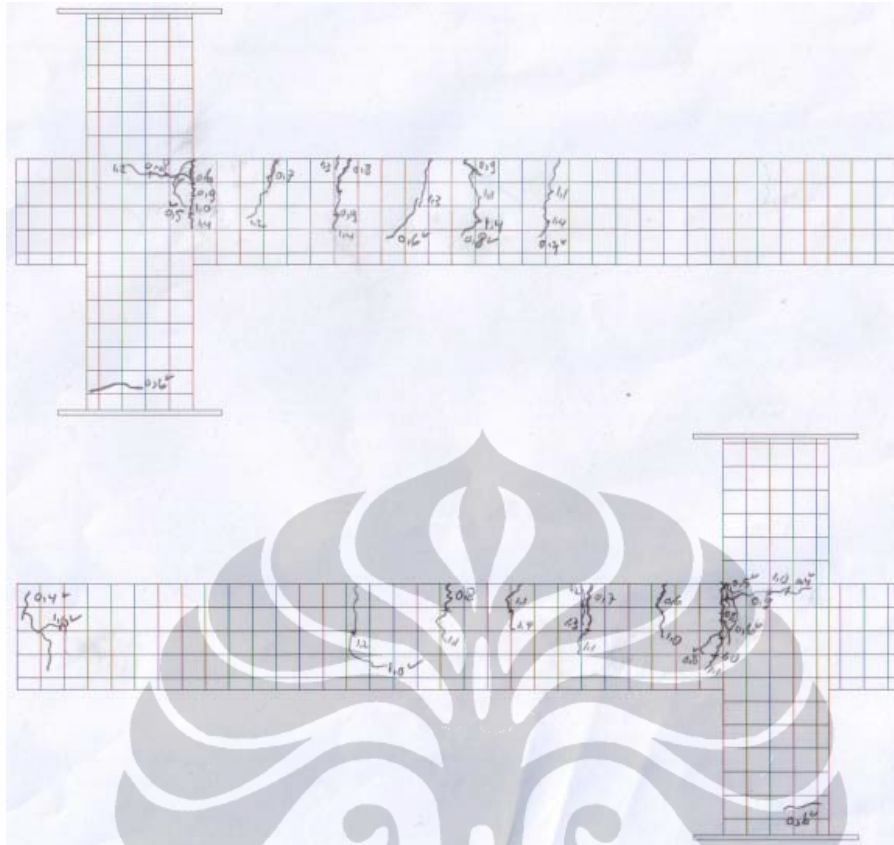
Gambar L230. Pola Retak Model-2.3. Sebelum perkuatan : $P= 1,3 \text{ kN}$



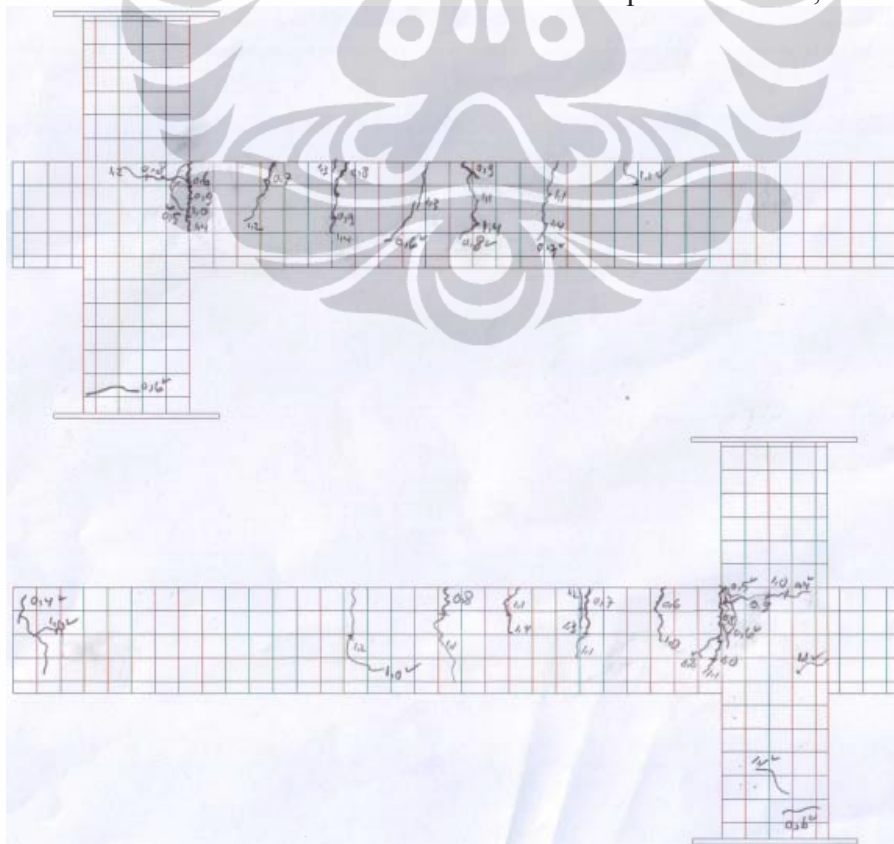
Gambar L235. Pola Retak Model-2.3 Sesudah perkuatan $P=0,7$ kN



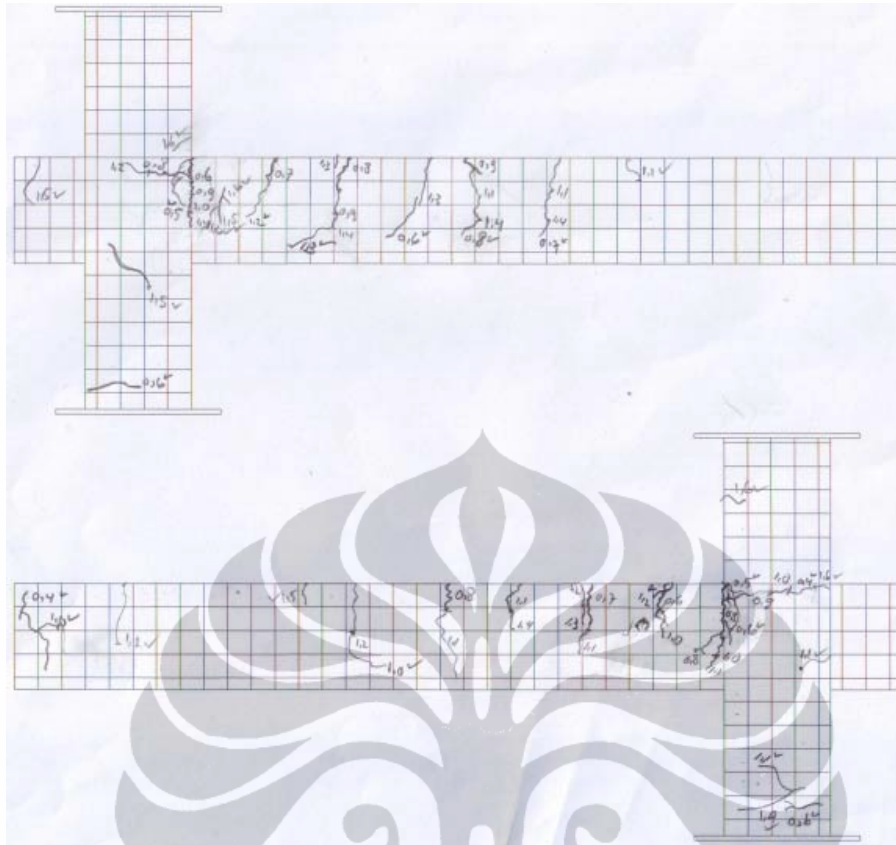
Gambar L236. Pola Retak Model-2.3 Sesudah perkuatan $P=0,8$ kN



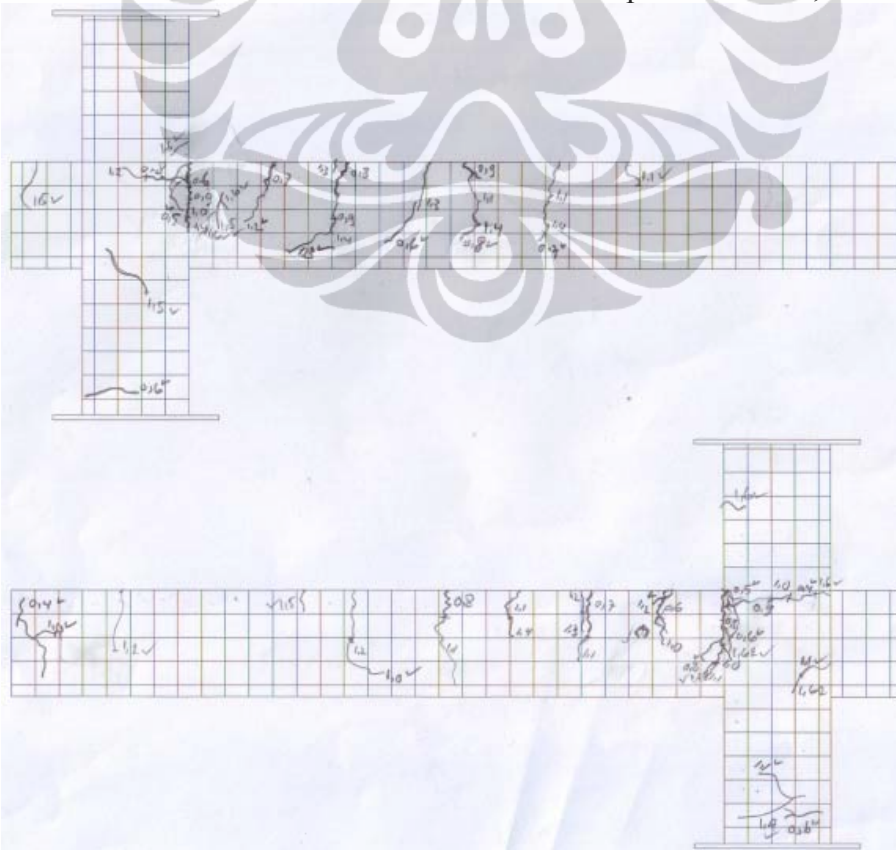
Gambar L237. Pola Retak Model-2.3 Sesudah perkuatan $P=1,0$ kN



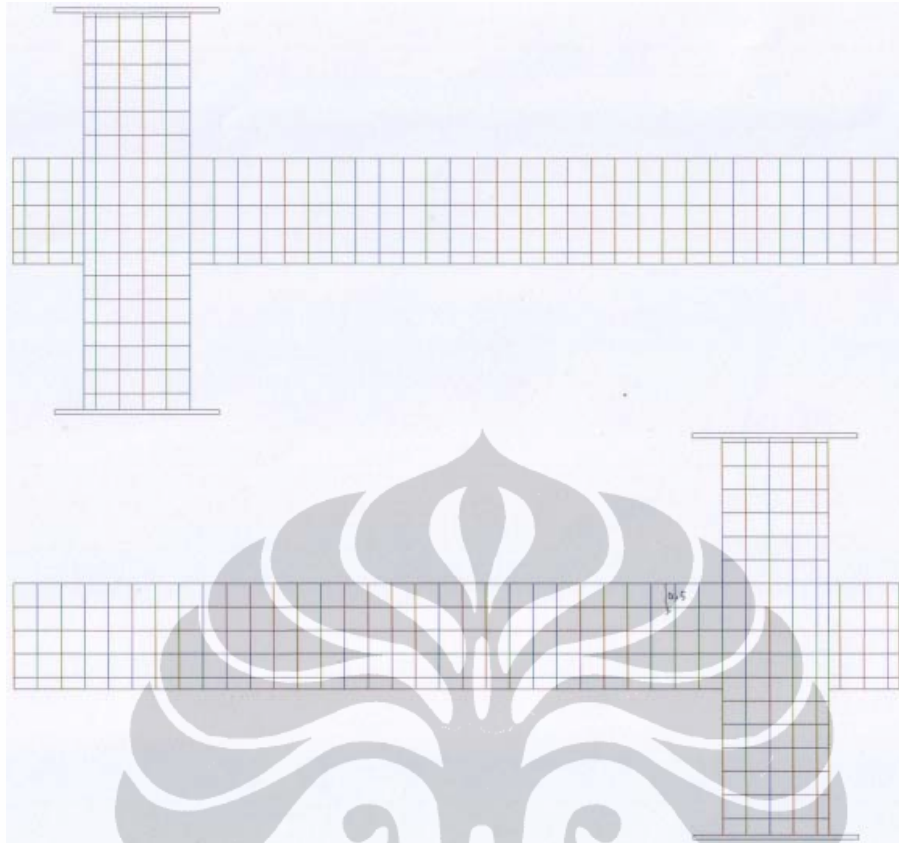
Gambar L238. Pola Retak Model-2.3 Sesudah perkuatan $P=1,1$ kN



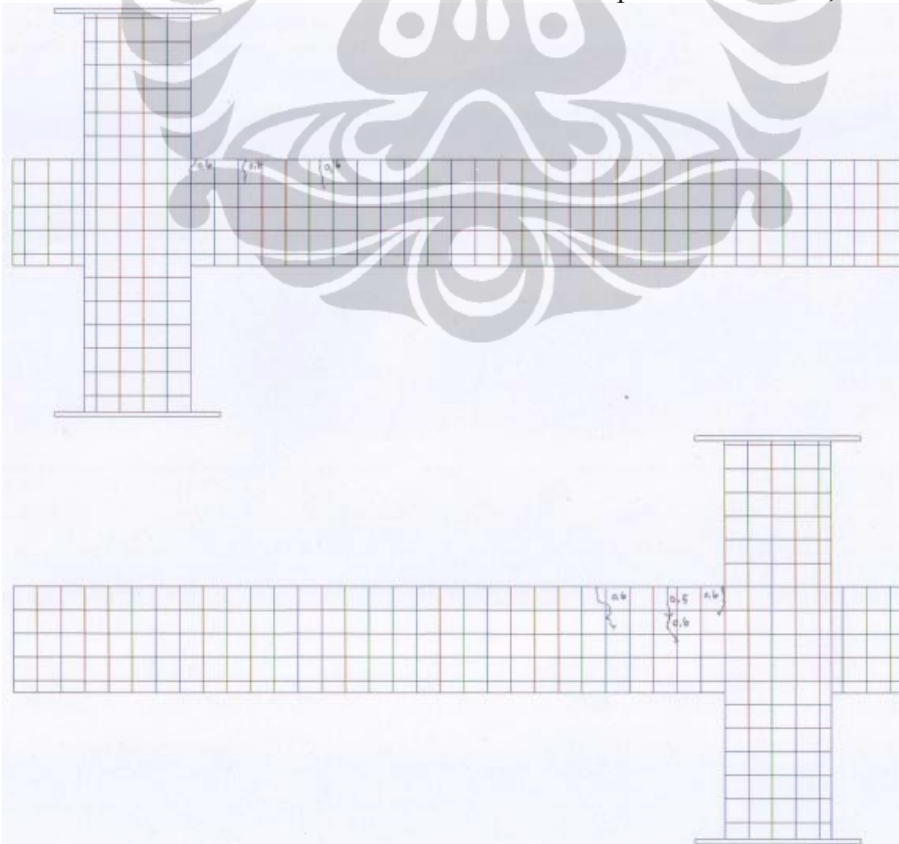
Gambar L243. Pola Retak Model-2.3 Sesudah perkuatan $P=1,6$ kN



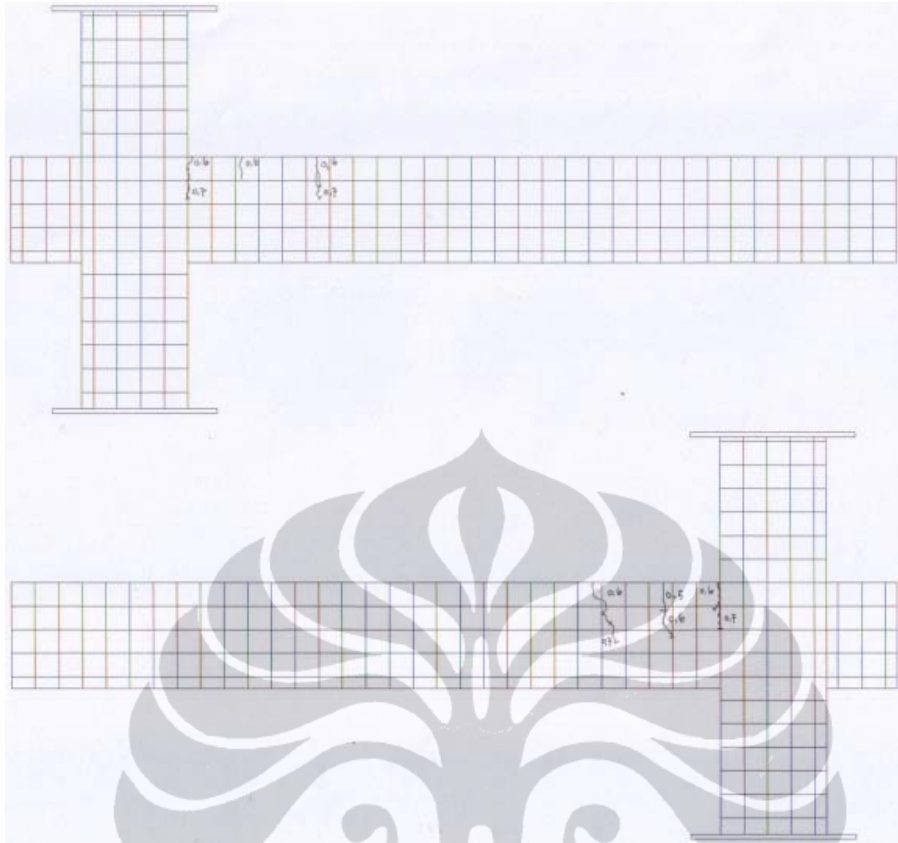
Gambar L244. Pola Retak Model-2.3 Sesudah perkuatan $P=1,62$ kN



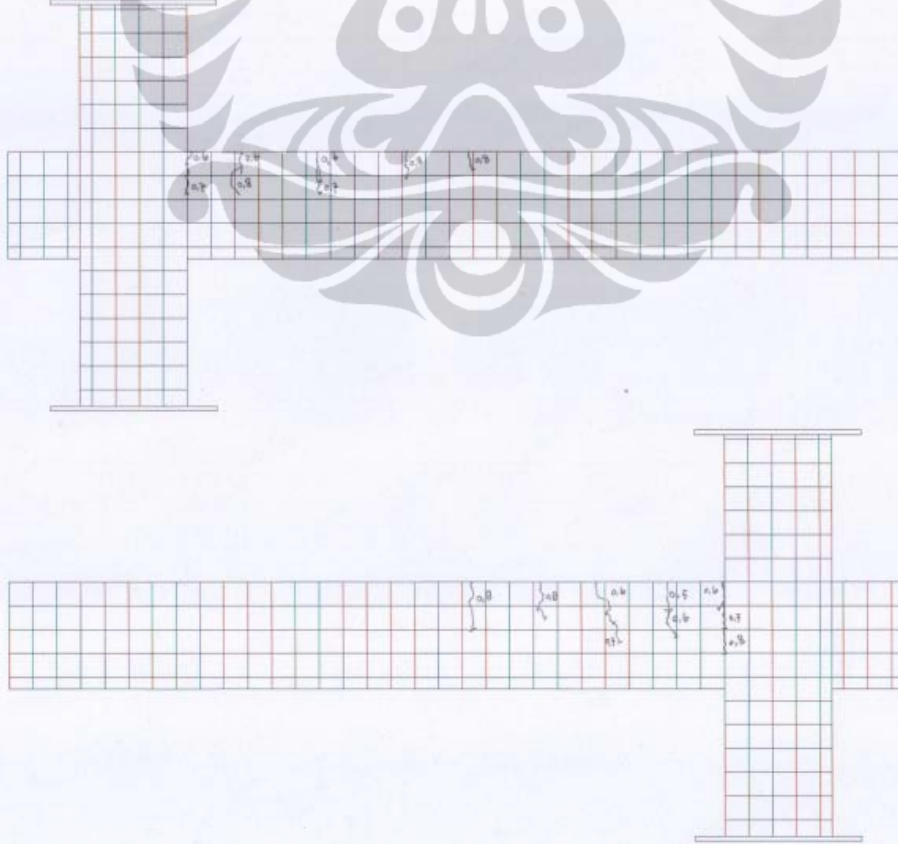
Gambar L246. Pola Retak Model-3.1 Sebelum perkuatan : $P= 0,5 \text{ kN}$



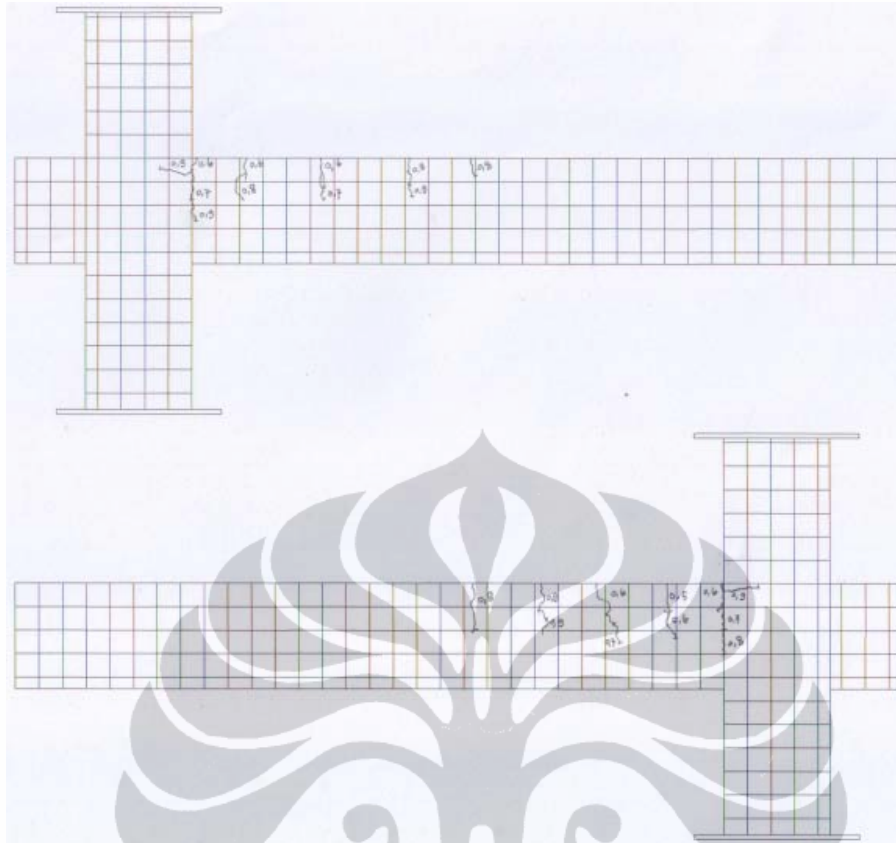
Gambar L247. Pola Retak Model-3.1 Sebelum perkuatan : $P= 0,6 \text{ kN}$



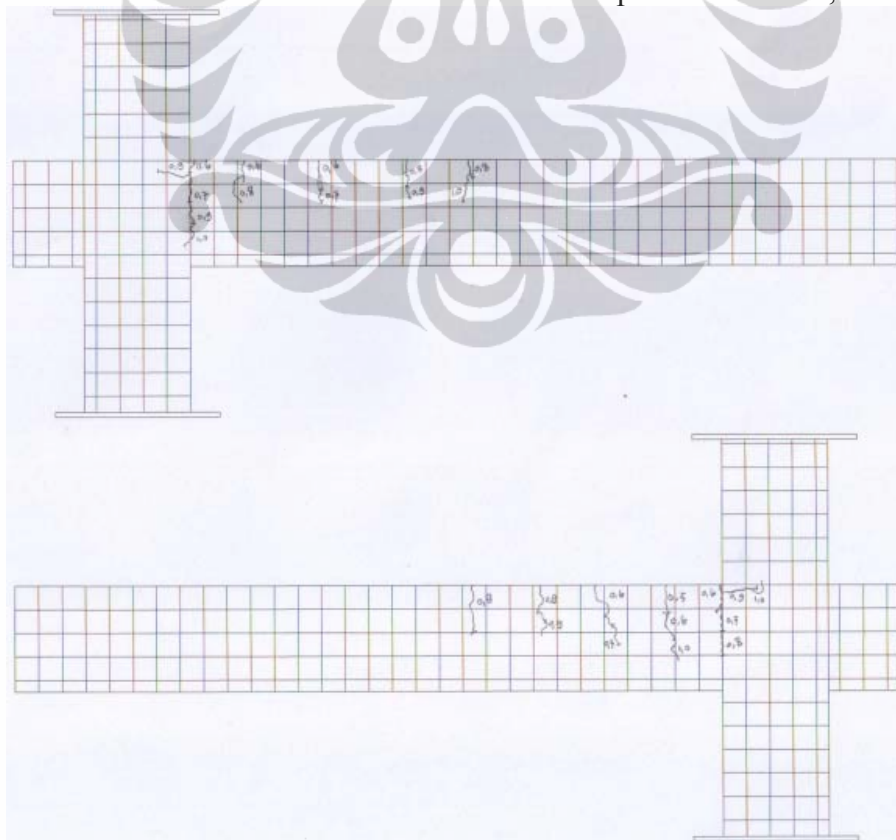
Gambar L248. Pola Retak Model-3.1 Sebelum perkuatan : $P= 0,7$ kN



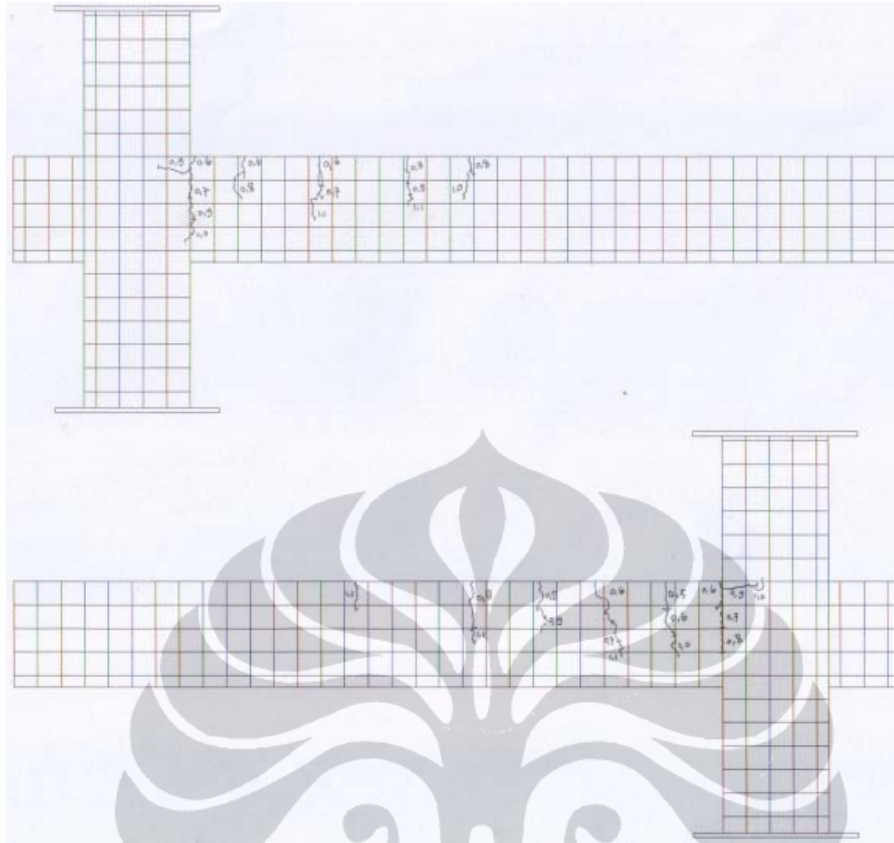
Gambar L249. Pola Retak Model-3.1 Sebelum perkuatan : $P= 0,8$ kN



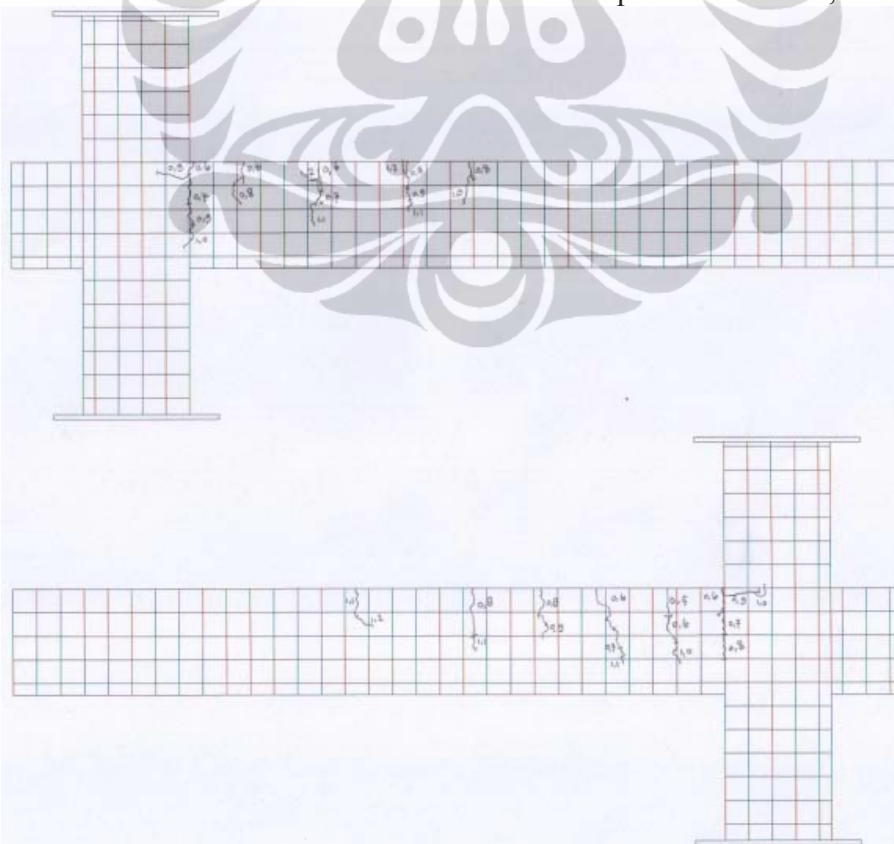
Gambar L250. Pola Retak Model-3.1 Sebelum perkuatan : $P= 0,9$ kN



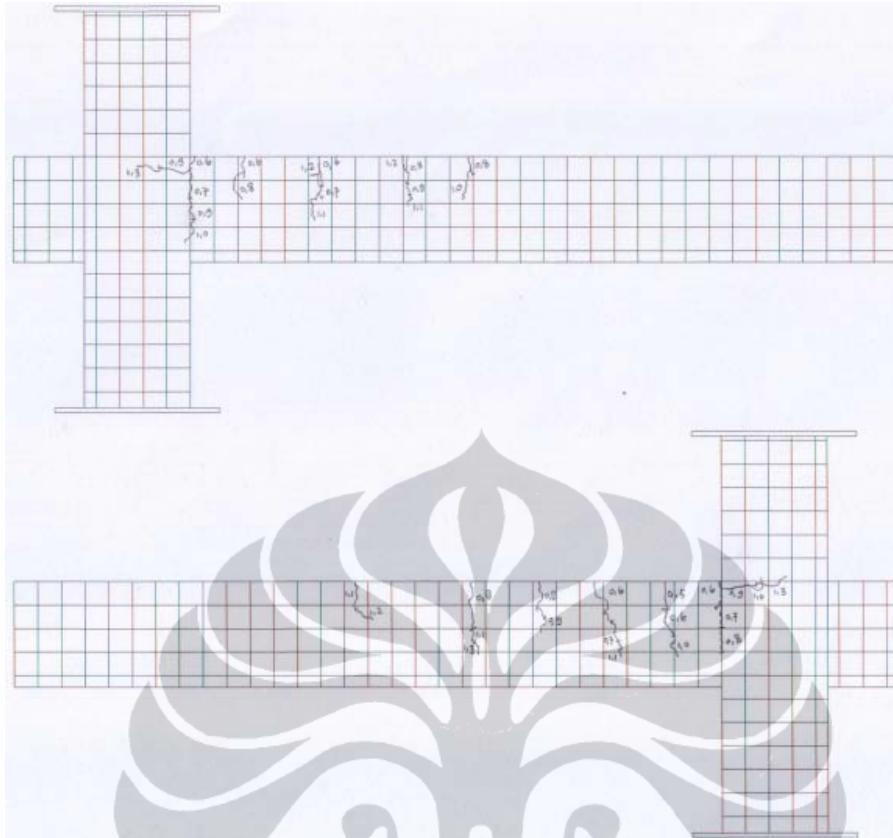
Gambar L251. Pola Retak Model-3.1 Sebelum perkuatan : $P= 1,0$ kN



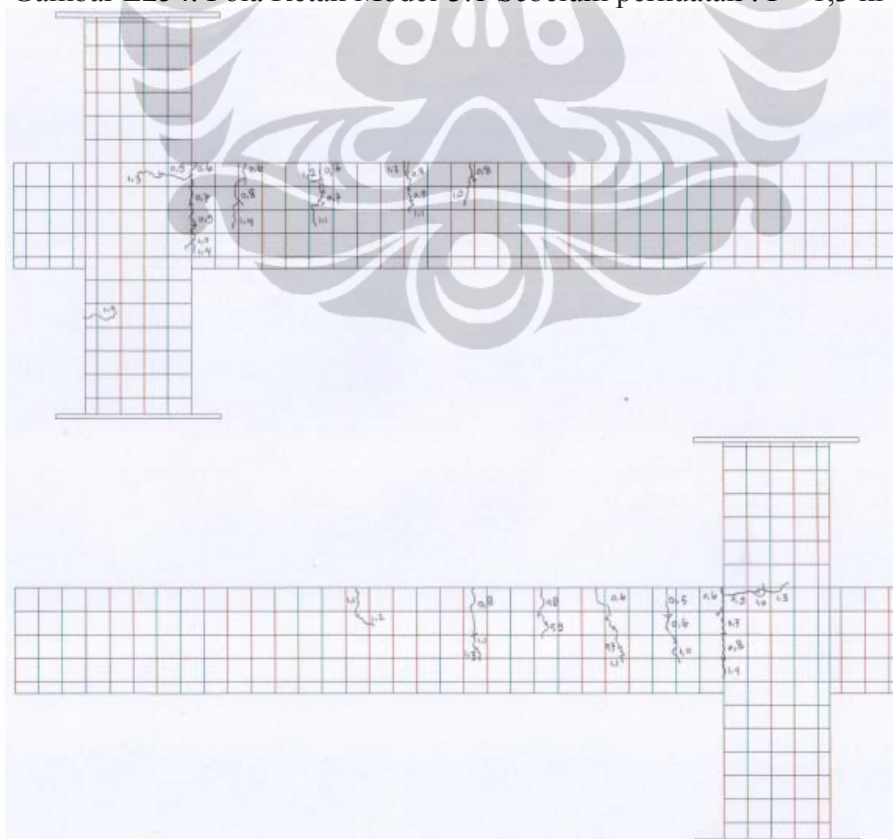
Gambar L252. Pola Retak Model-3.1 Sebelum perkuatan : $P= 1,1 \text{ kN}$



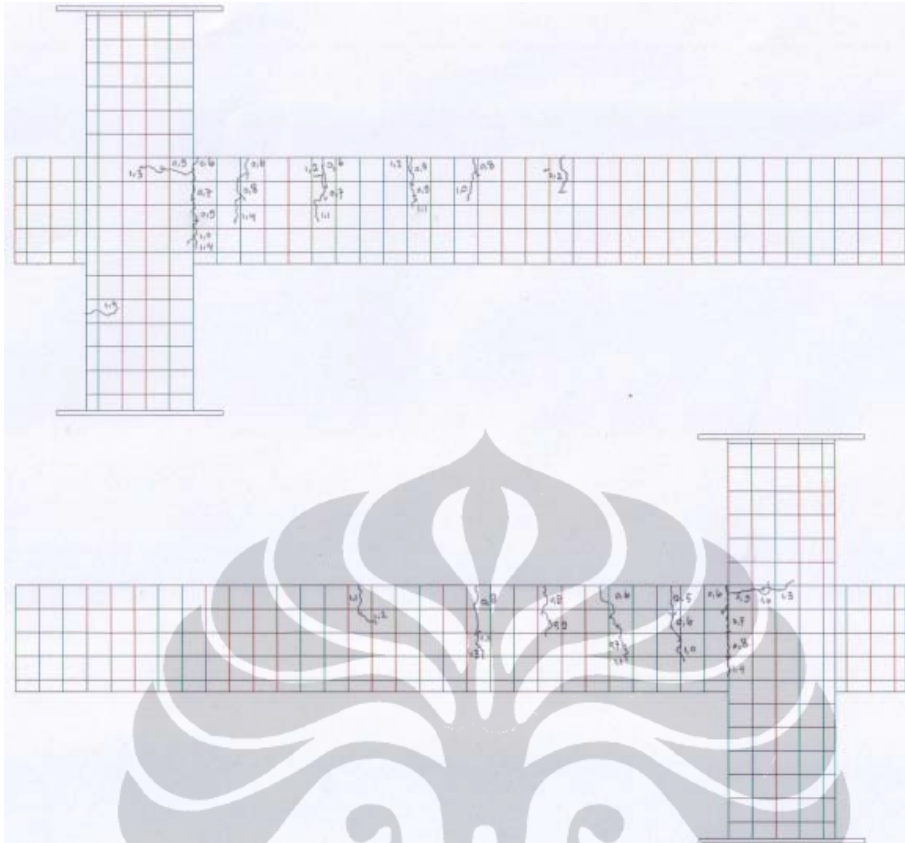
Gambar L253. Pola Retak Model-3.1 Sebelum perkuatan : $P= 1,2 \text{ kN}$



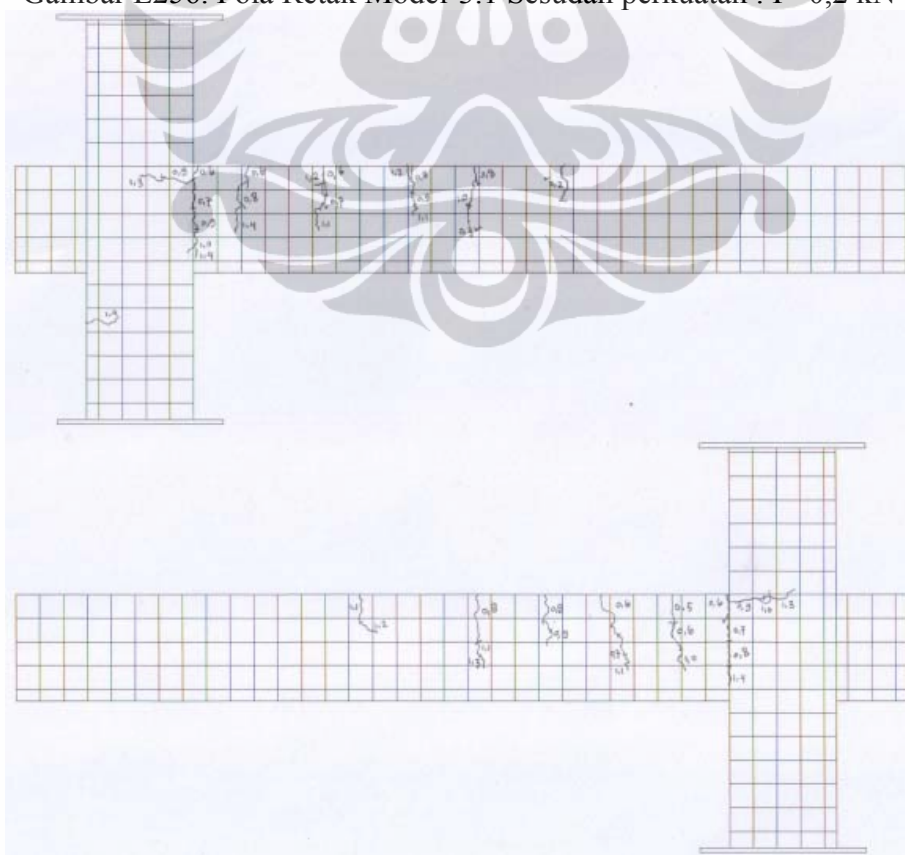
Gambar L254. Pola Retak Model-3.1 Sebelum perkuatan : $P= 1,3 \text{ kN}$



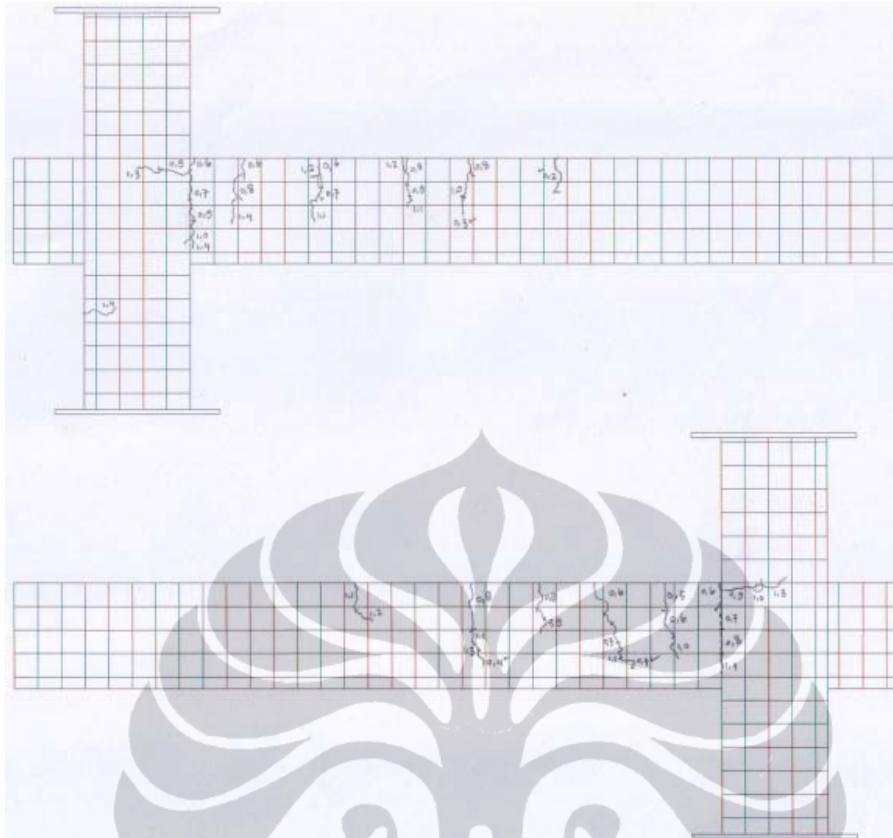
Gambar L255. Pola Retak Model-3.1 Sebelum perkuatan : $P= 1,4 \text{ kN}$



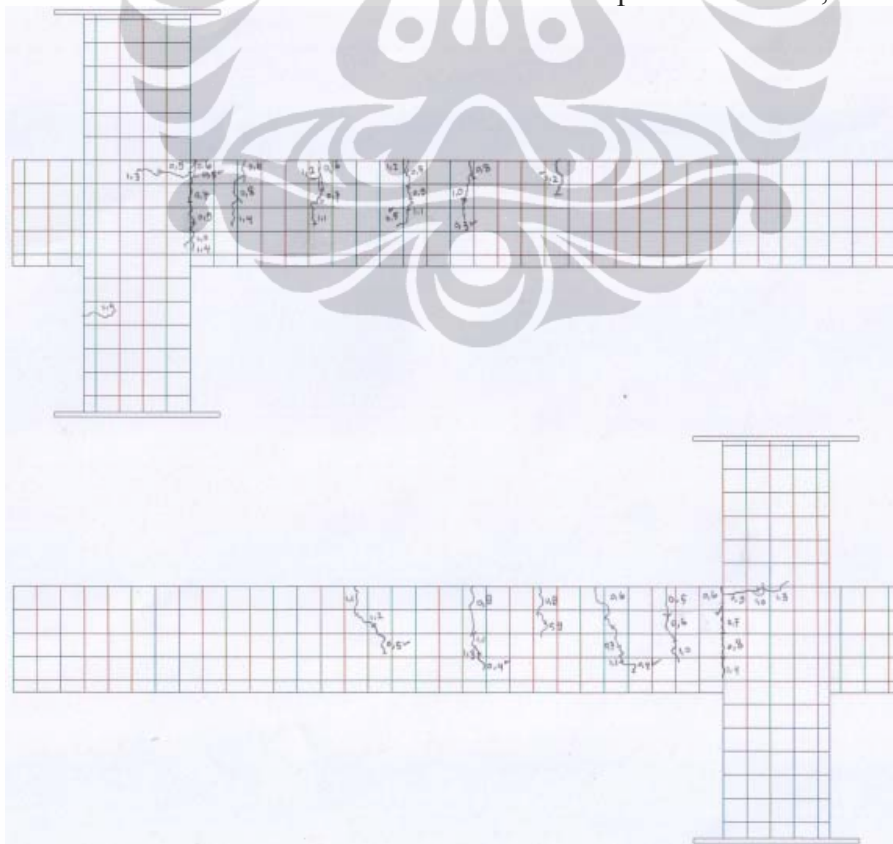
Gambar L256. Pola Retak Model-3.1 Sesudah perkuatan : $P=0,2$ kN



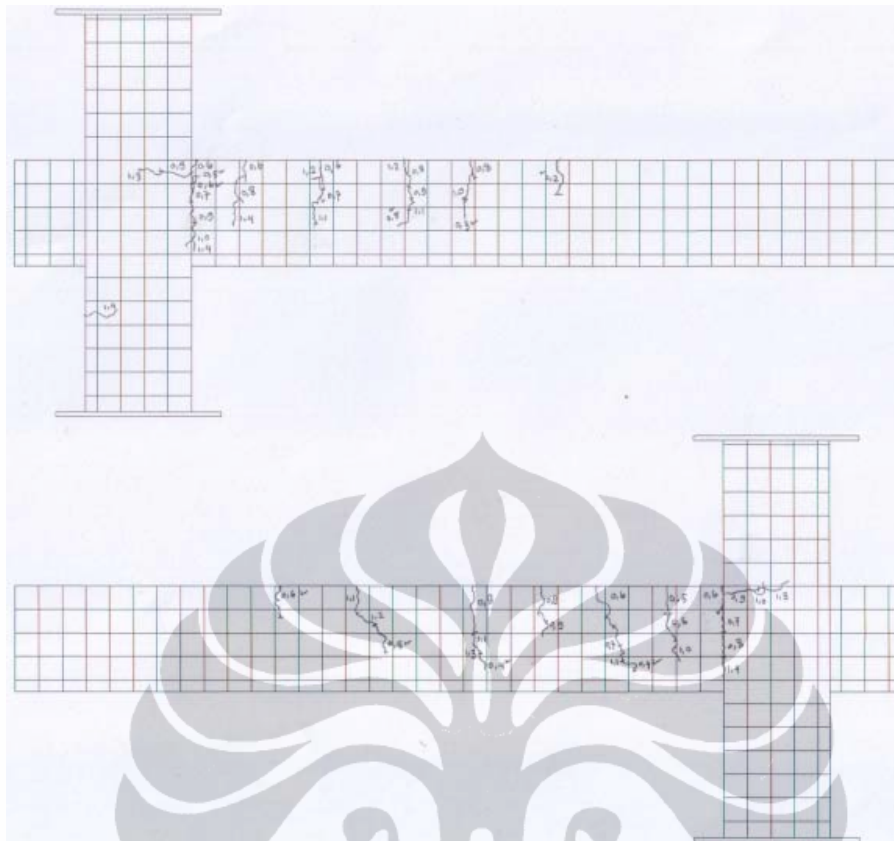
Gambar L257. Pola Retak Model-3.1 Sesudah perkuatan : $P=0,3$ kN



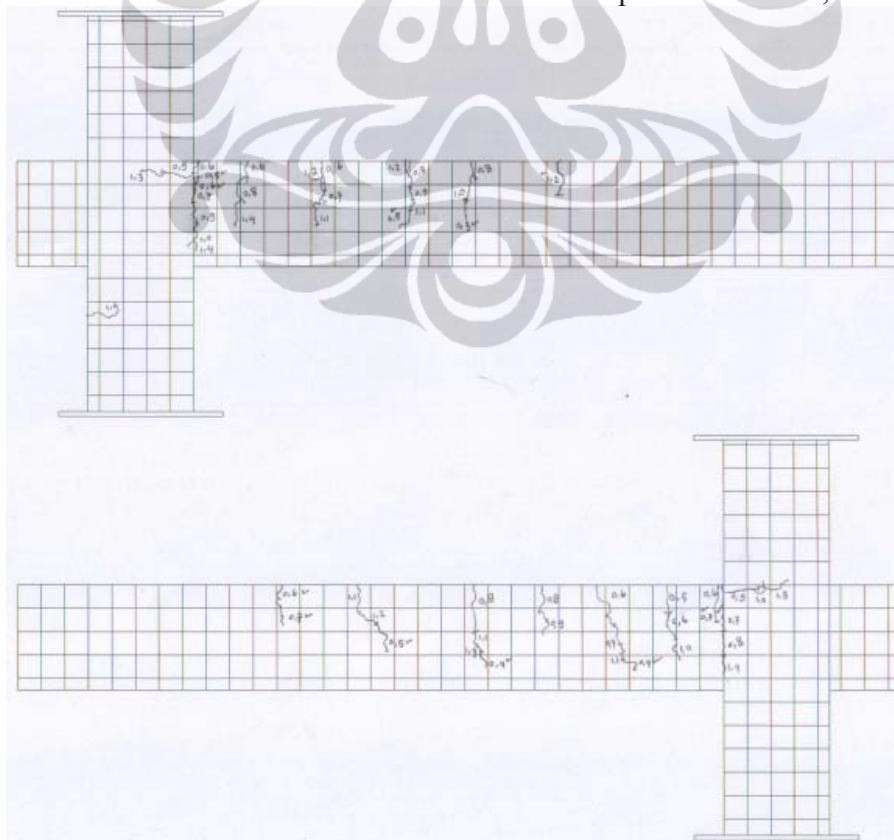
Gambar L258. Pola Retak Model-3.1 Sesudah perkuatan : $P=0,4$ kN



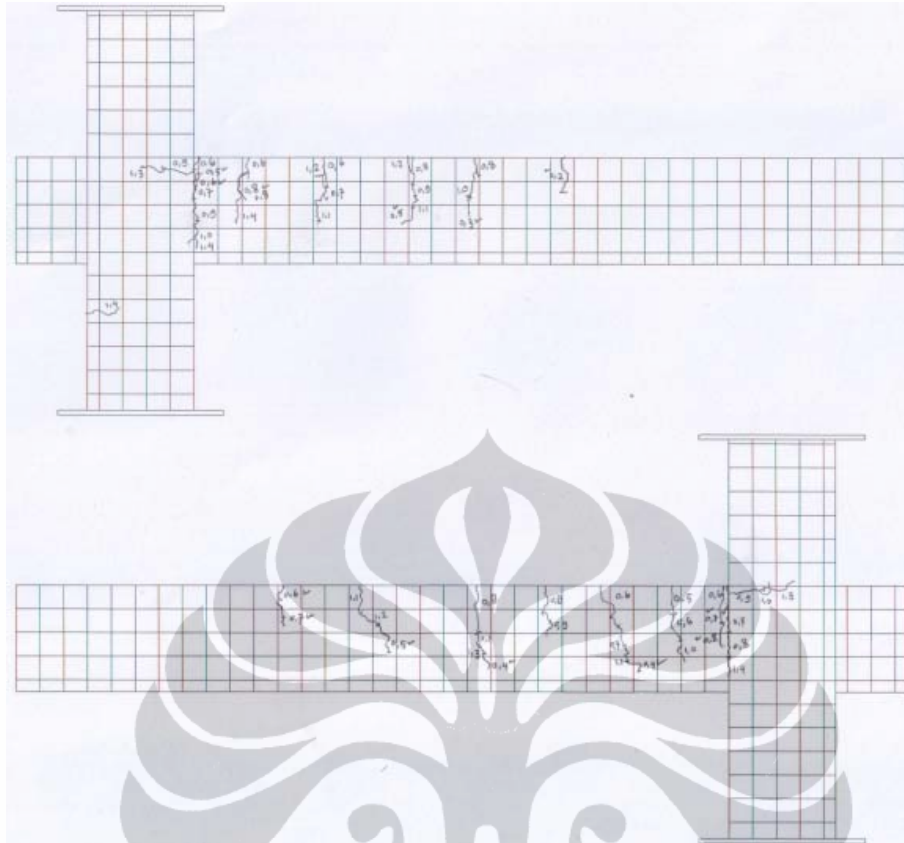
Gambar L259. Pola Retak Model-3.1 Sesudah perkuatan : $P=0,5$ kN



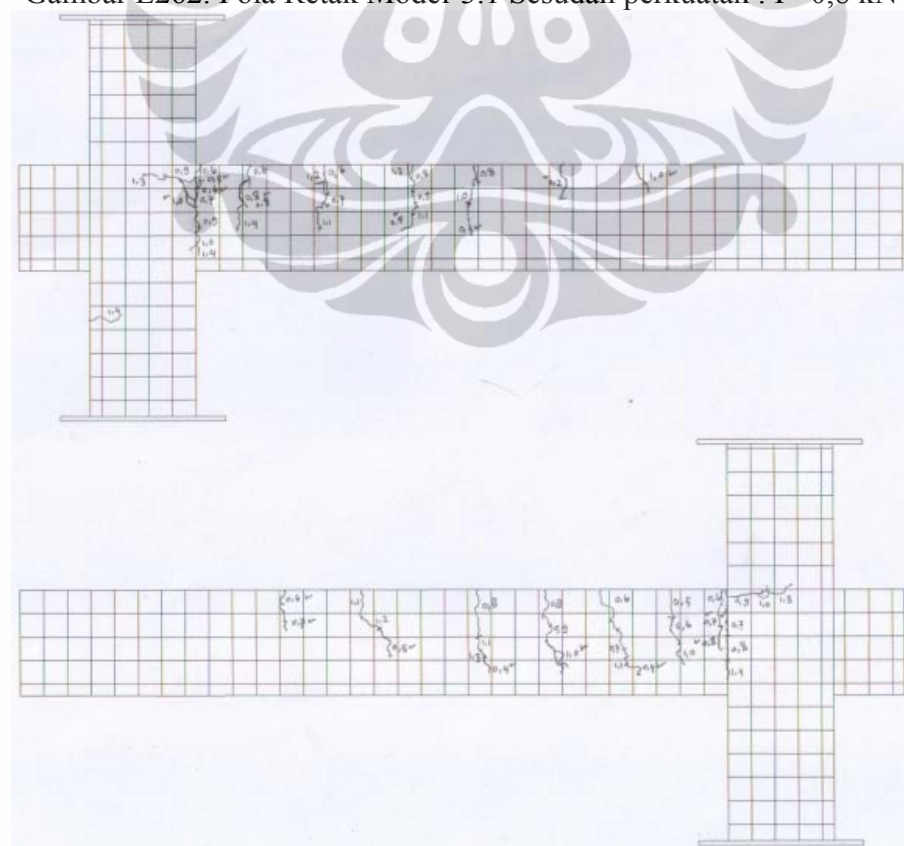
Gambar L260. Pola Retak Model-3.1 Sesudah perkuatan : $P=0,6 \text{ kN}$



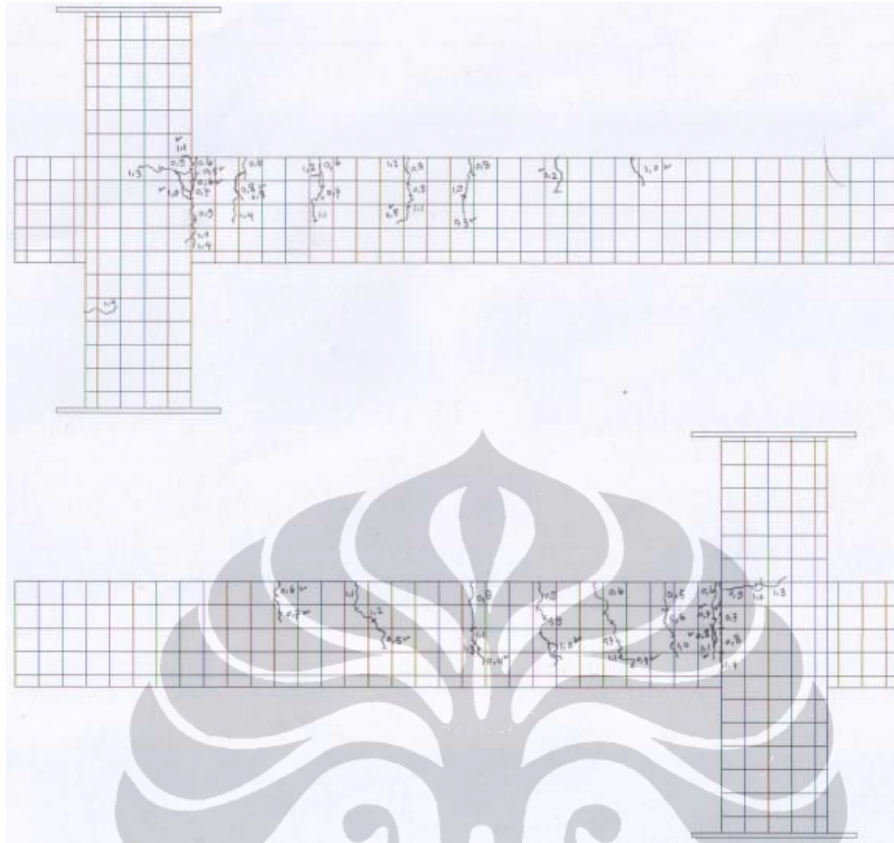
Gambar L261. Pola Retak Model-3.1 Sesudah perkuatan : $P=0,7 \text{ kN}$



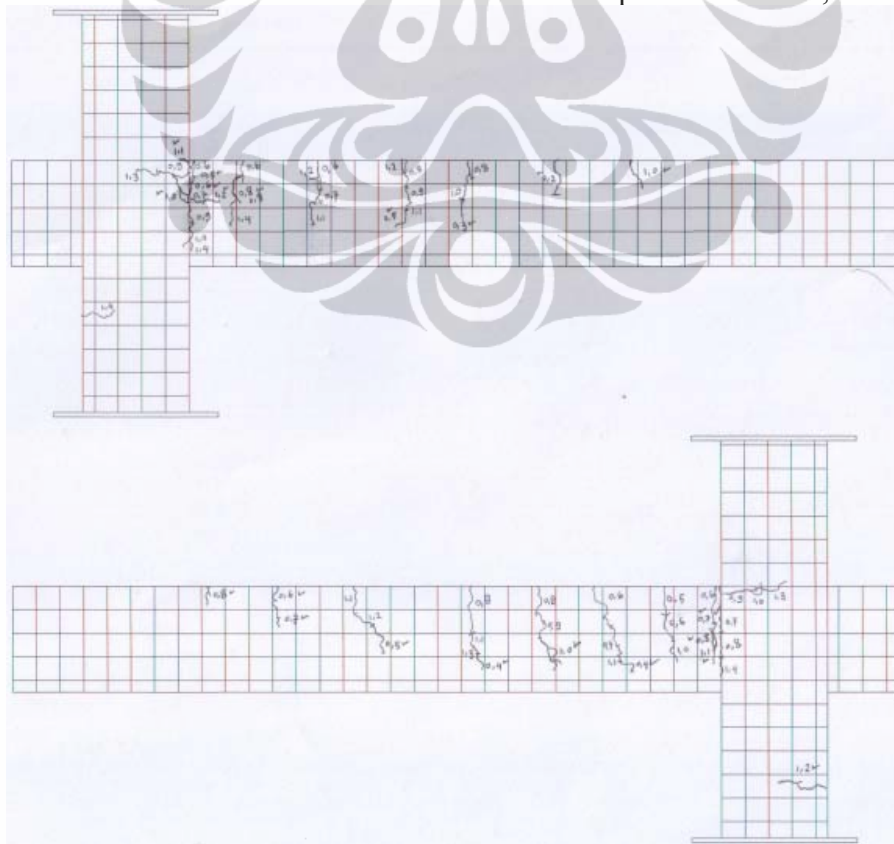
Gambar L262. Pola Retak Model-3.1 Sesudah perkuatan : $P=0,8$ kN



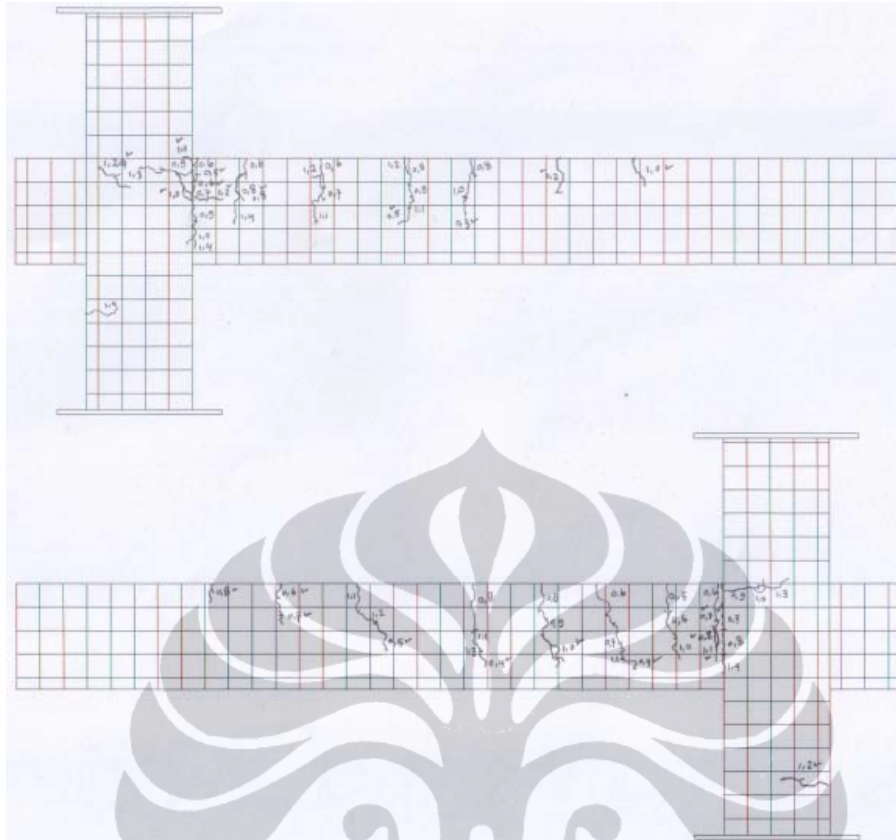
Gambar L263. Pola Retak Model-3.1 Sesudah perkuatan : $P=0,9$ kN



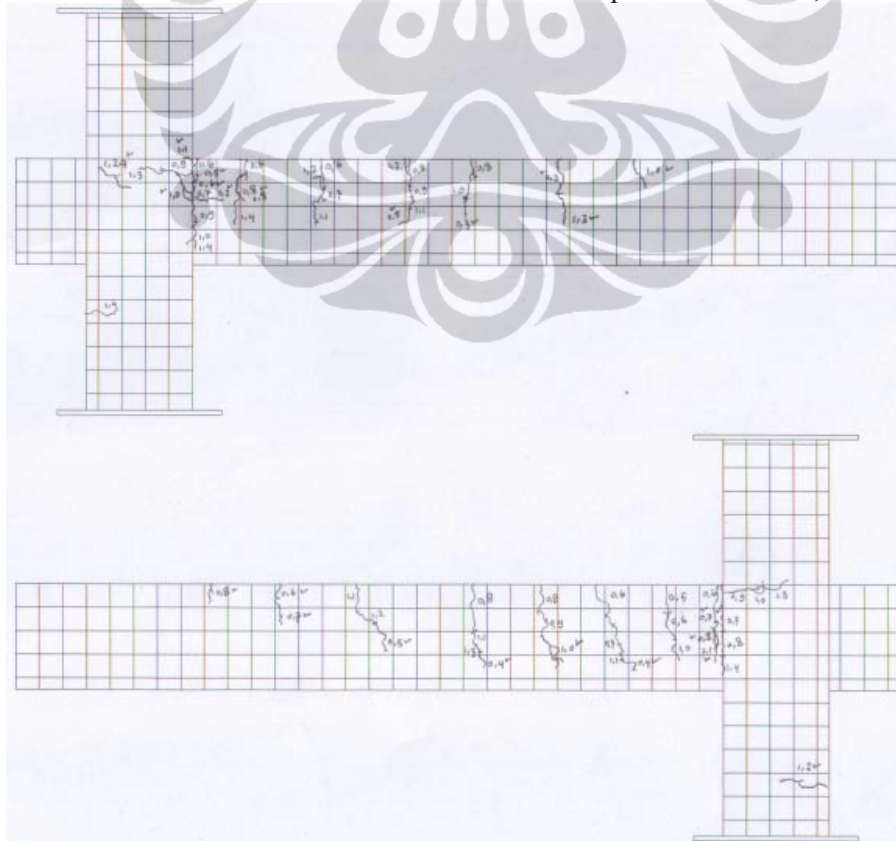
Gambar L264. Pola Retak Model-3.1 Sesudah perkuatan : $P=1,0$ kN



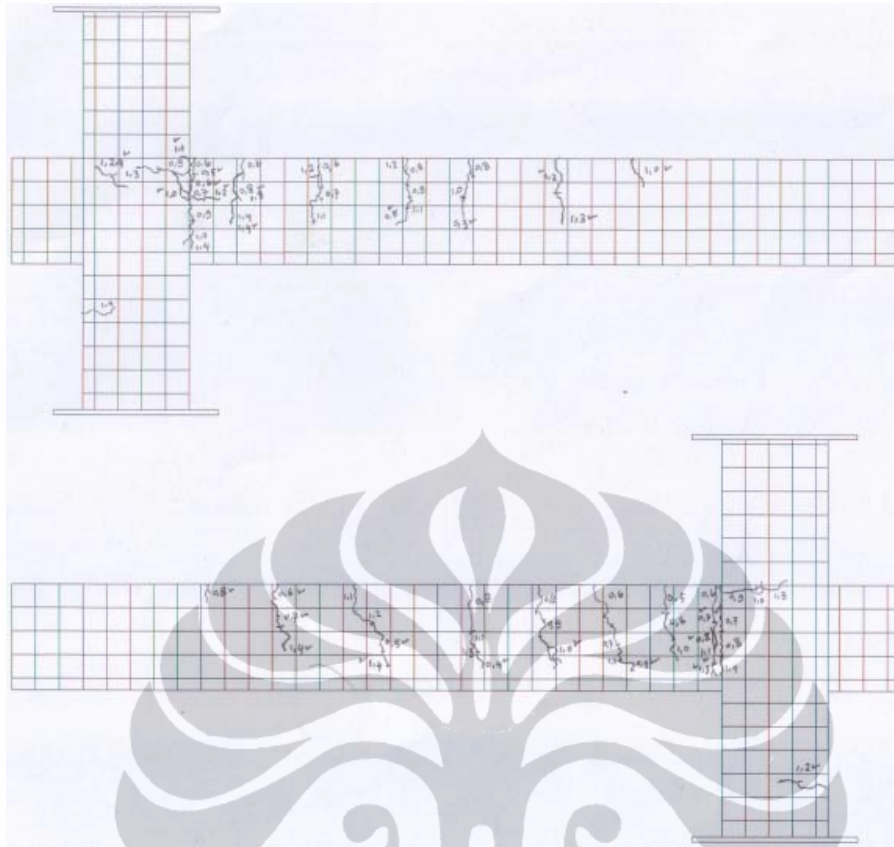
Gambar L265. Pola Retak Model-3.1 Sesudah perkuatan : $P=1,2$ kN



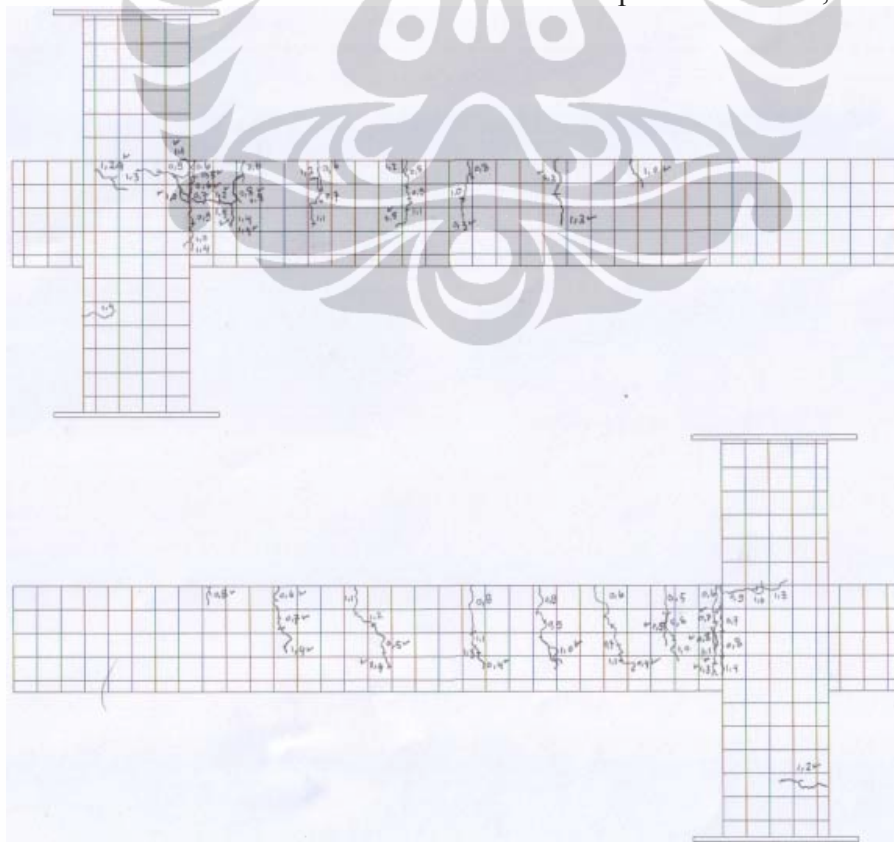
Gambar L266. Pola Retak Model-3.1 Sesudah perkuatan : $P=1,24$ kN



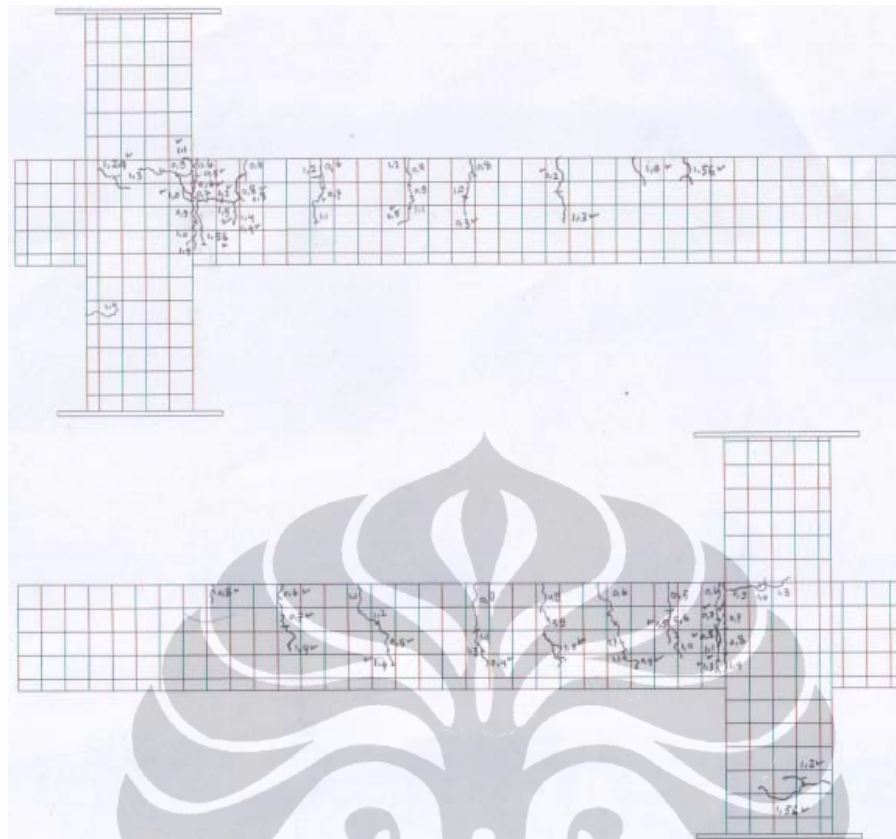
Gambar L267. Pola Retak Model-3.1 Sesudah perkuatan : $P=1,3$ kN



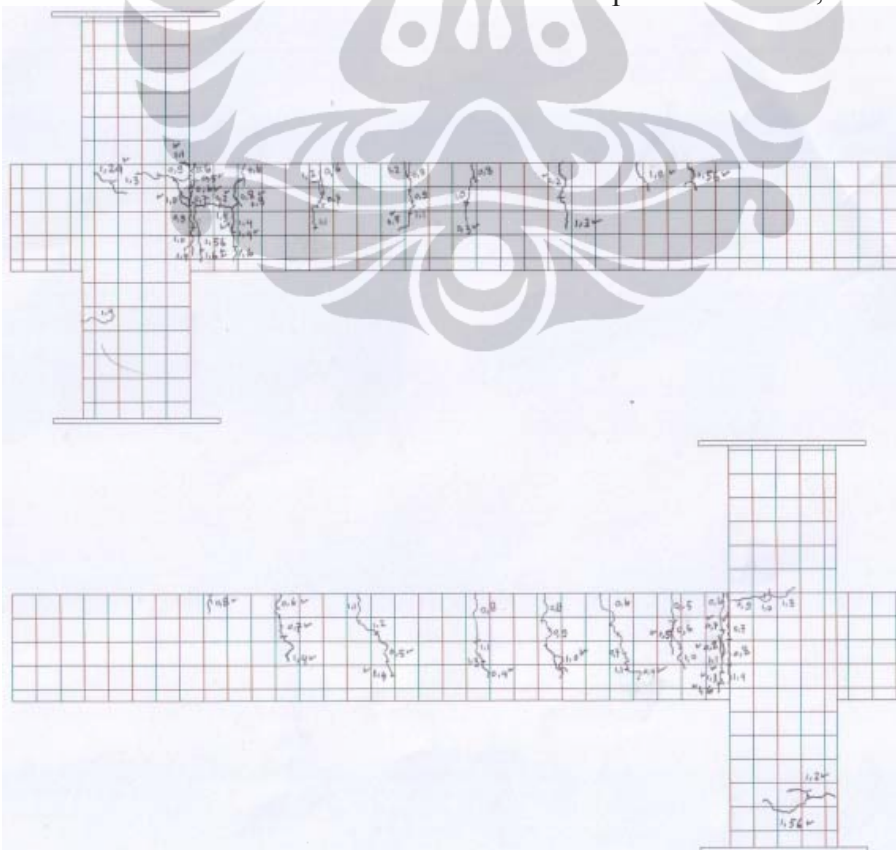
Gambar L268. Pola Retak Model-3.1 Sesudah perkuatan : $P=1,4 \text{ kN}$



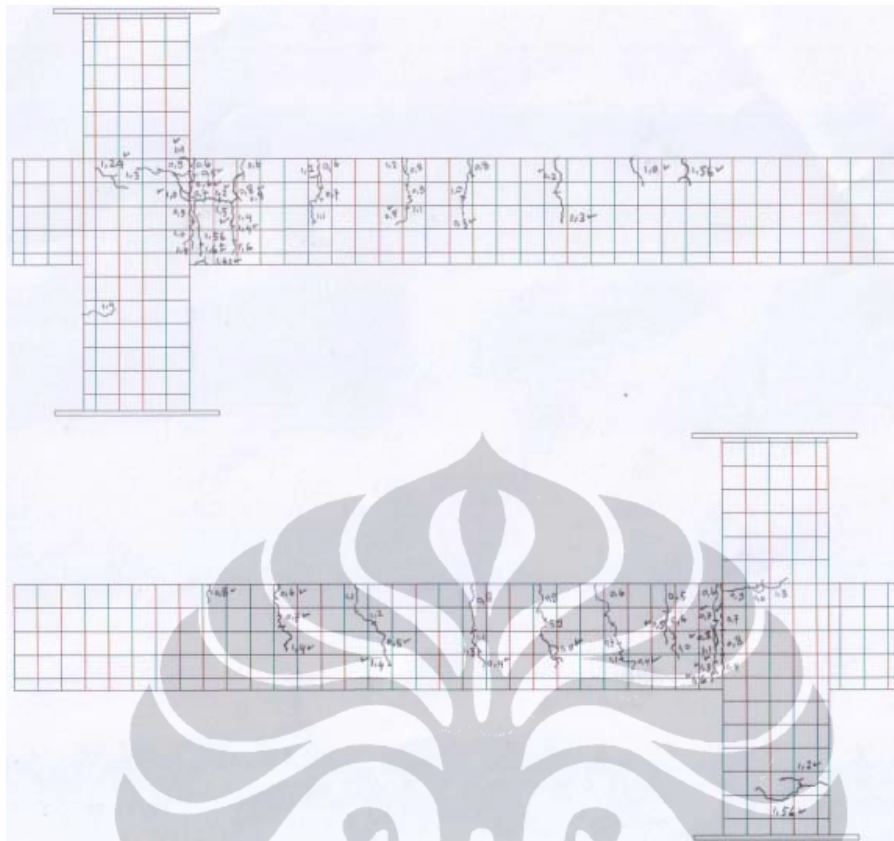
Gambar L269. Pola Retak Model-3.1 Sesudah perkuatan : $P=1,5 \text{ kN}$



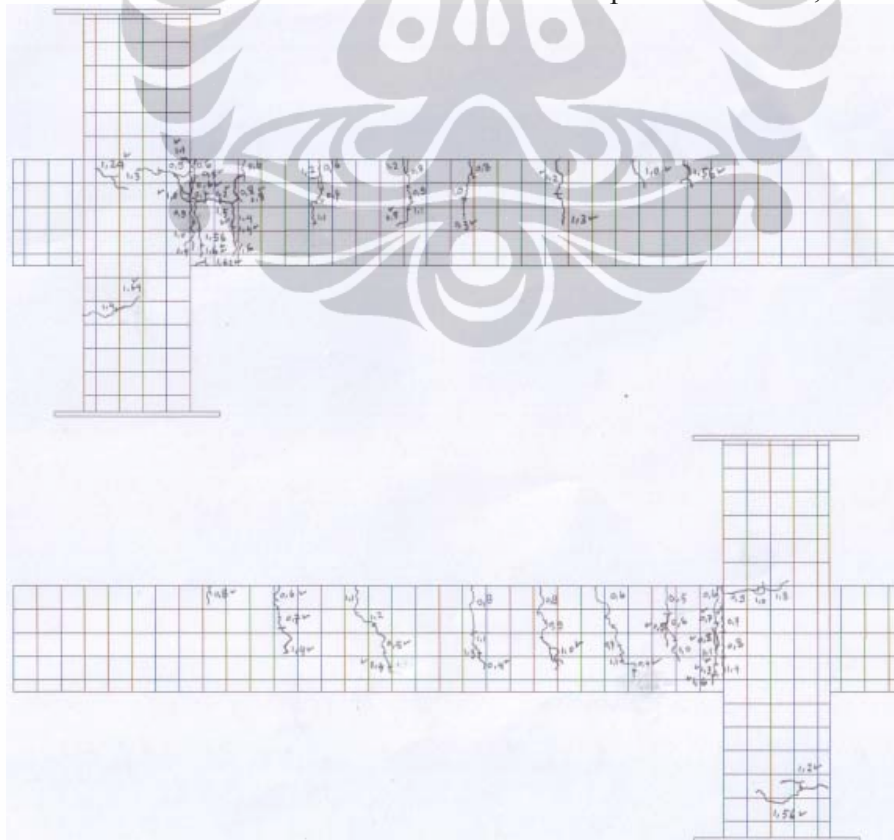
Gambar L270. Pola Retak Model-3.1 Sesudah perkuatan : $P=1,56$ kN



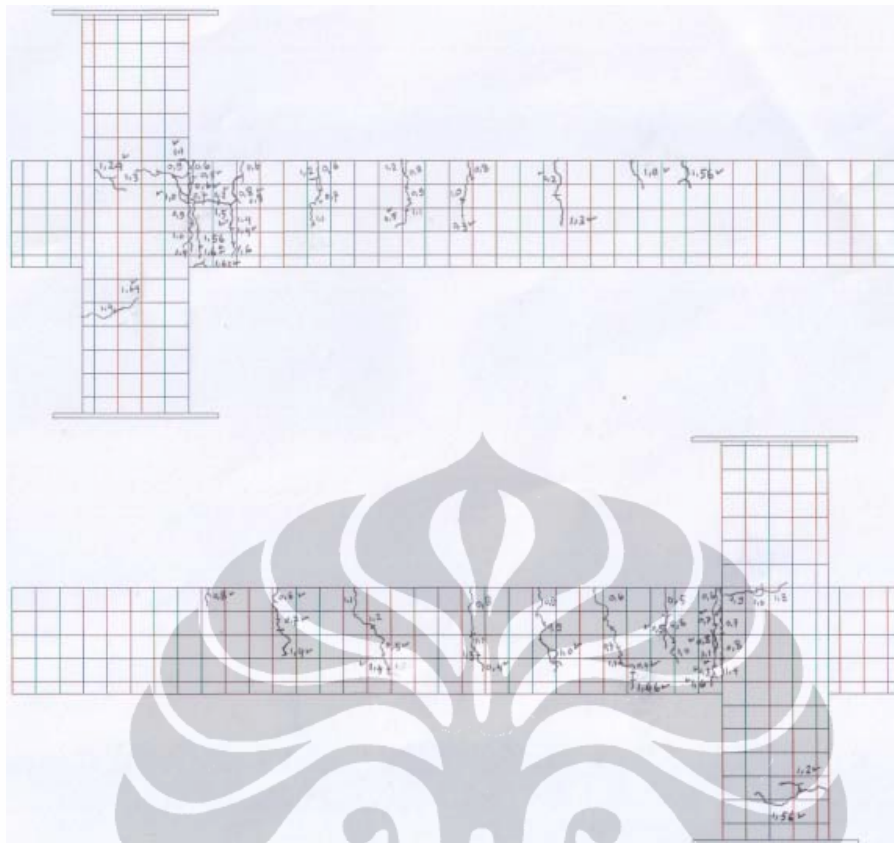
Gambar L271. Pola Retak Model-3.1 Sesudah perkuatan : $P=1,6$ kN



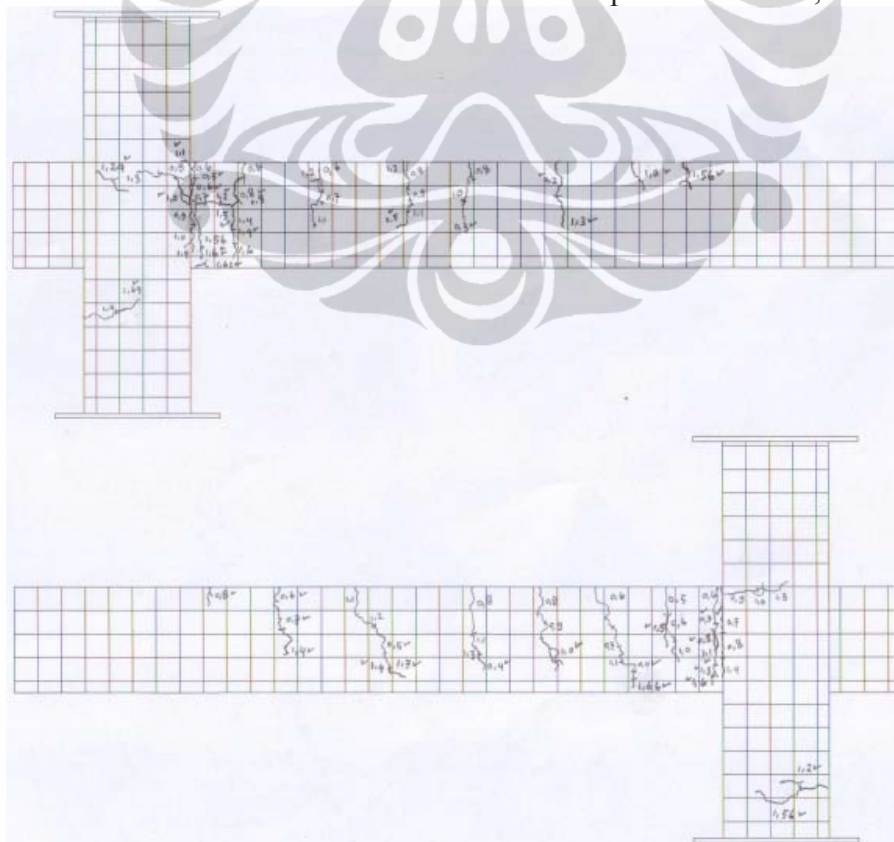
Gambar L272. Pola Retak Model-3.1 Sesudah perkuatan : $P=1,62$ kN



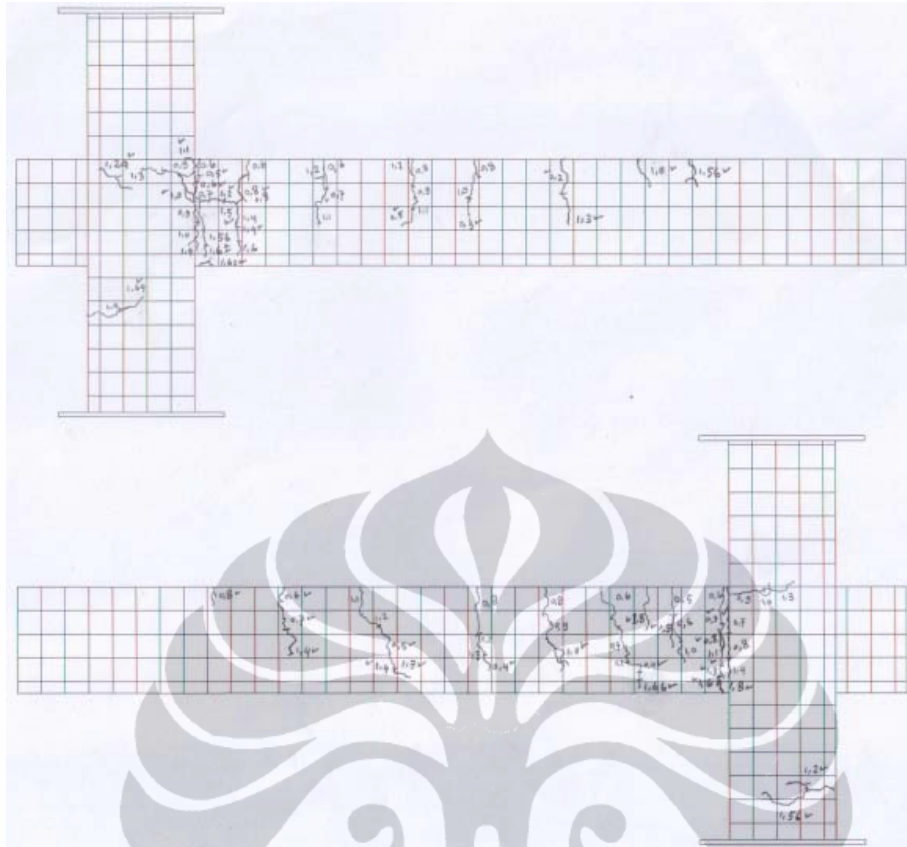
Gambar L273. Pola Retak Model-3.1 Sesudah perkuatan : $P=1,64$ kN



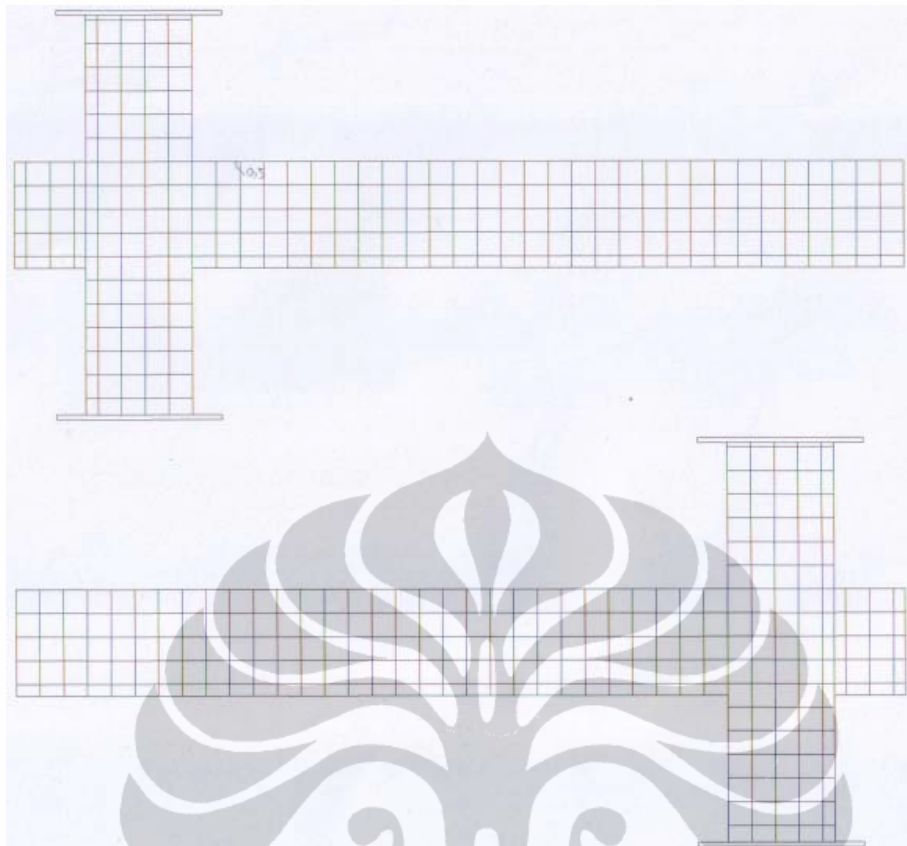
Gambar L274. Pola Retak Model-3.1 Sesudah perkuatan : $P=1,66$ kN



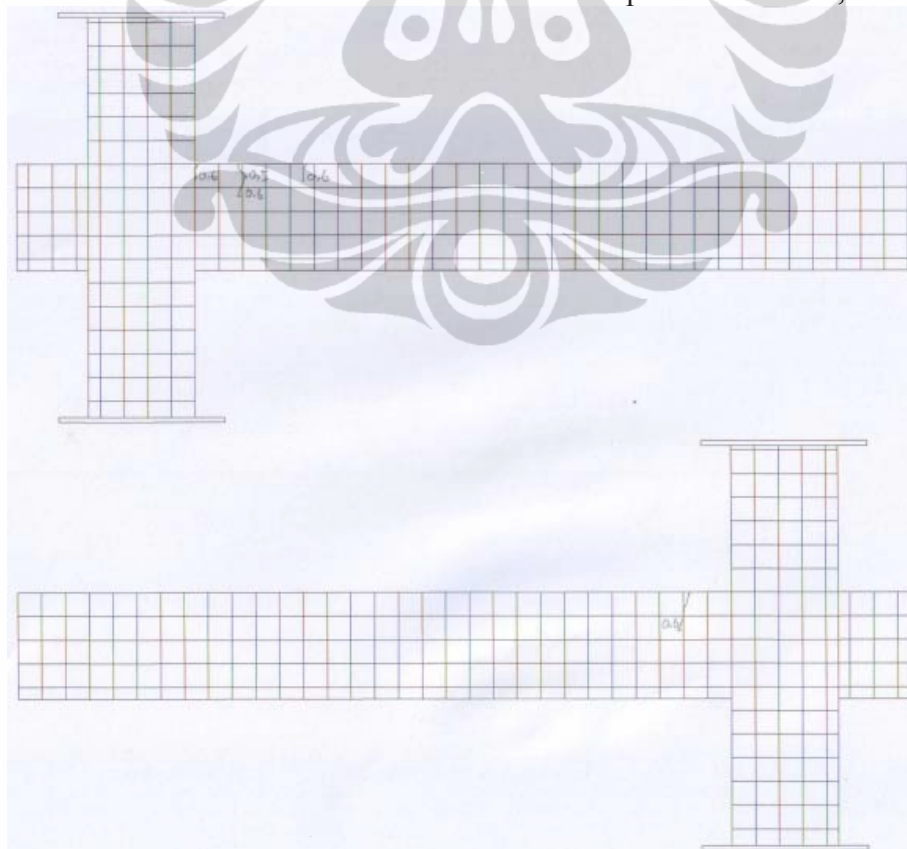
Gambar L275. Pola Retak Model-3.1 Sesudah perkuatan : $P=1,7$ kN



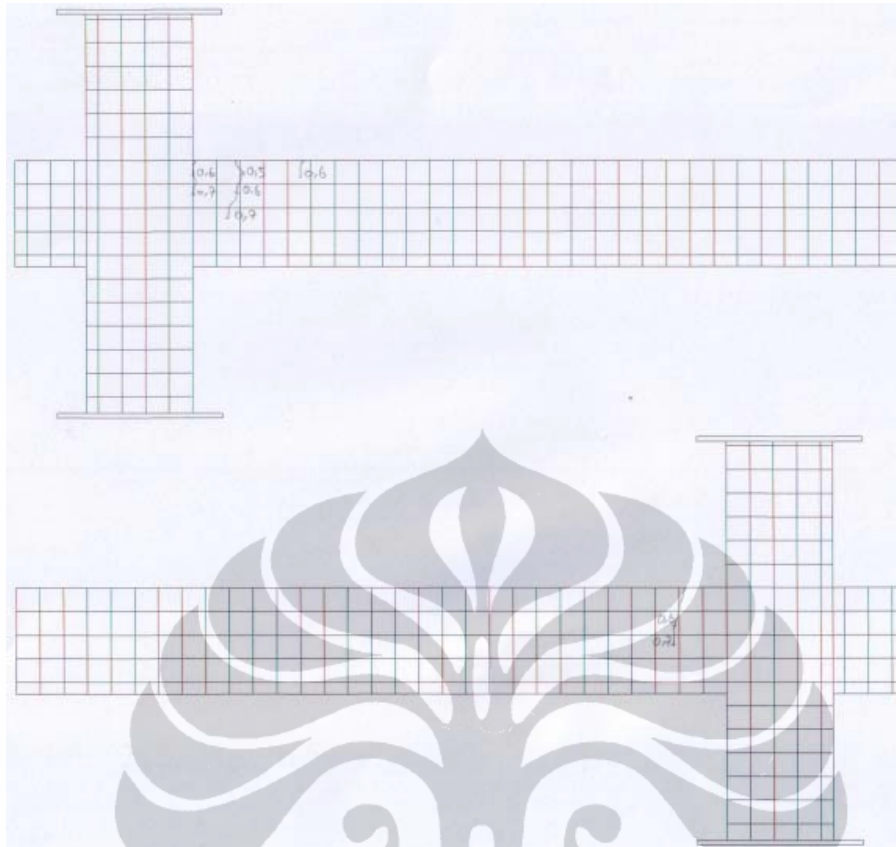
Gambar L276. Pola Retak Model-3.1 Sesudah perkuatan : $P=1,8$ kN



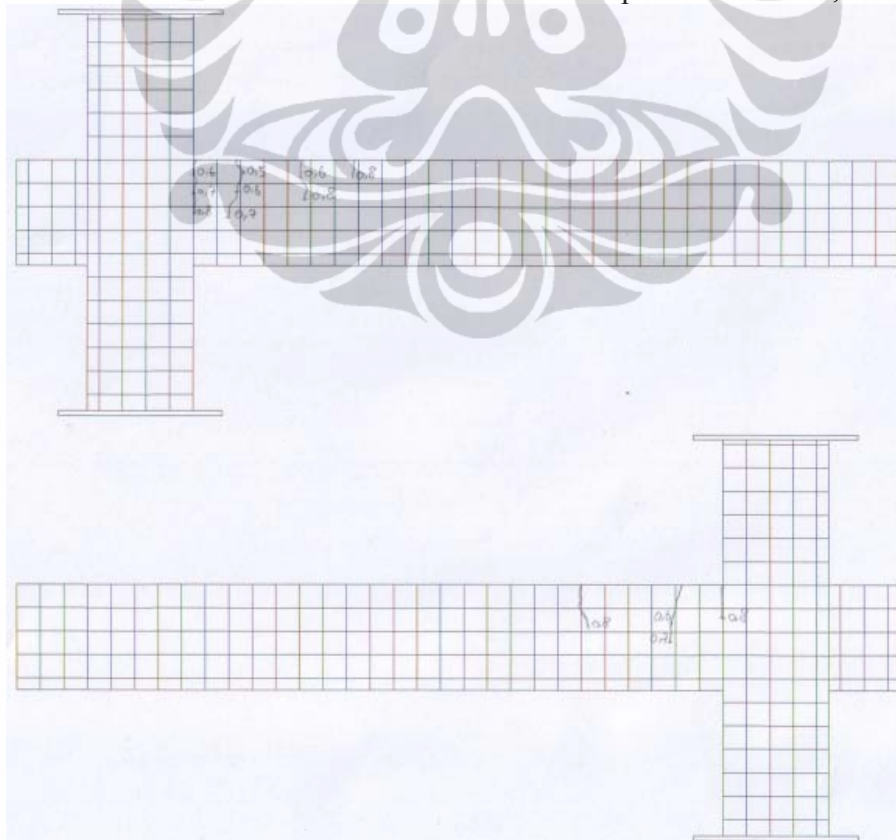
Gambar L277. Pola Retak Model-3.2. Sebelum perkuatan : $P= 0,5$ kN



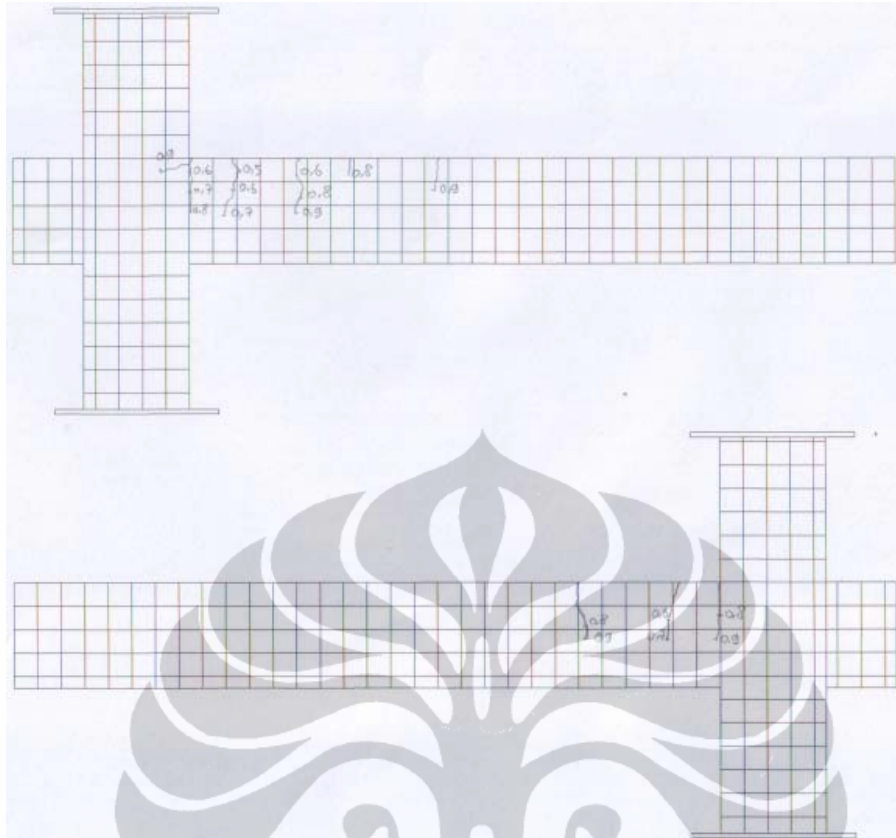
Gambar L278. Pola Retak Model-3.2. Sebelum perkuatan : $P= 0,6$ kN



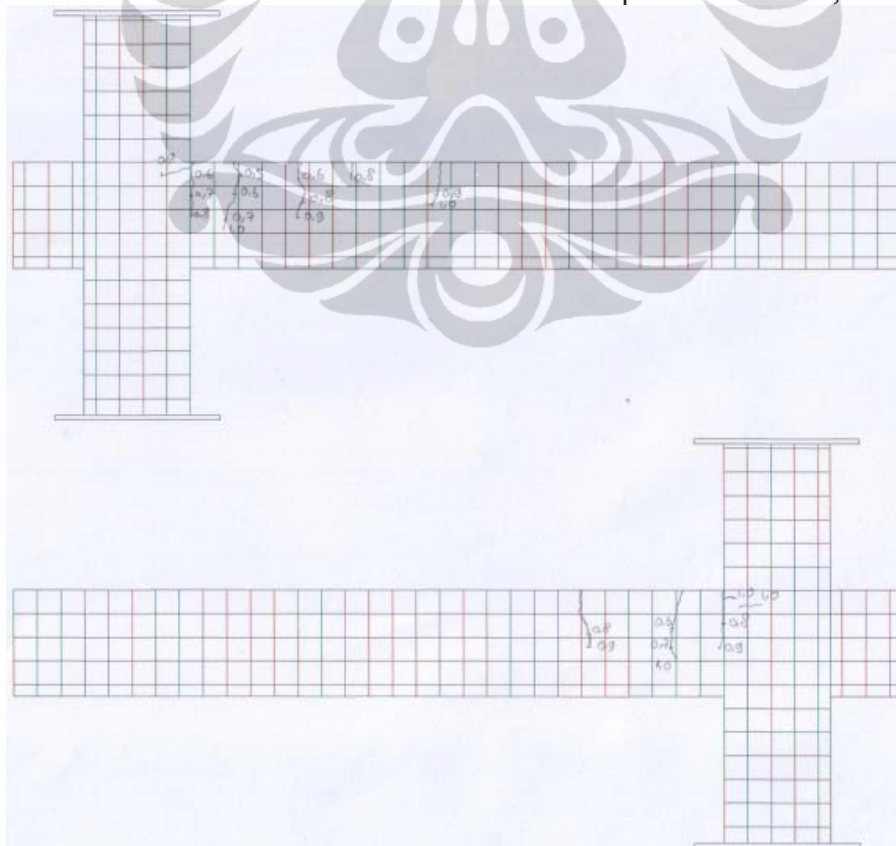
Gambar L279. Pola Retak Model-3.2. Sebelum perkuatan : $P= 0,7 \text{ kN}$



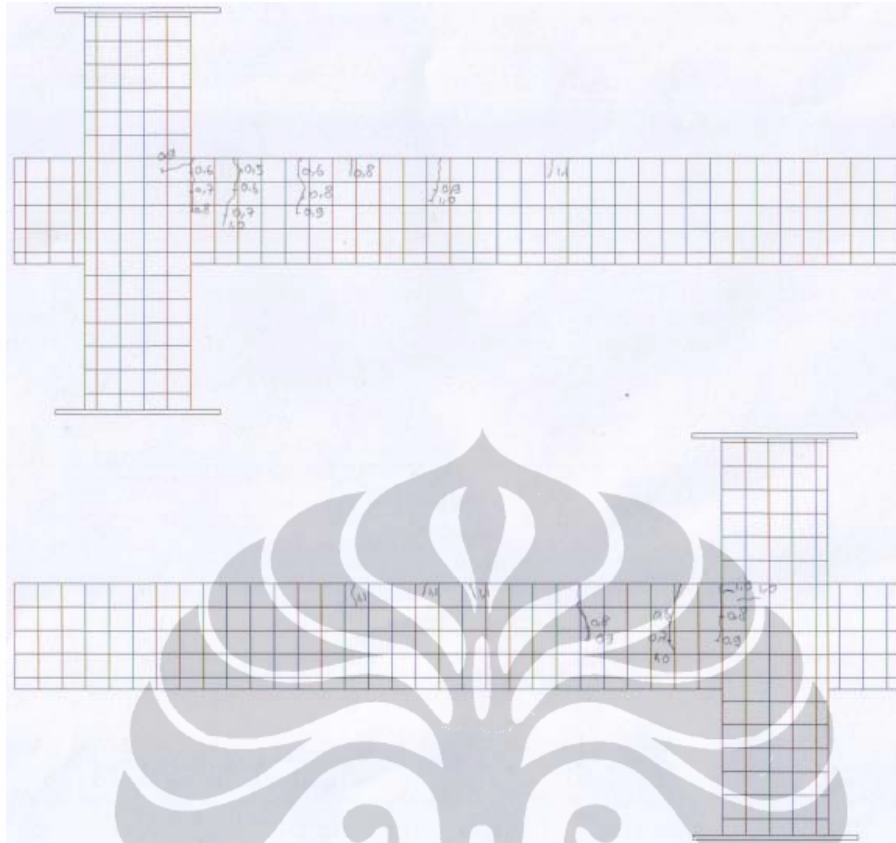
Gambar L280. Pola Retak Model-3.2. Sebelum perkuatan : $P= 0,8 \text{ kN}$



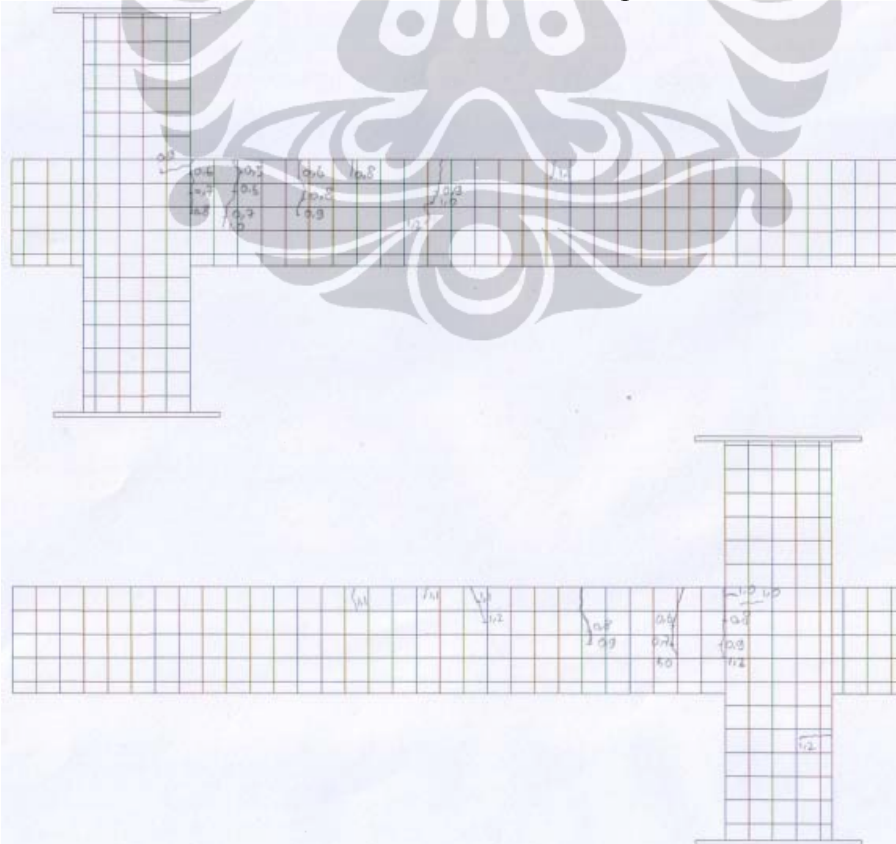
Gambar L281. Pola Retak Model-3.2. Sebelum perkuatan : $P= 0,9 \text{ kN}$



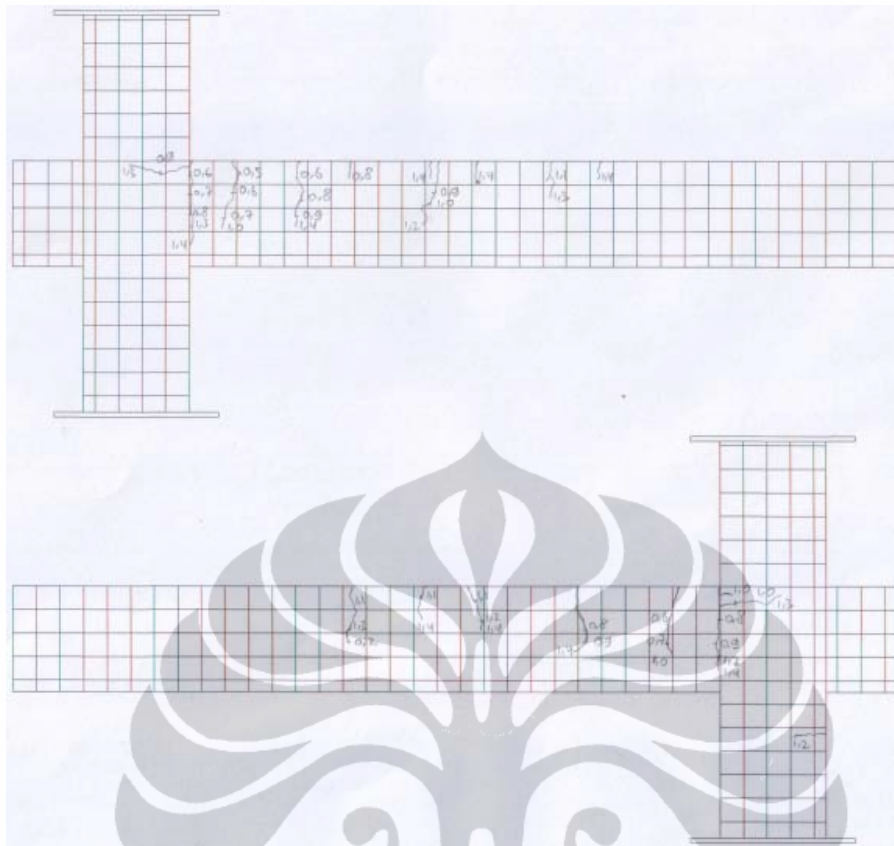
Gambar L282. Pola Retak Model-3.2. Sebelum perkuatan : $P= 1,0 \text{ kN}$



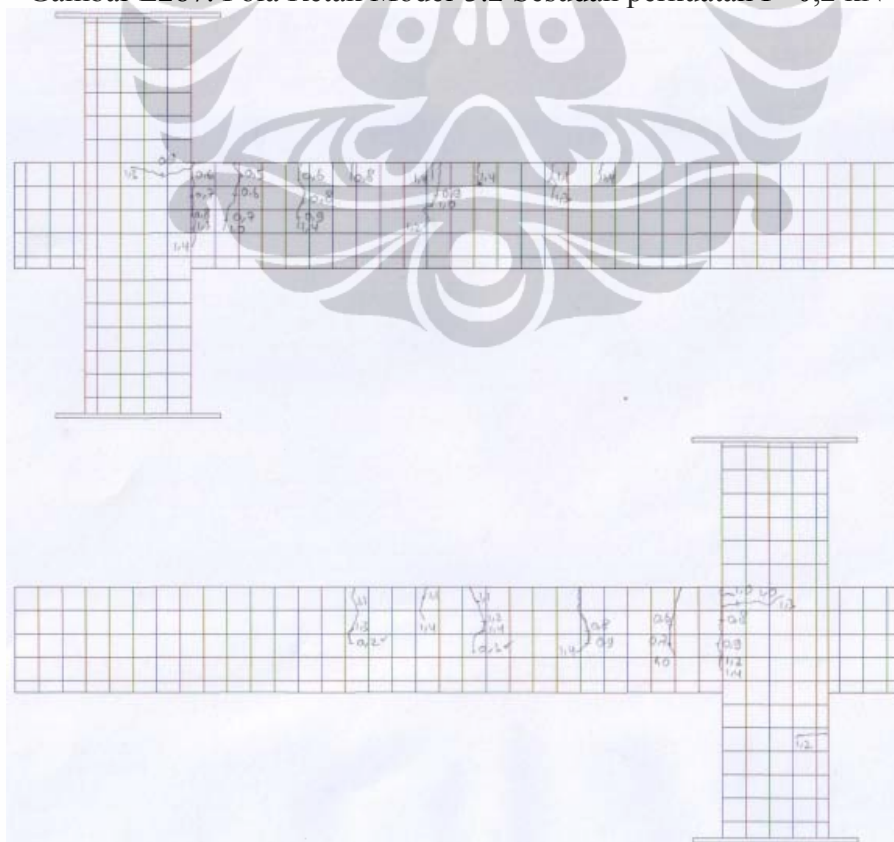
Gambar L283. Pola Retak Model-3.2. Sebelum perkuatan : $P= 1,1 \text{ kN}$



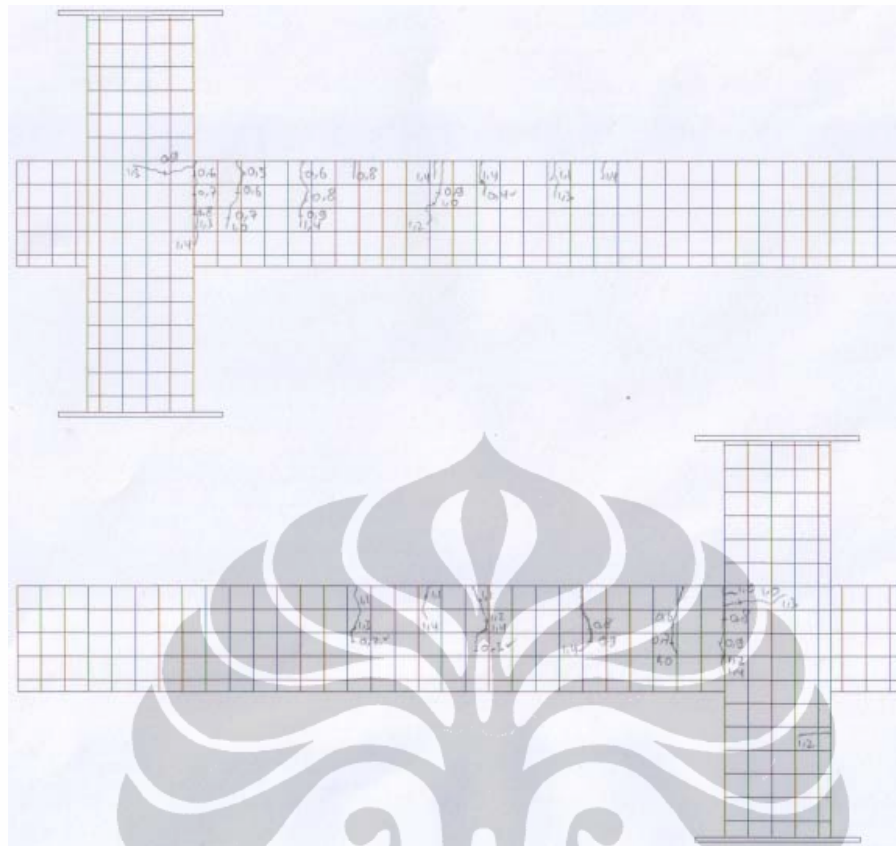
Gambar L284. Pola Retak Model-3.2. Sebelum perkuatan : $P= 1,2 \text{ kN}$



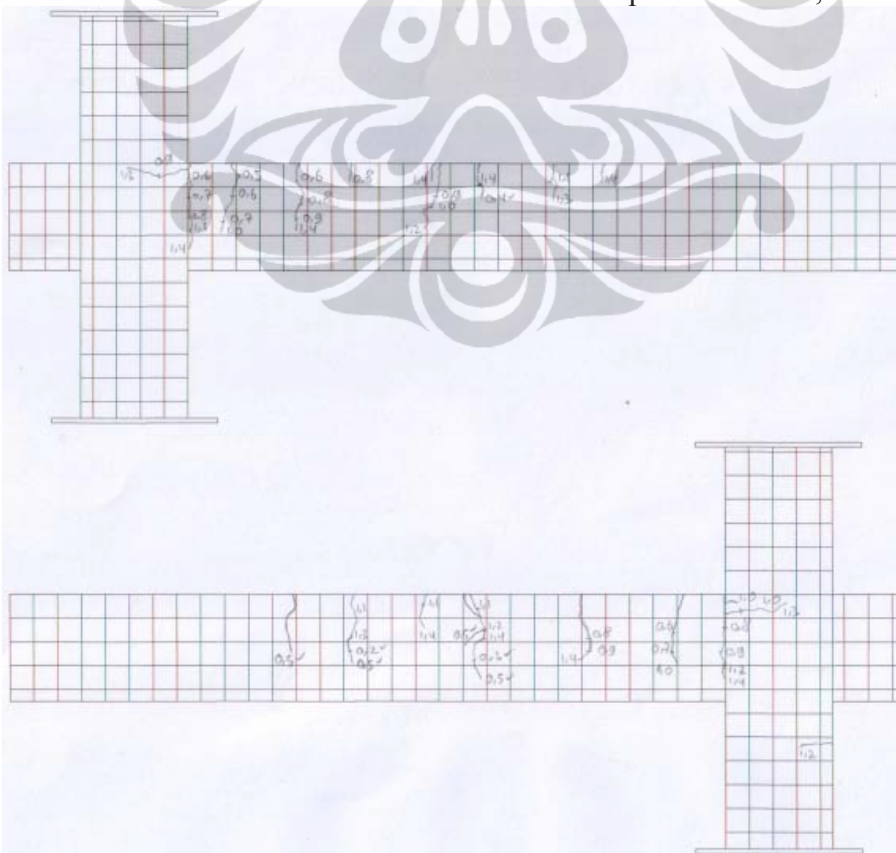
Gambar L287. Pola Retak Model-3.2 Sesudah perkuatan $P=0,2$ kN



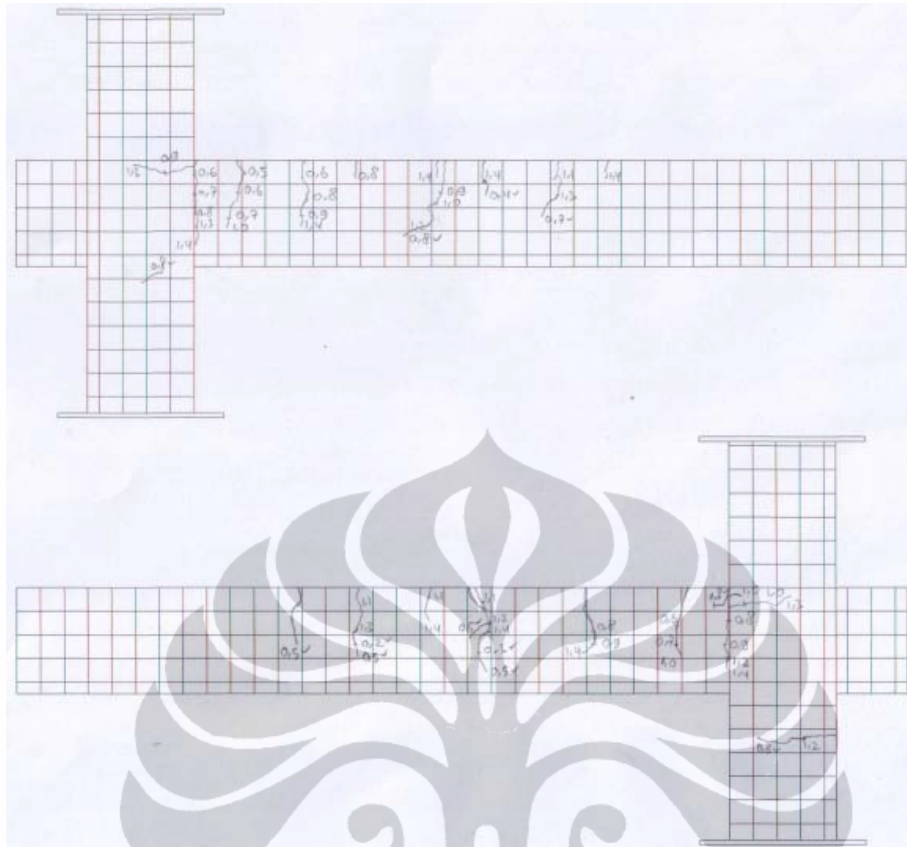
Gambar L288. Pola Retak Model-3.2 Sesudah perkuatan $P=0,3$ kN



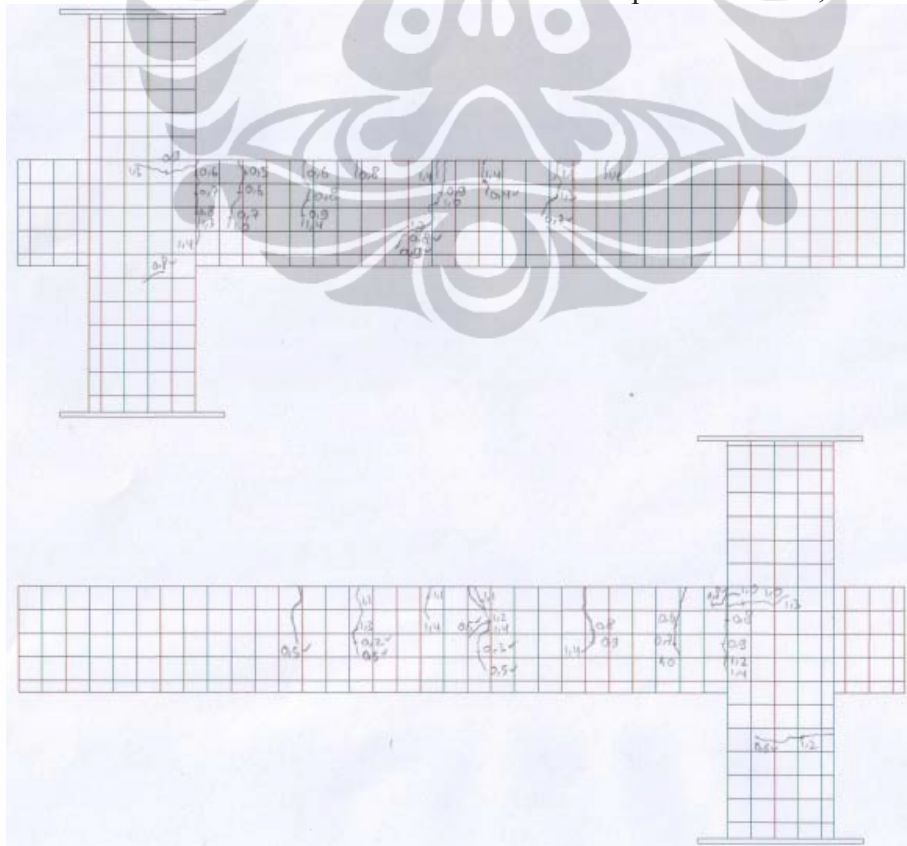
Gambar L289. Pola Retak Model-3.2 Sesudah perkuatan $P=0,4$ kN



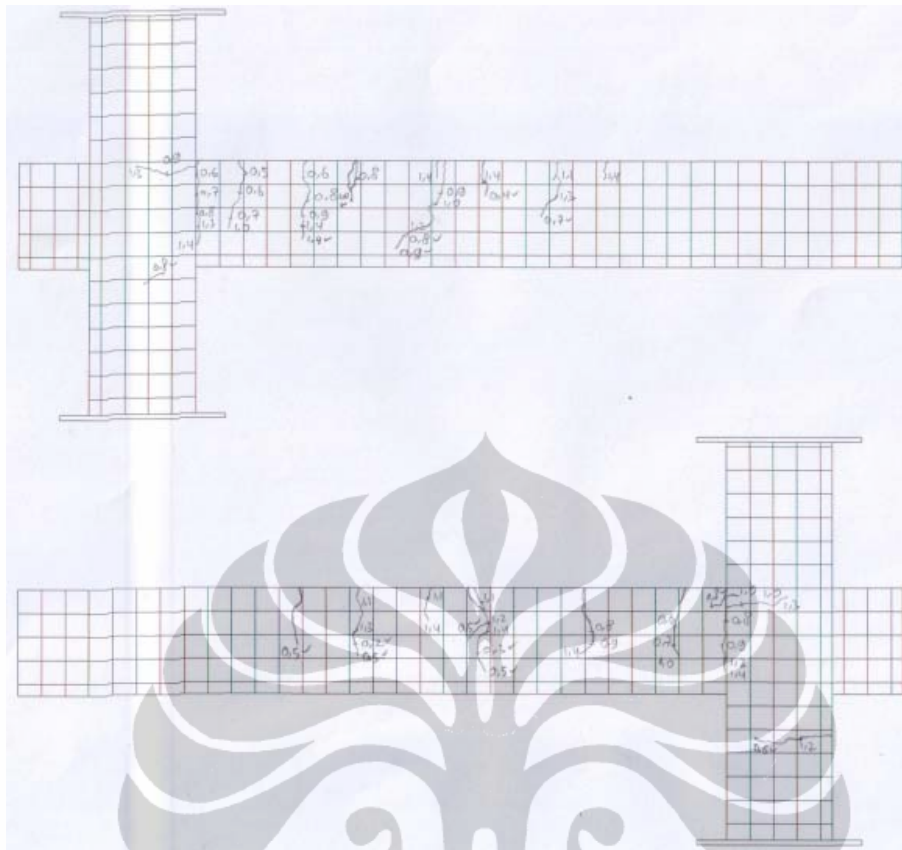
Gambar L290. Pola Retak Model-3.2 Sesudah perkuatan $P=0,5$ kN



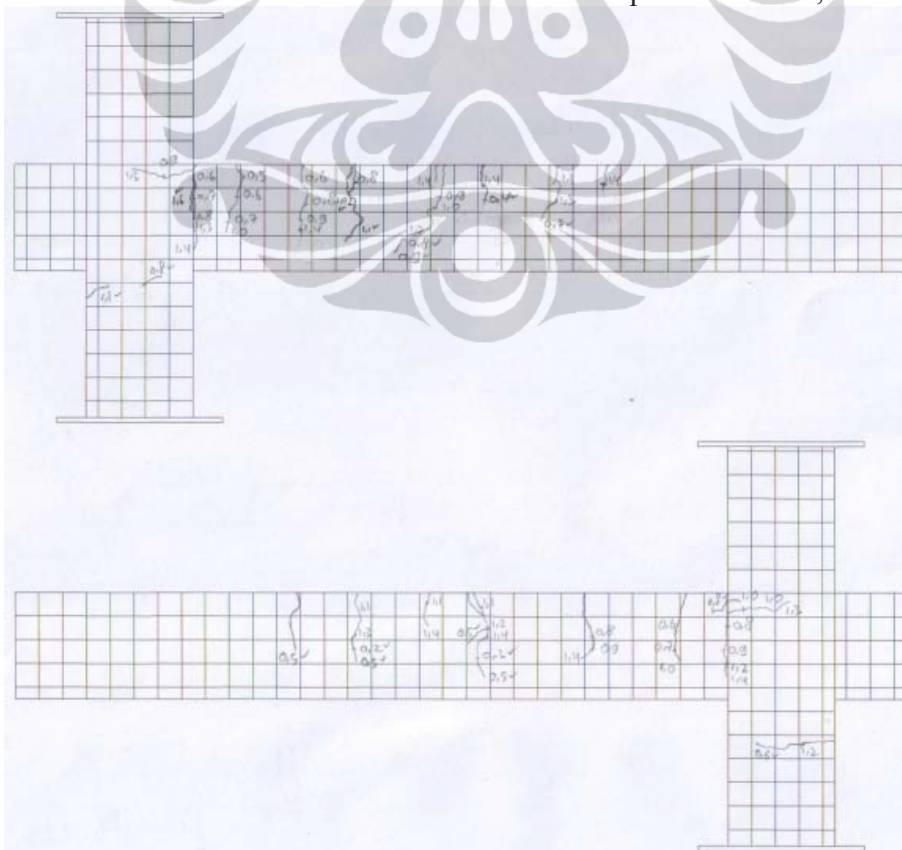
Gambar L293. Pola Retak Model-3.2 Sesudah perkuatan $P=0,8$ kN



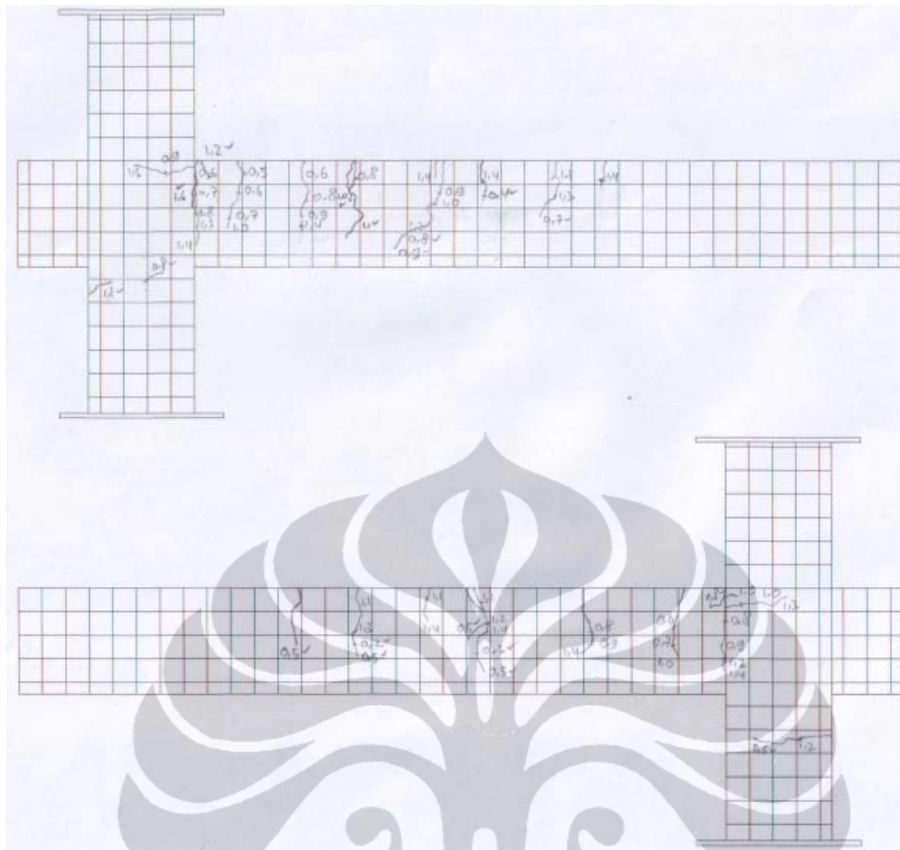
Gambar L294. Pola Retak Model-3.2 Sesudah perkuatan $P=0,9$ kN



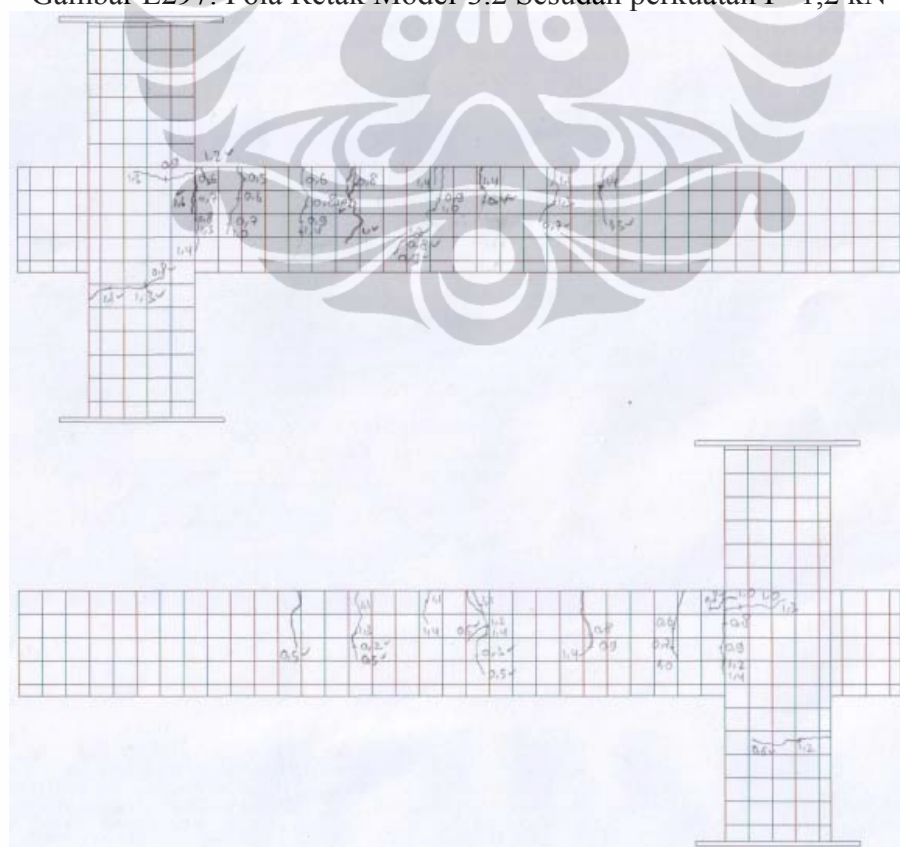
Gambar L295. Pola Retak Model-3.2 Sesudah perkuatan $P=1,0$ kN



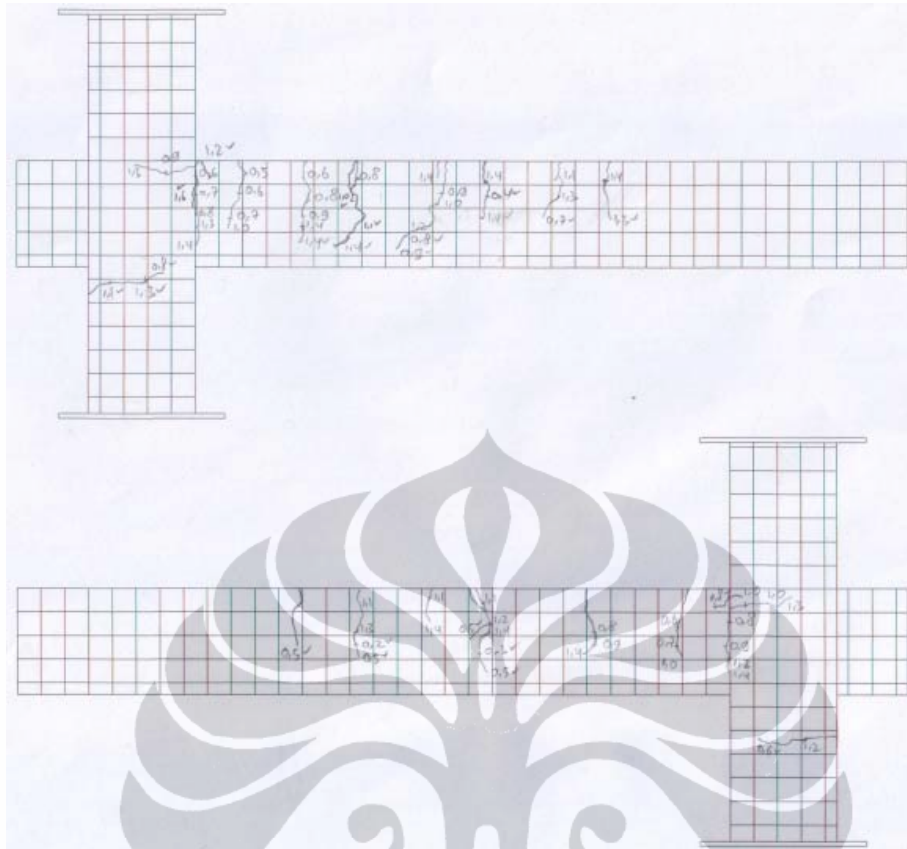
Gambar L296. Pola Retak Model-3.2 Sesudah perkuatan $P=1,1$ kN



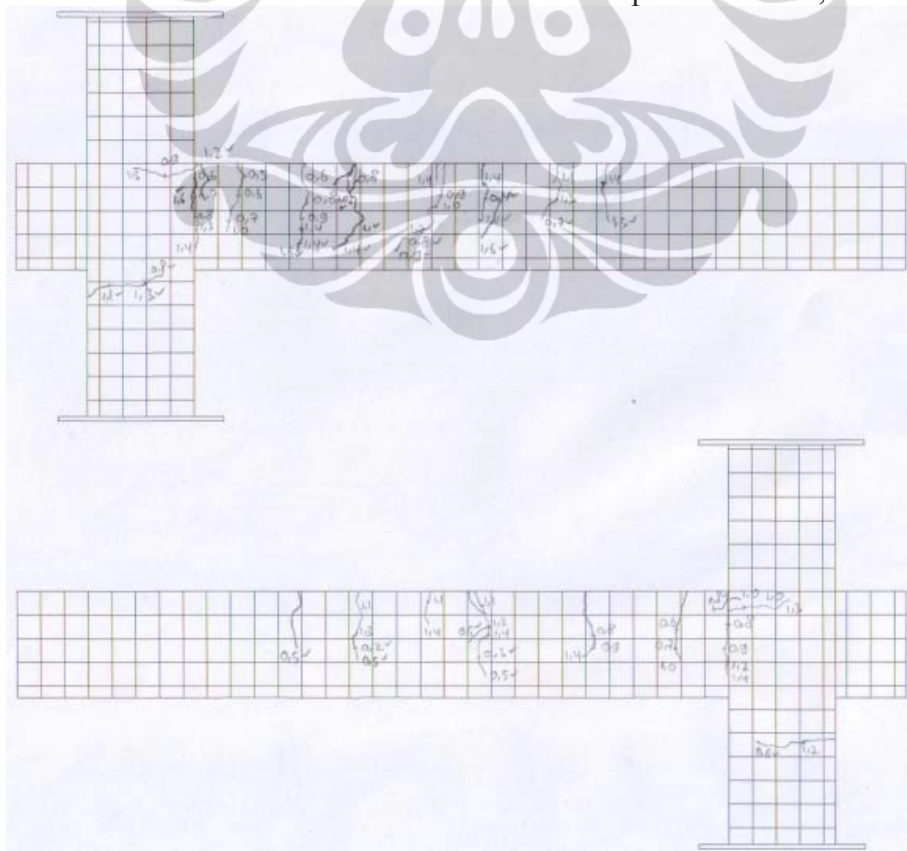
Gambar L297. Pola Retak Model-3.2 Sesudah perkuatan $P=1,2$ kN



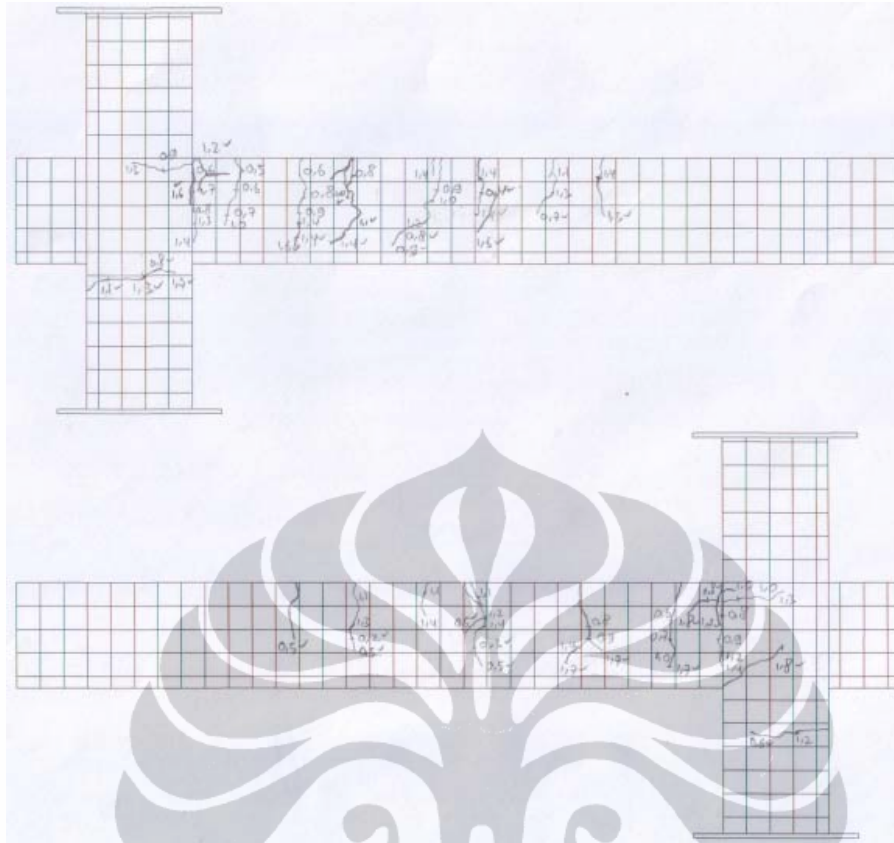
Gambar L298. Pola Retak Model-3.2 Sesudah perkuatan $P=1,3$ kN



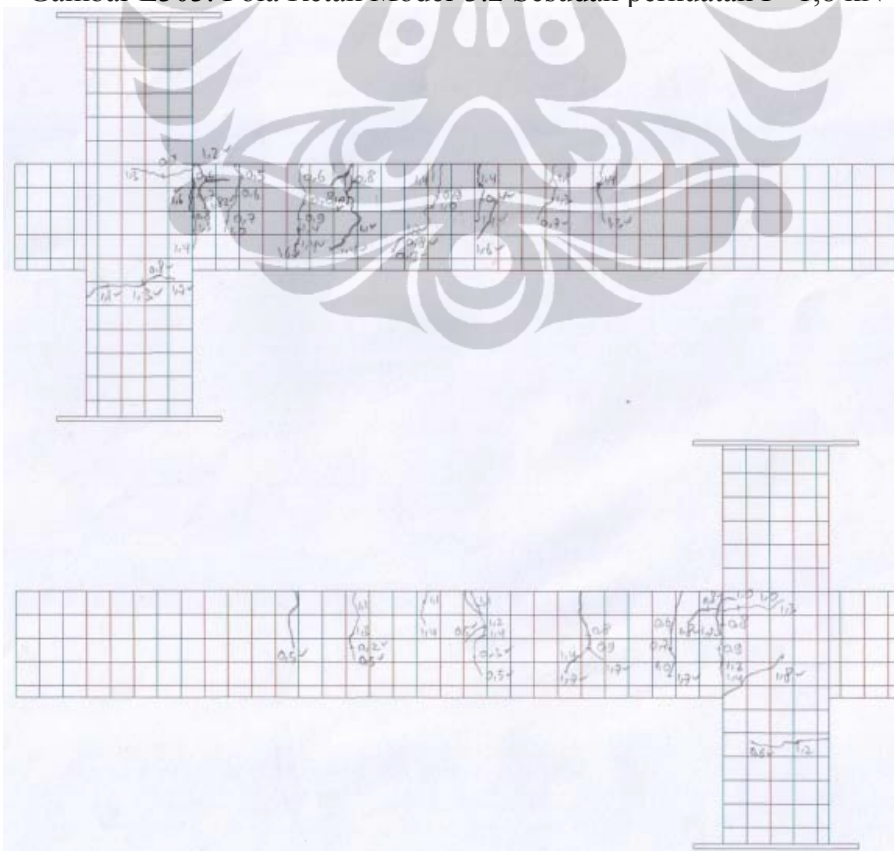
Gambar L299. Pola Retak Model-3.2 Sesudah perkuatan $P=1,4$ kN



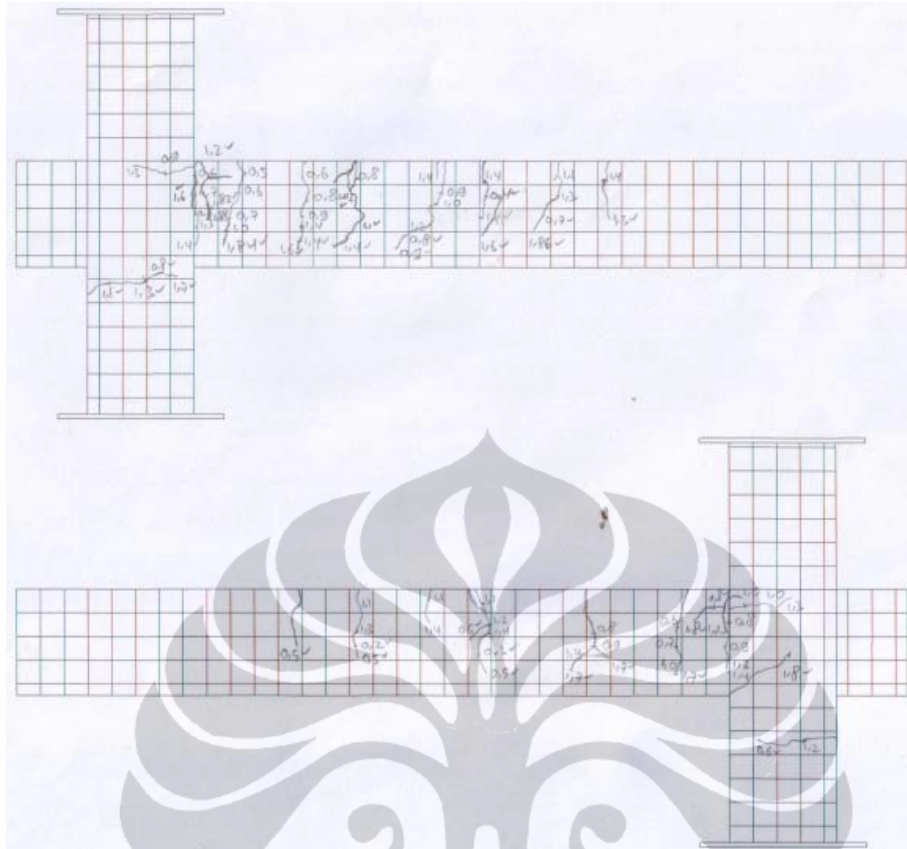
Gambar L300. Pola Retak Model-3.2 Sesudah perkuatan $P=1,5$ kN



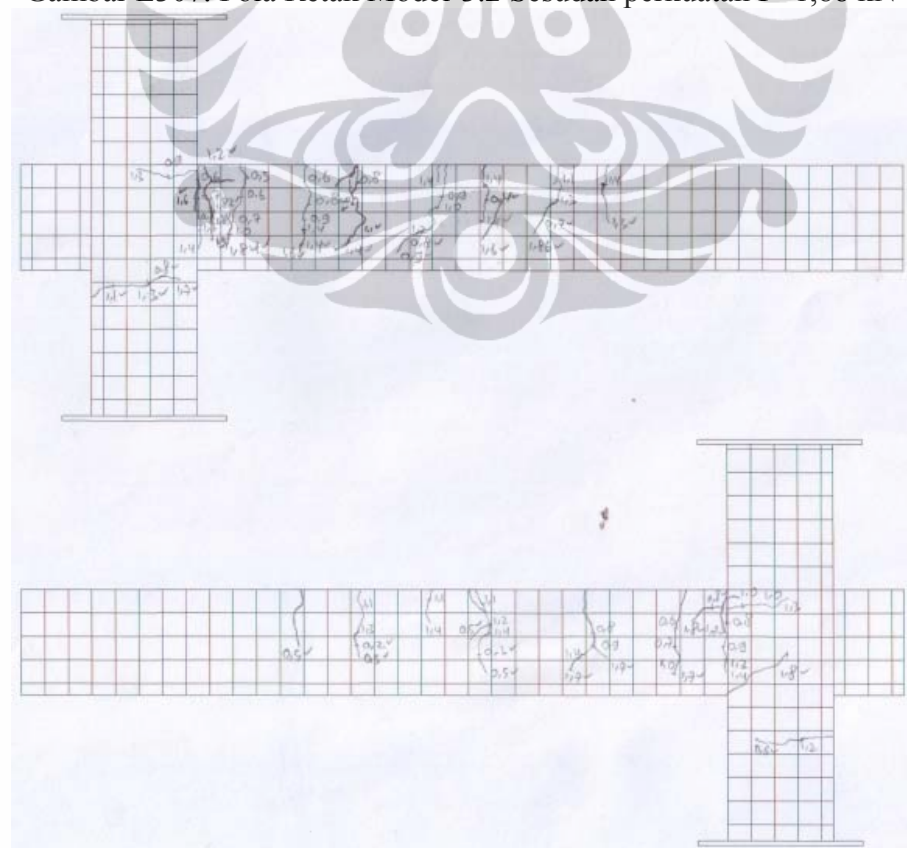
Gambar L303. Pola Retak Model-3.2 Sesudah perkuatan $P=1,8$ kN



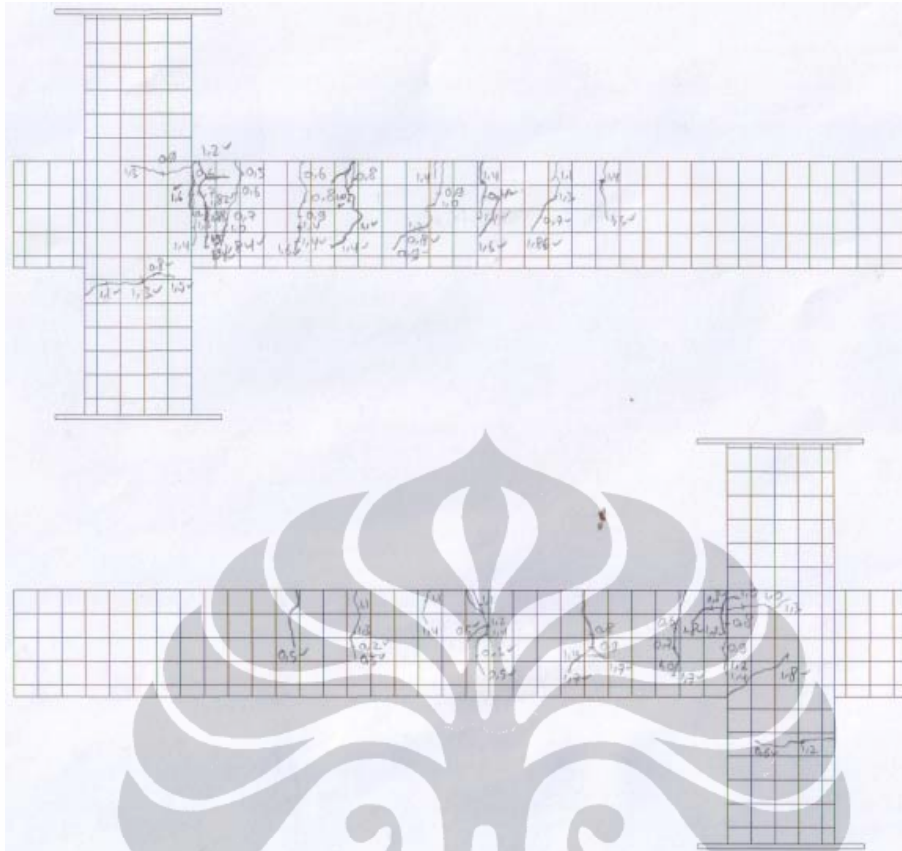
Gambar L304. Pola Retak Model-3.2 Sesudah perkuatan $P=1,82$ kN



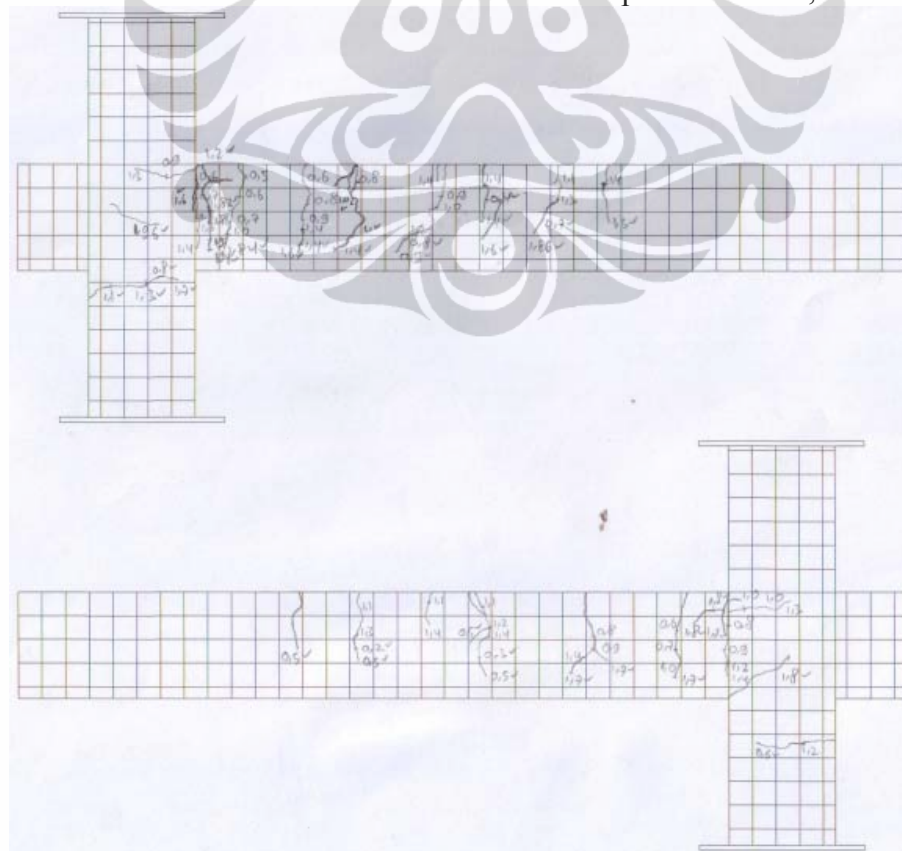
Gambar L307. Pola Retak Model-3.2 Sesudah perkuatan $P=1,88$ kN



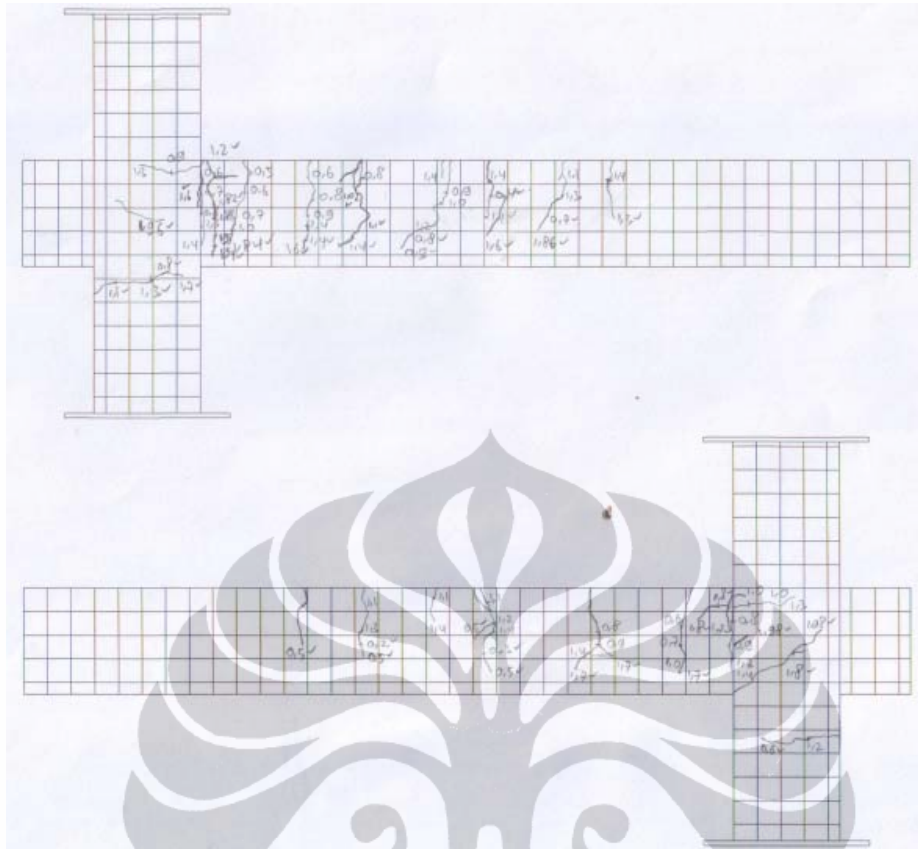
Gambar L308. Pola Retak Model-3.2 Sesudah perkuatan $P=1,9$ kN



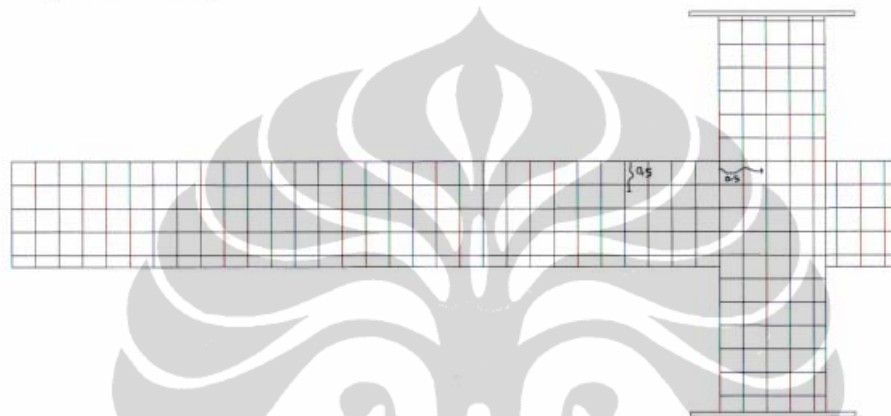
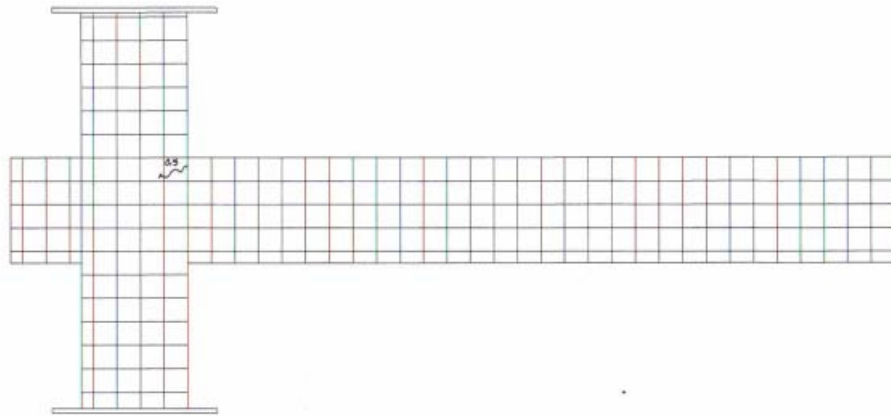
Gambar L309. Pola Retak Model-3.2 Sesudah perkuatan $P=1,94$ kN



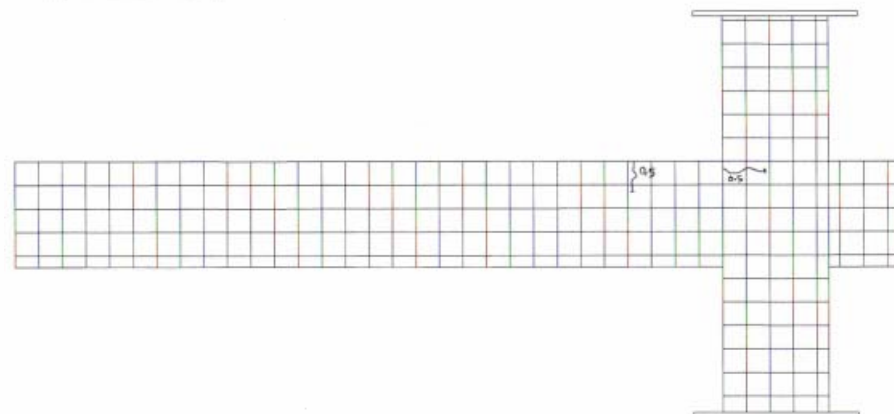
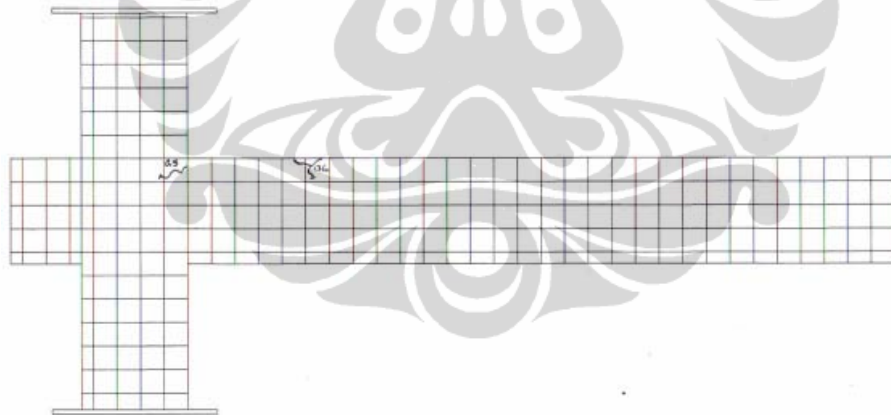
Gambar L310. Pola Retak Model-3.2 Sesudah perkuatan $P=1,96$ kN



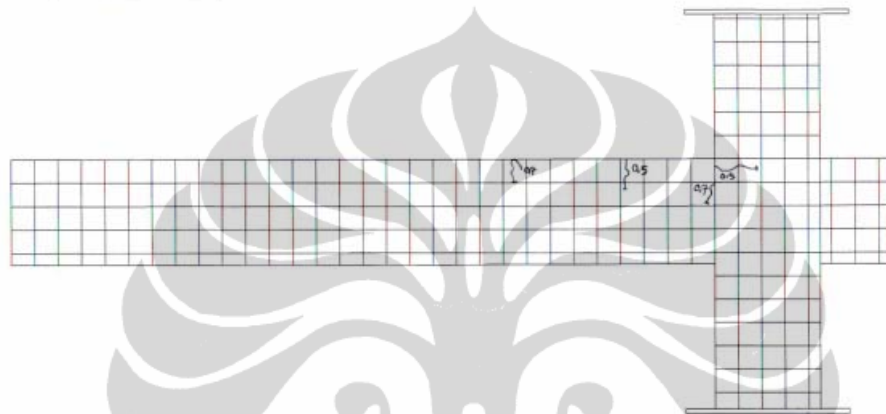
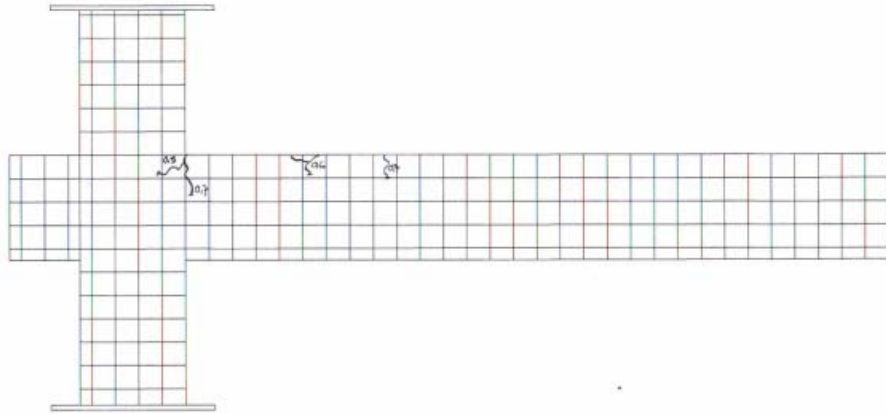
Gambar L311. Pola Retak Model-3.2 Sesudah perkuatan $P=1,98$ kN



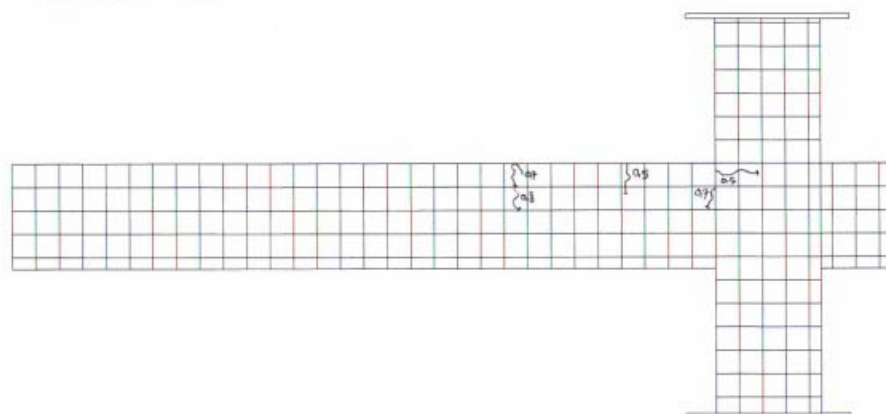
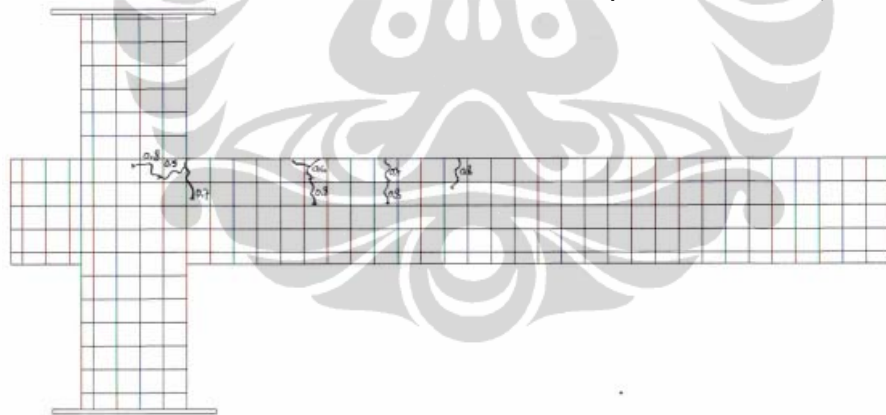
Gambar L312. Pola Retak Model-3.3 Sebelum perkuatan : $P= 0,5$ kN



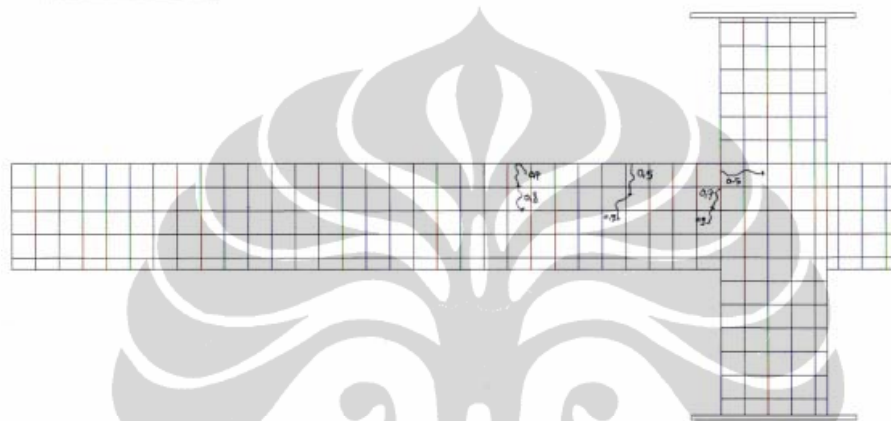
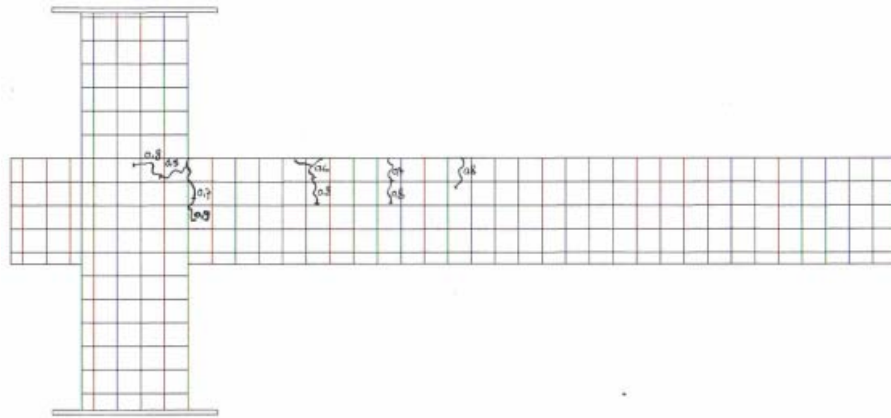
Gambar L313. Pola Retak Model-3.3 Sebelum perkuatan : $P= 0,6$ kN



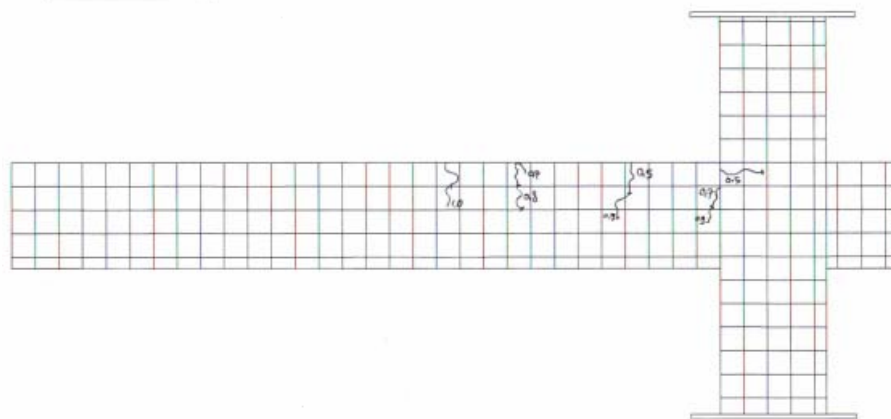
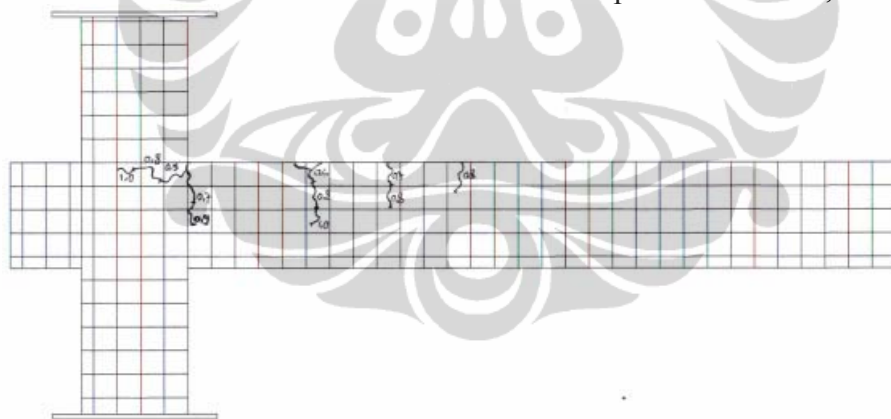
Gambar L314. Pola Retak Model-3.3 Sebelum perkuatan : $P= 0,7$ kN



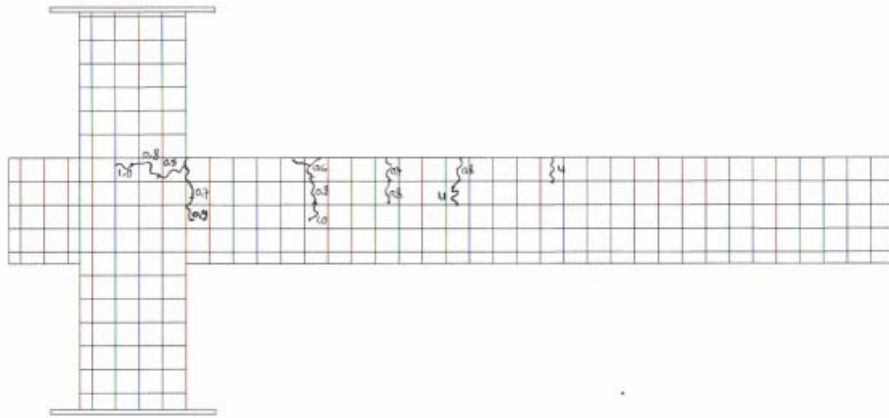
Gambar L315. Pola Retak Model-3.3 Sebelum perkuatan : $P= 0,8$ kN



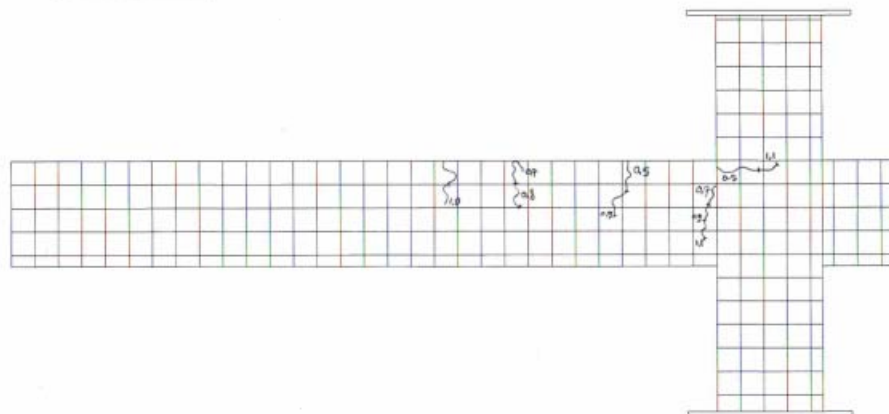
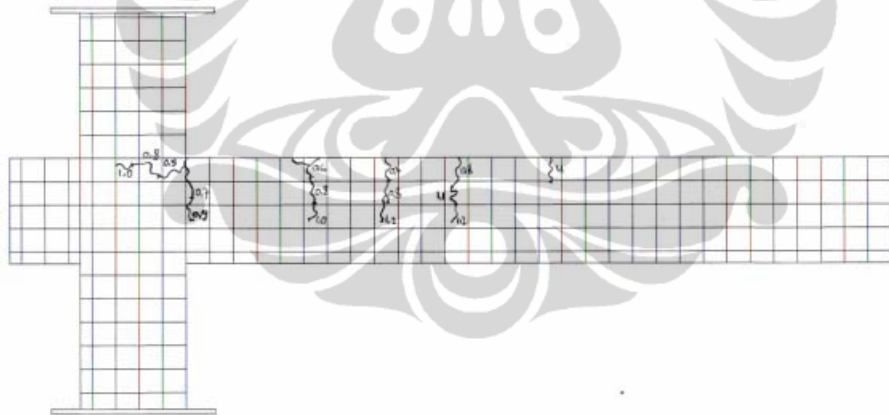
Gambar L316. Pola Retak Model-3.3 Sebelum perkuatan : $P= 0,9$ kN



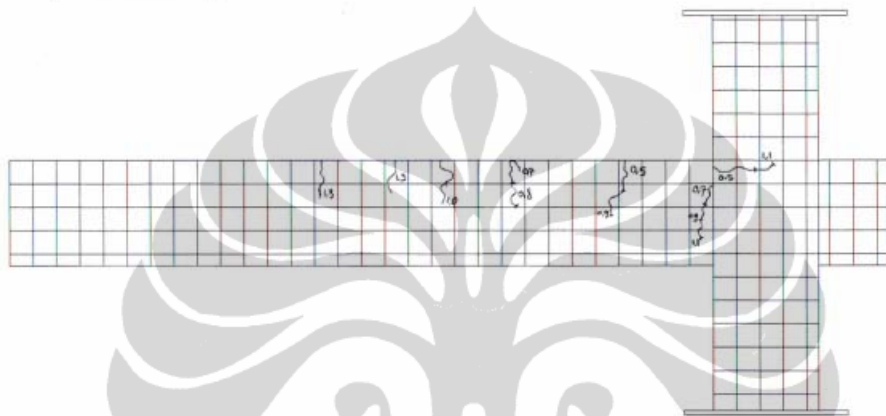
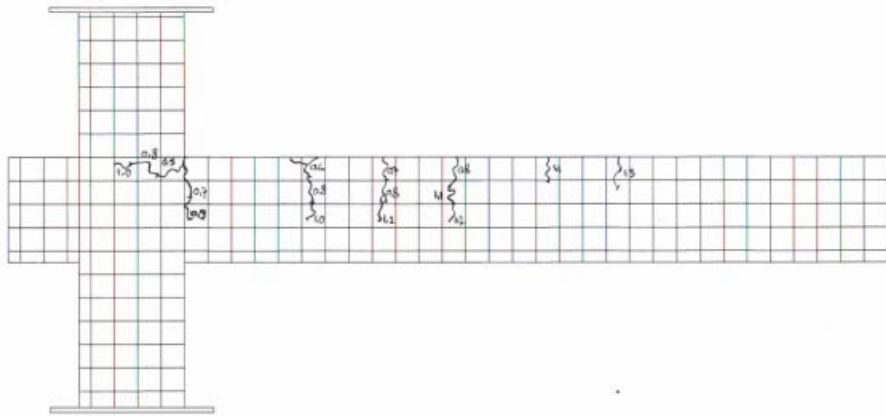
Gambar L317. Pola Retak Model-3.3 Sebelum perkuatan : $P= 1,0$ kN



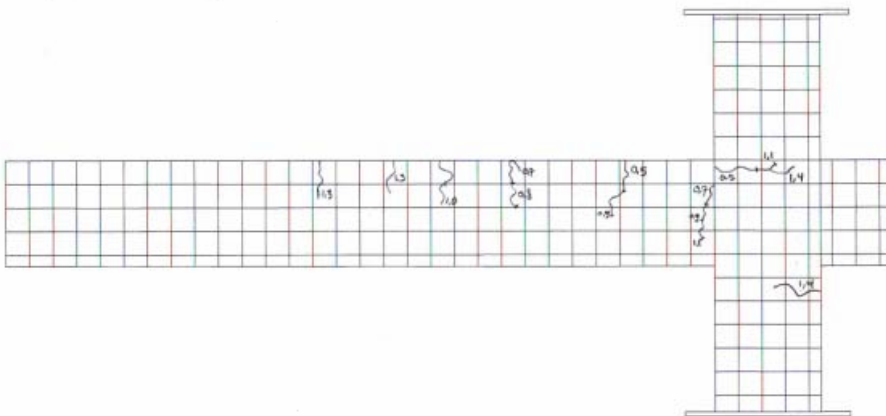
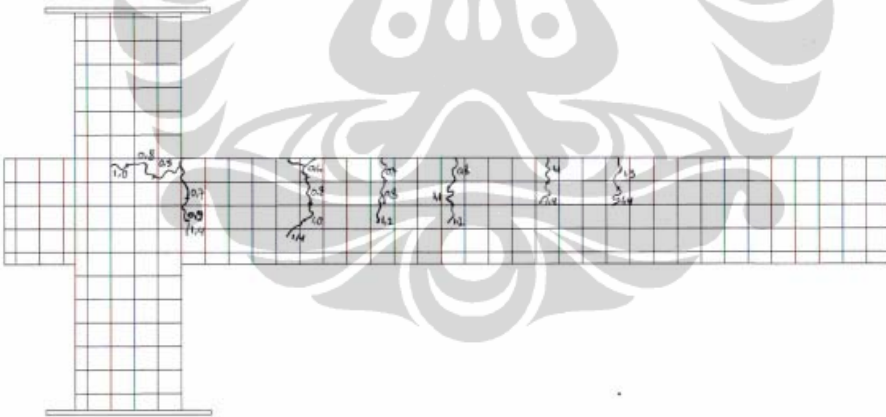
Gambar L318. Pola Retak Model-3.3 Sebelum perkuatan : $P= 1,1$ kN



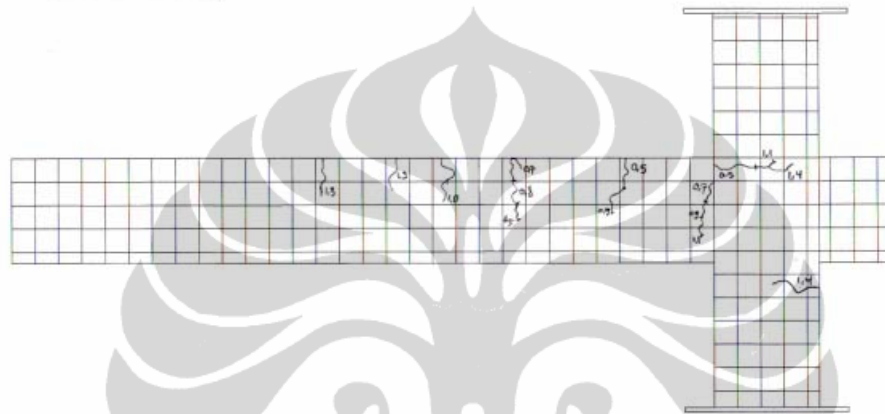
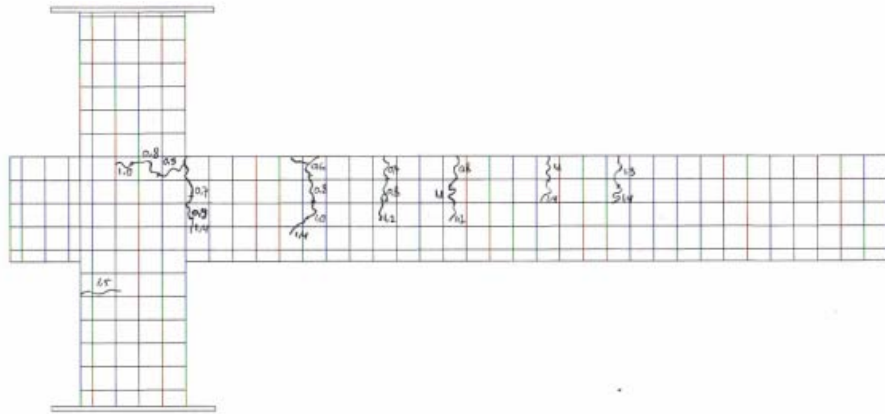
Gambar L319. Pola Retak Model-3.3 Sebelum perkuatan : $P= 1,2$ kN



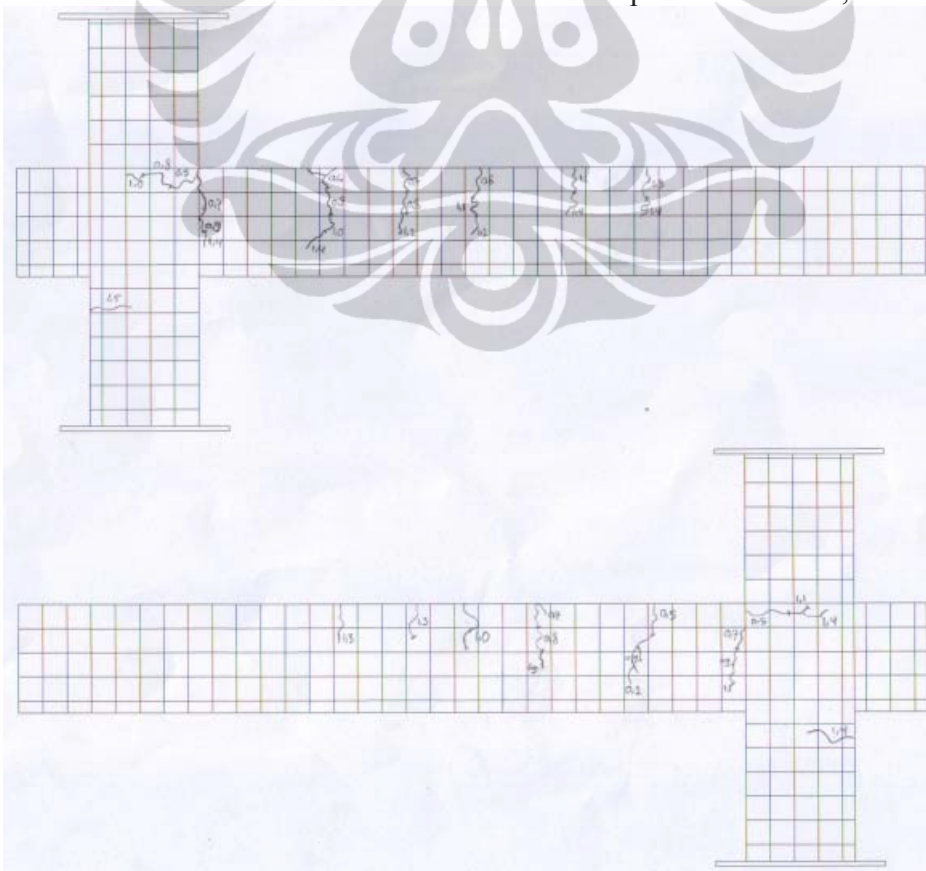
Gambar L320. Pola Retak Model-3.3 Sebelum perkuatan : $P= 1,3 \text{ kN}$



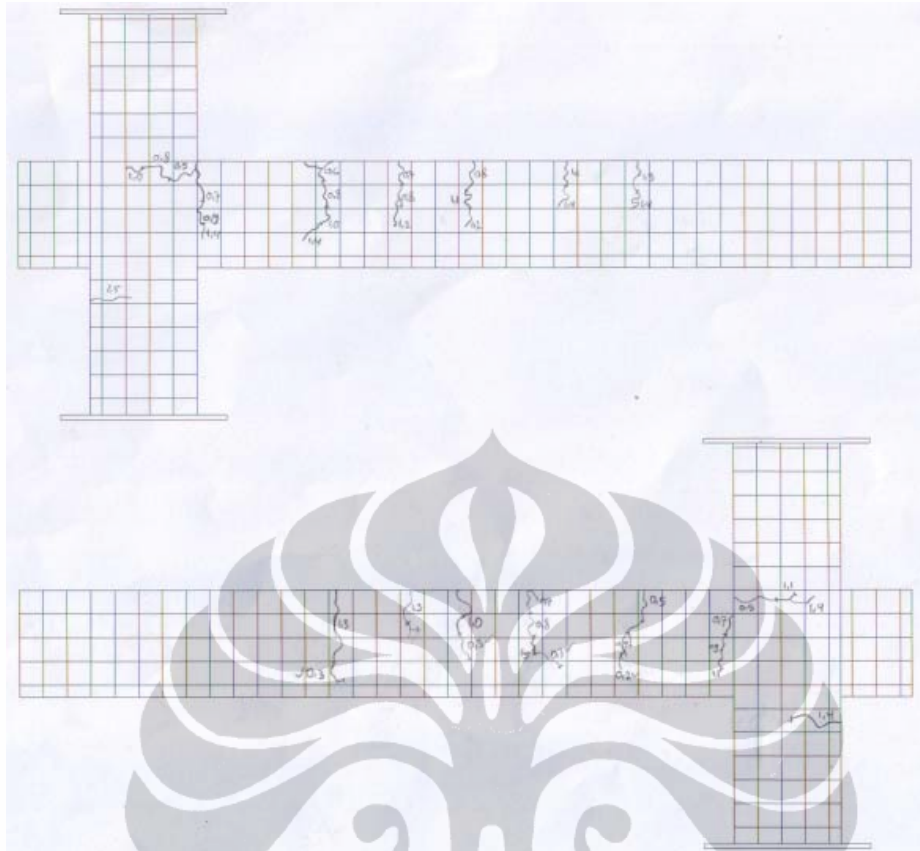
Gambar L321. Pola Retak Model-3.3 Sebelum perkuatan : $P= 1,4 \text{ kN}$



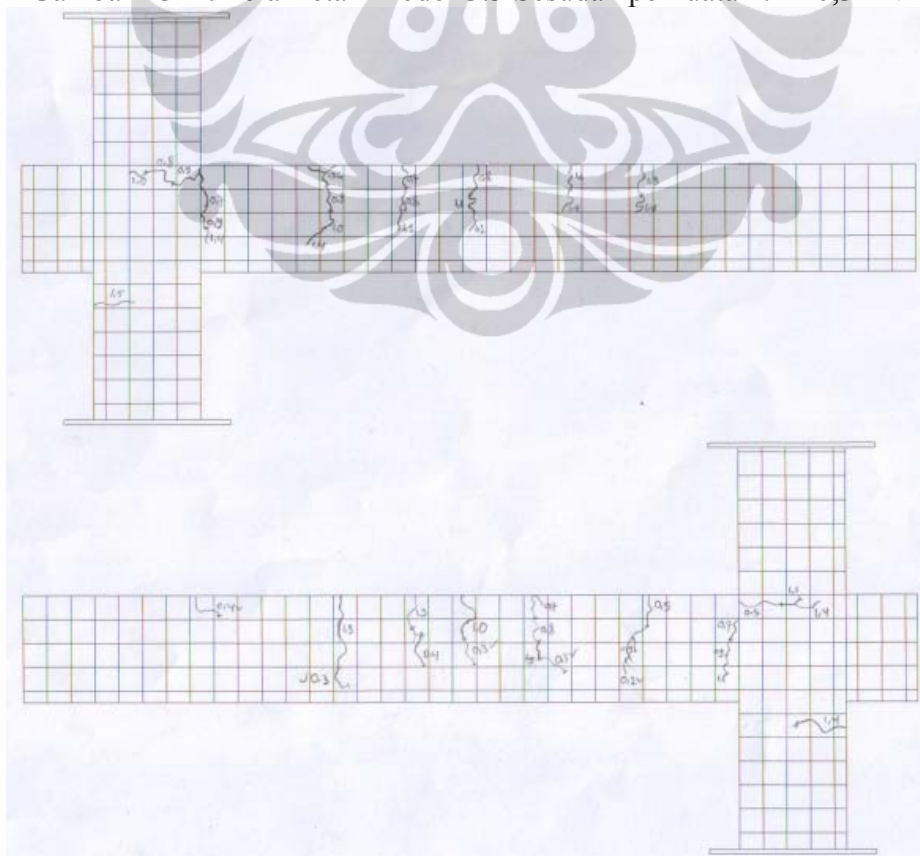
Gambar L322. Pola Retak Model-3.3 Sebelum perkuatan : $P= 1,5$ kN



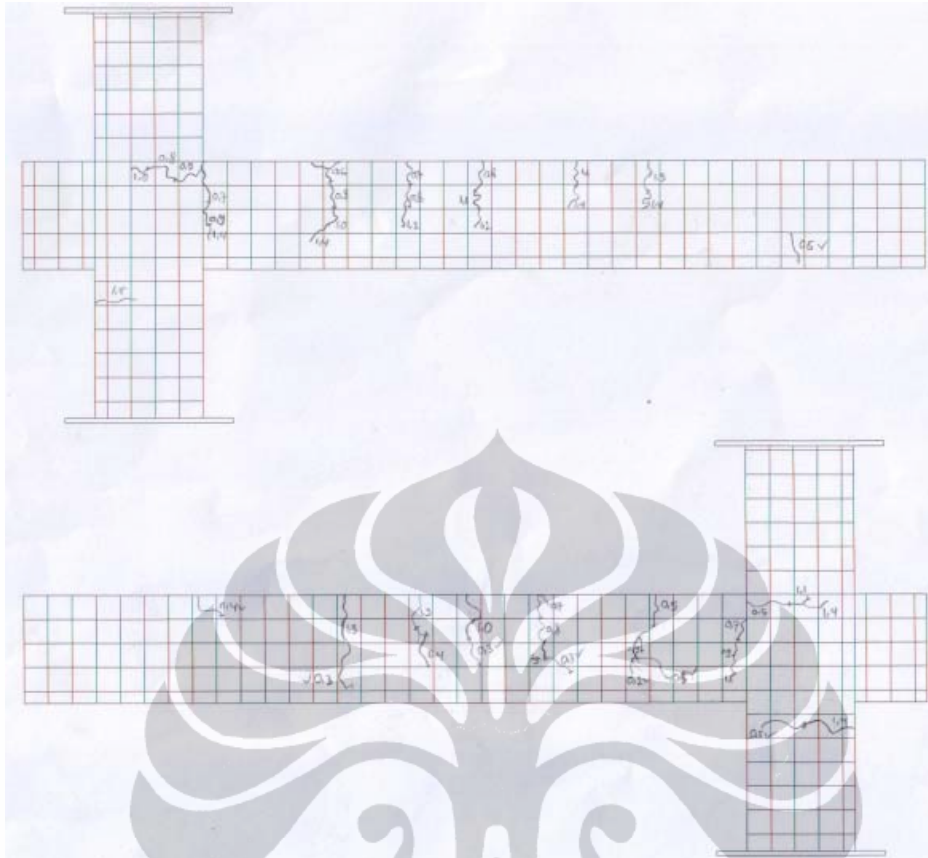
Gambar L323. Pola Retak Model-3.3 Sesudah perkuatan : $P=0,2$ kN



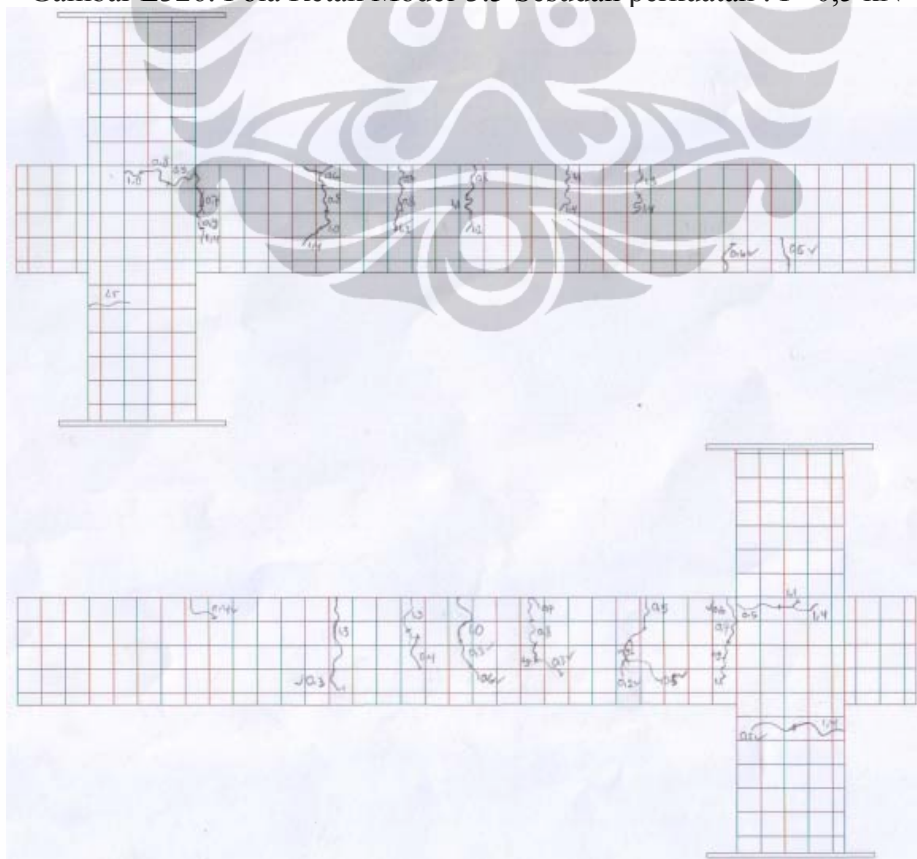
Gambar L324. Pola Retak Model-3.3 Sesudah perkuatan : $P=0,3$ kN



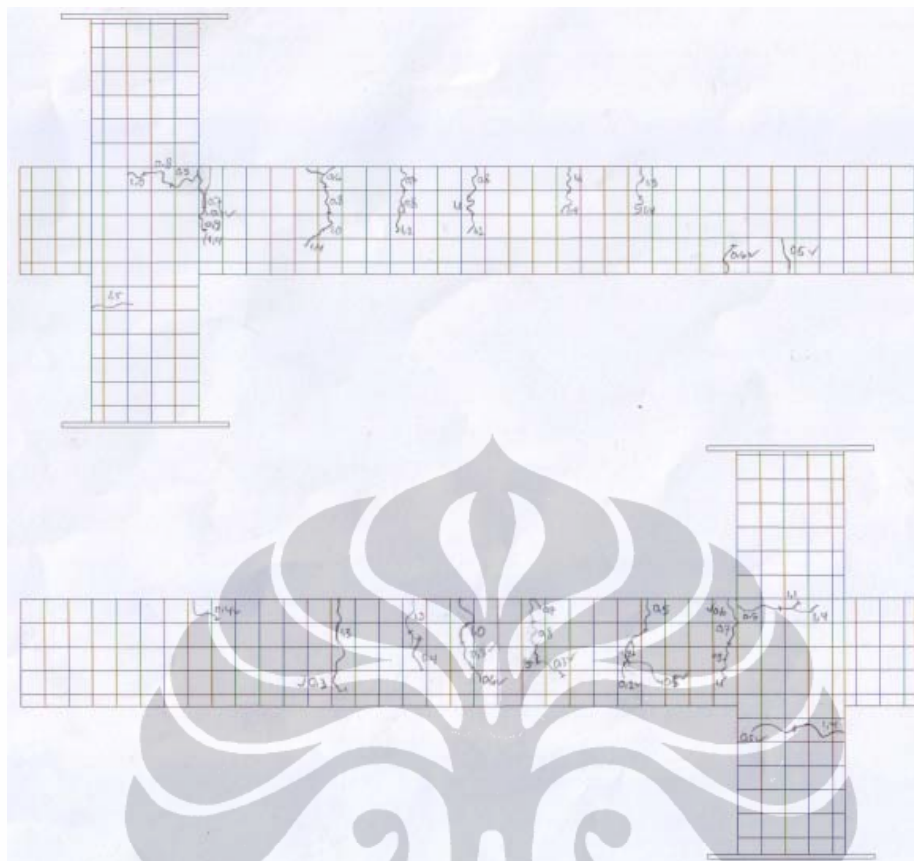
Gambar L325. Pola Retak Model-3.3 Sesudah perkuatan : $P=0,4$ kN



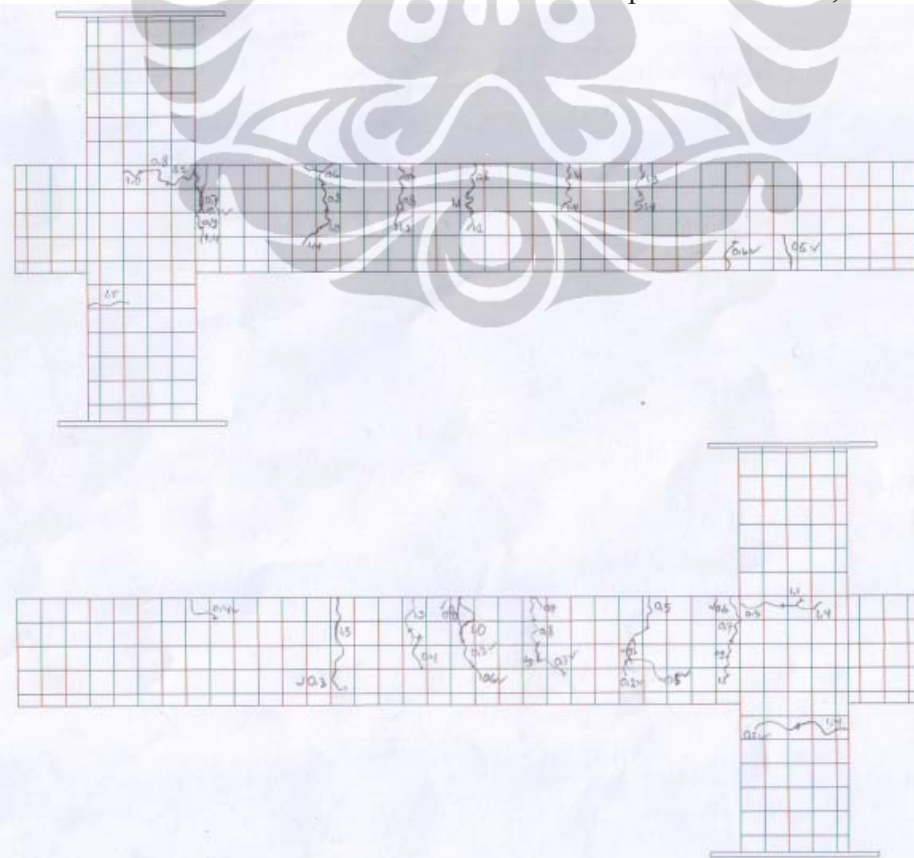
Gambar L326. Pola Retak Model-3.3 Sesudah perkuatan : $P=0,5$ kN



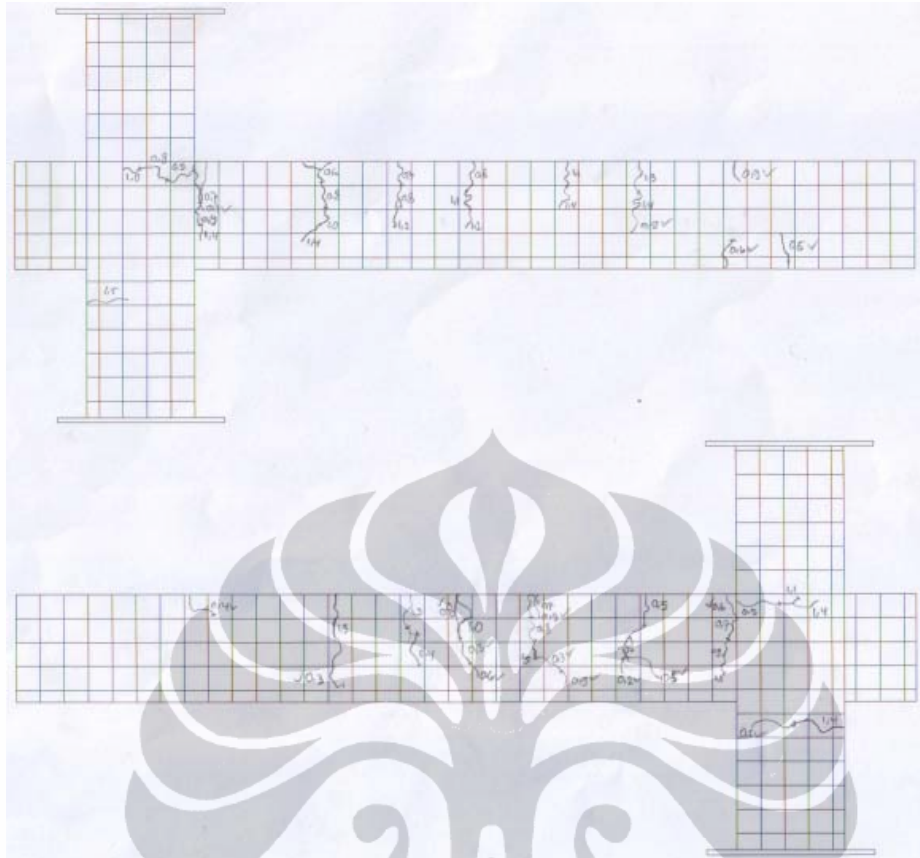
Gambar L327. Pola Retak Model-3.3 Sesudah perkuatan : $P=0,6$ kN



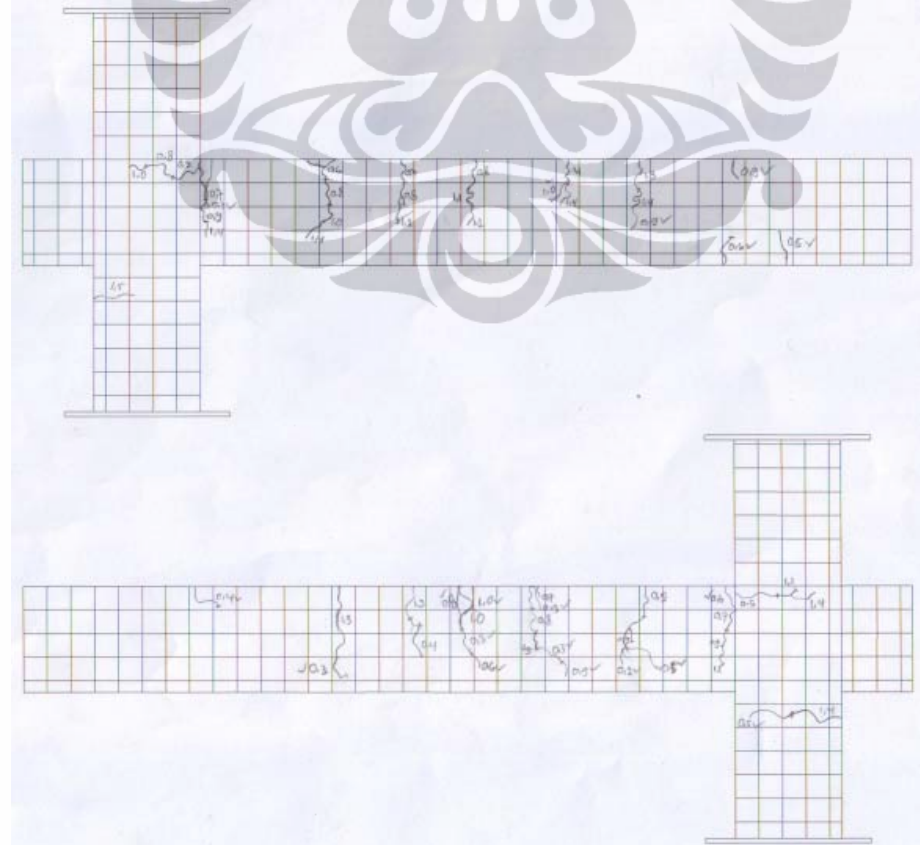
Gambar L328. Pola Retak Model-3.3 Sesudah perkuatan : $P=0,7$ kN



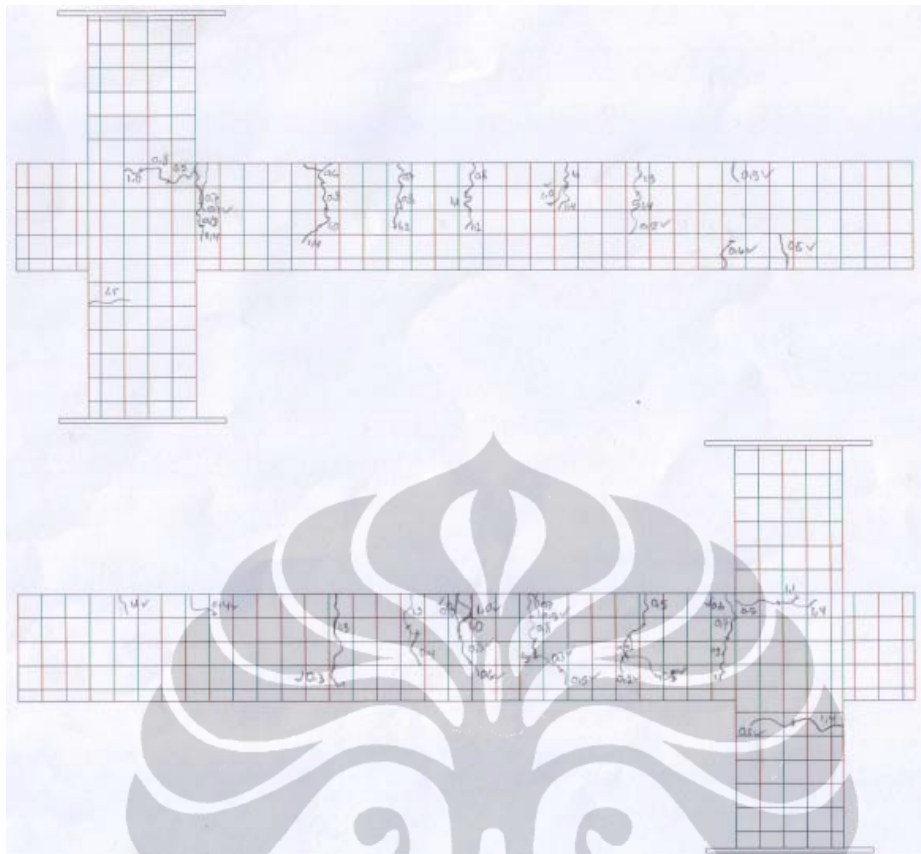
Gambar L329. Pola Retak Model-3.3 Sesudah perkuatan : $P=0,8$ kN



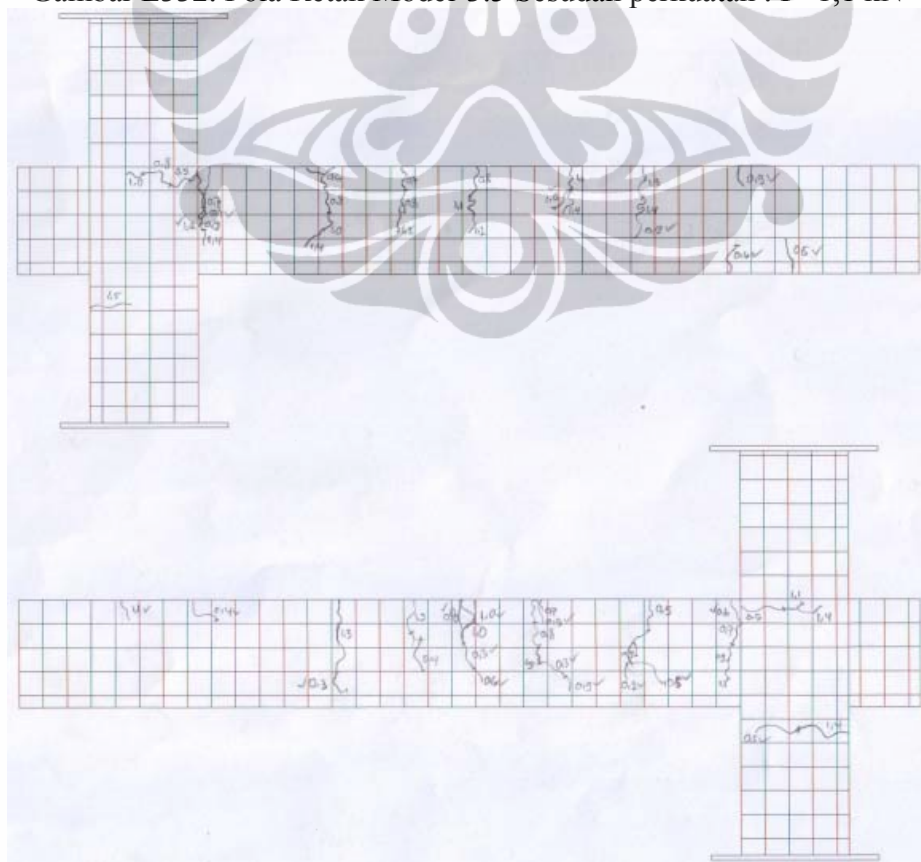
Gambar L330. Pola Retak Model-3.3 Sesudah perkuatan : $P=0,9$ kN



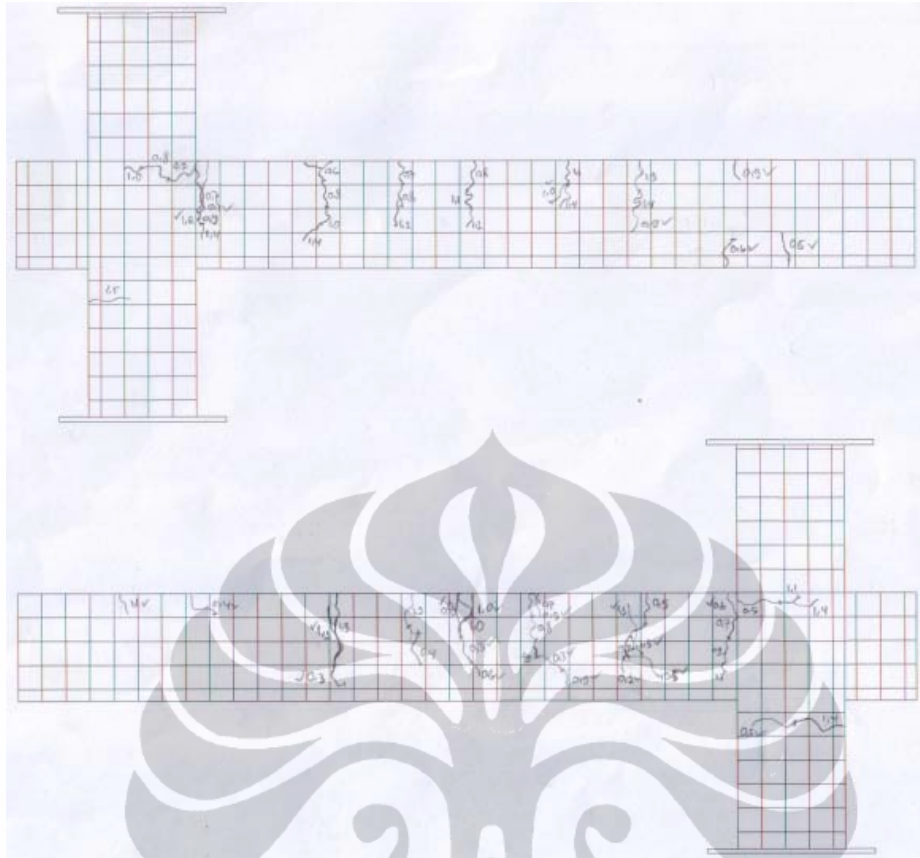
Gambar L331. Pola Retak Model-3.3 Sesudah perkuatan : $P=1,0$ kN



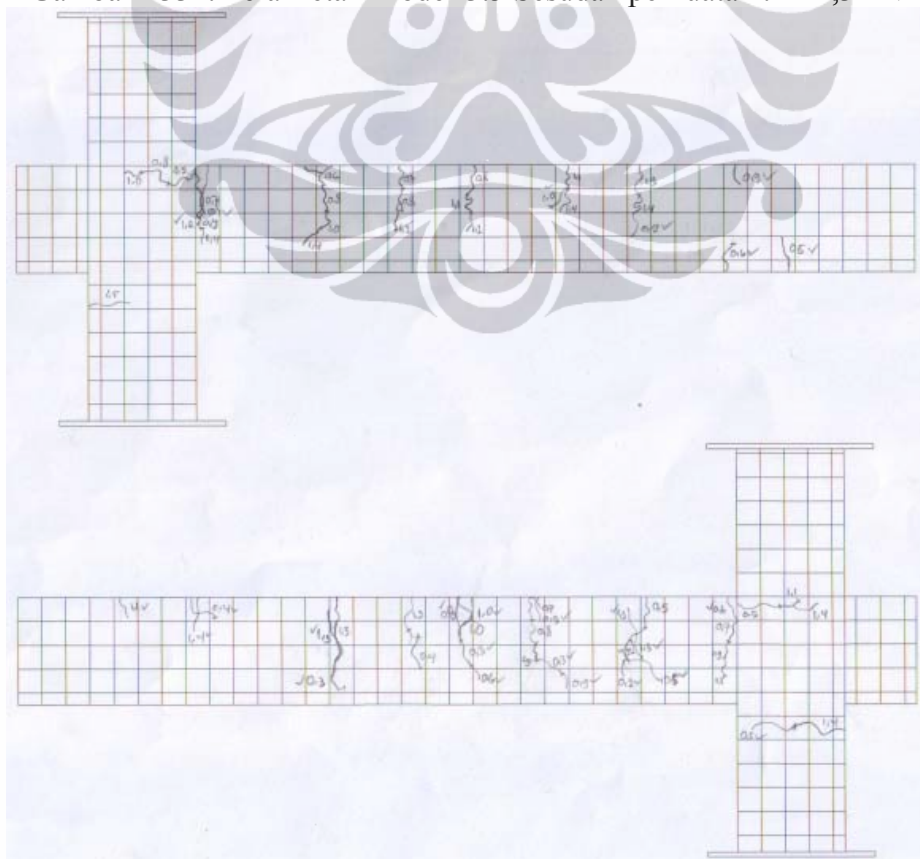
Gambar L332. Pola Retak Model-3.3 Sesudah kekuatan : $P=1,1$ kN



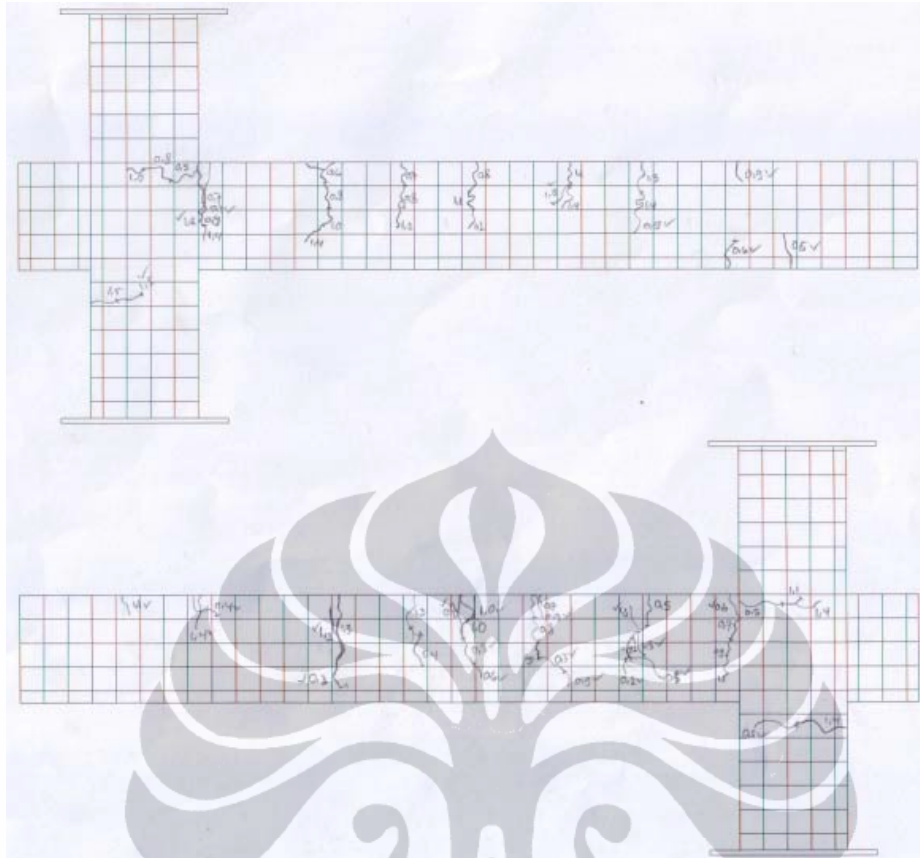
Gambar L333. Pola Retak Model-3.3 Sesudah kekuatan : $P=1,2$ kN



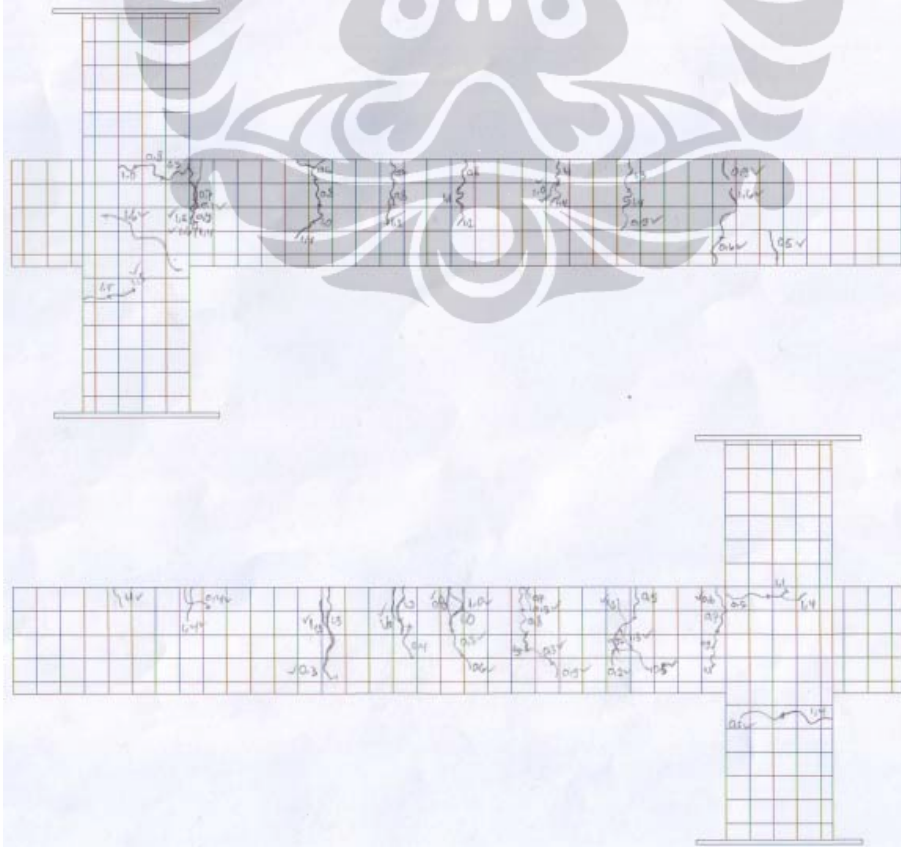
Gambar L334. Pola Retak Model-3.3 Sesudah perkuatan : $P=1,3$ kN



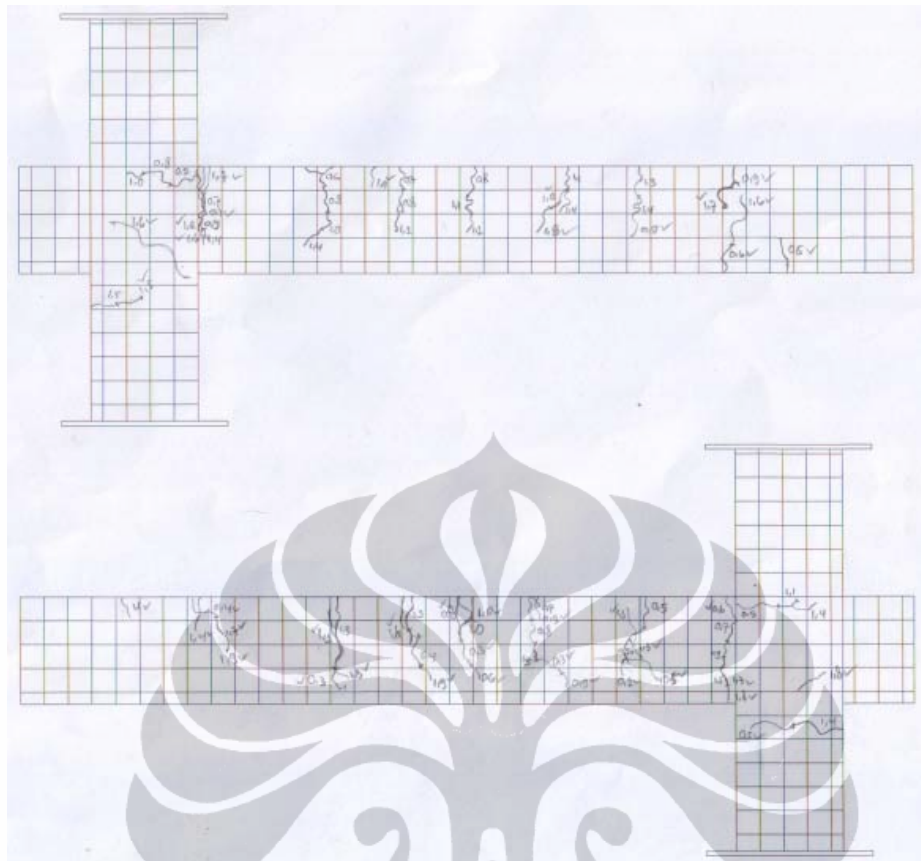
Gambar L335. Pola Retak Model-3.3 Sesudah perkuatan : $P=1,4$ kN



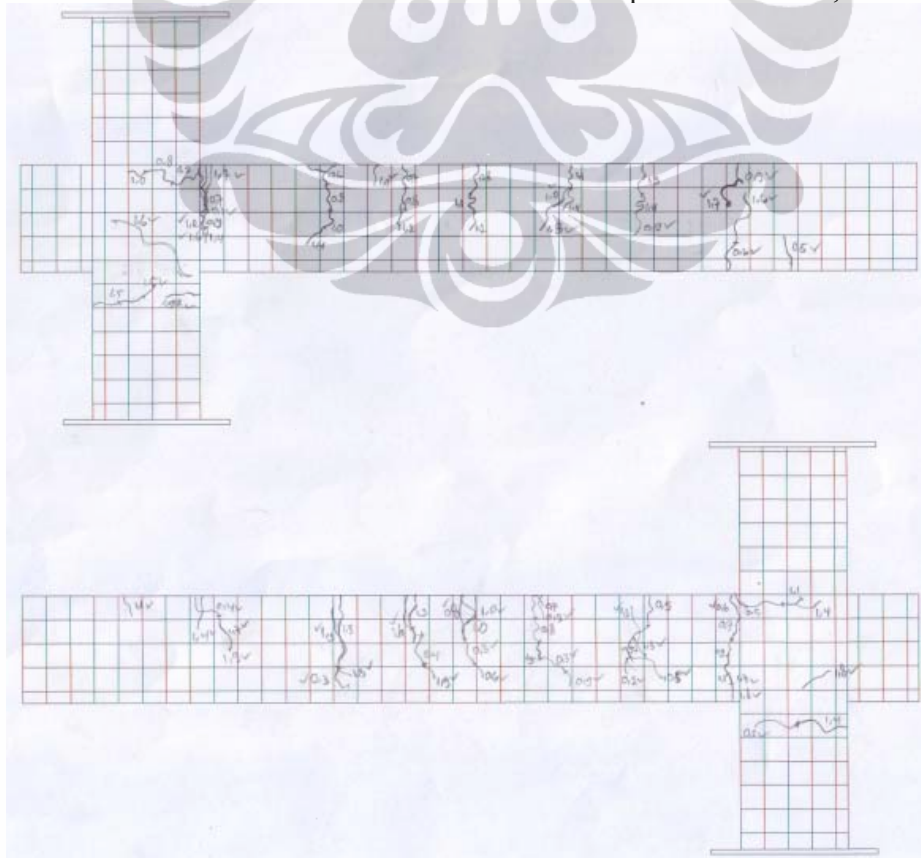
Gambar L336. Pola Retak Model-3.3 Sesudah perkuatan : $P=1,5$ kN



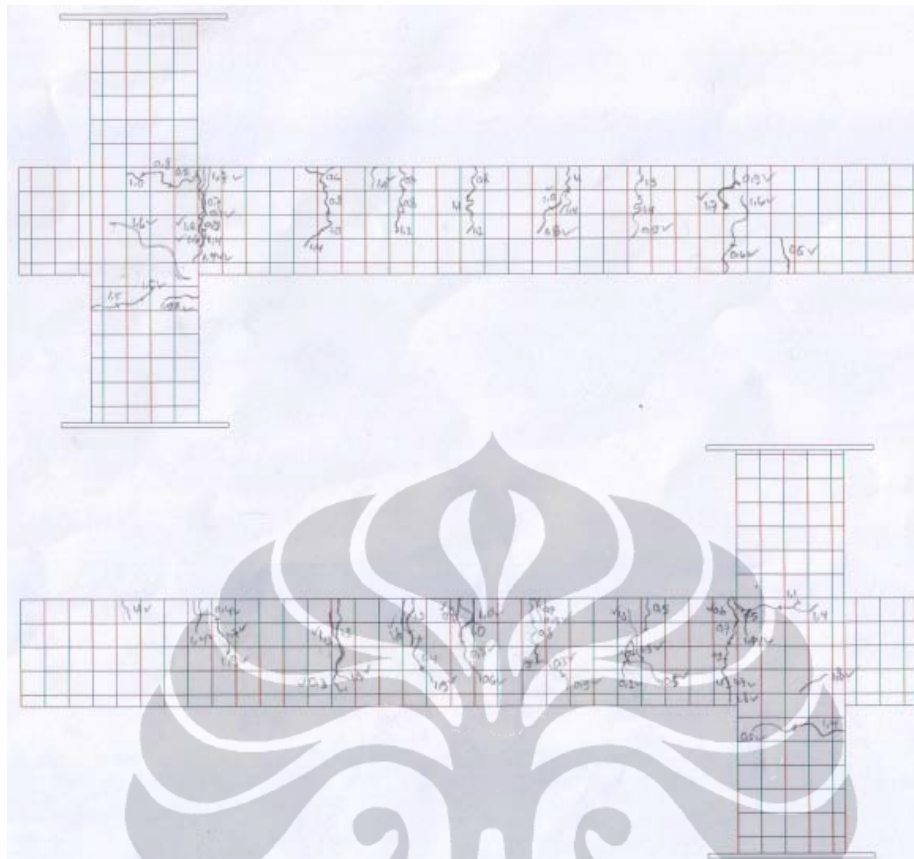
Gambar L337. Pola Retak Model-3.3 Sesudah perkuatan : $P=1,6$ kN



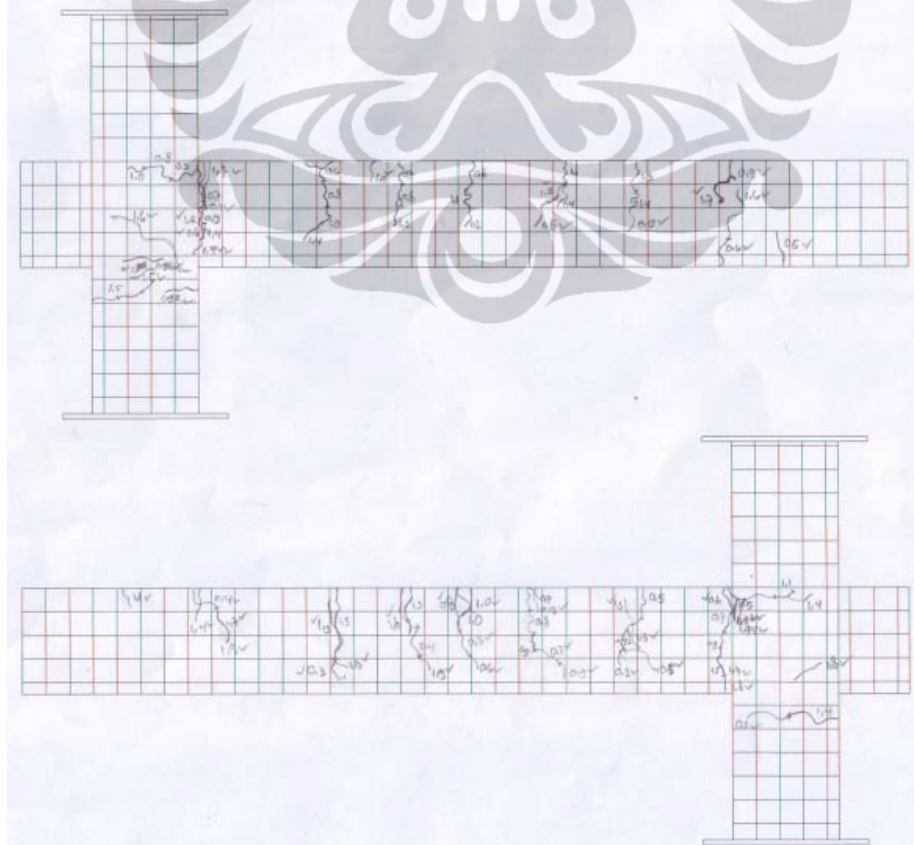
Gambar L340. Pola Retak Model-3.3 Sesudah perkuatan : $P=1,9$ kN



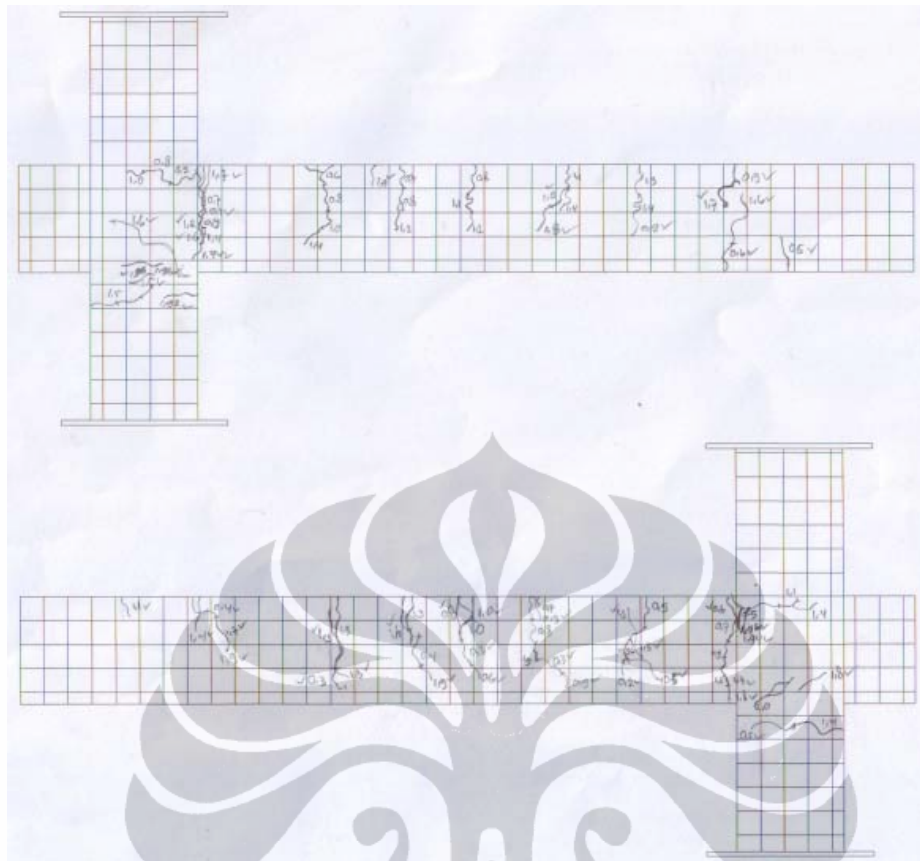
Gambar L341. Pola Retak Model-3.3 Sesudah perkuatan : $P=1,92$ kN



Gambar L342. Pola Retak Model-3.3 Sesudah perkuatan : $P=1,94$ kN



Gambar L343. Pola Retak Model-3.3 Sesudah perkuatan : $P=1,96$ kN



Gambar L344. Pola Retak Model-3.3 Sesudah perkuatan : $P=2,0$ kN