LAMPIRAN 1

DESAIN AWAL

1.1 Perhitungan Dinding Geser Teoritis

- Dinding Rencana

  b = 400 mm

  h = 80 mm

  L = 800 mm

- Tulangan

  Longitudinal : 16-Ø8

  Transversal : Ø8-150

- Kontrol Dinding

  a. Rasio Tulangan Vertikal

  Ukuran Ø8

  $$\rho v = \frac{16\ x\ (\frac{1}{4}\ x\ \pi\ x\ 7{,}88^2\ )}{400\ x\ 80} = 2{,}44\%$$

  b. Rasio Tulangan Horizontal

  Menurut SNI, jarak sengkang tidak dapat lebih besar dari :

  - Total kumulatif dari 48 kali diameter tulangan horizontal (Ø8) = 48 x 8 = 384 mm
  - Total kumulatif dari 16 kali diameter tulangan vertikal (Ø8) = 16 x 8 = 128 mm

  Sehingga, penggunaan tulangan baja Ø8 dengan jarak spasi 150 mm telah memenuhi salah satu syarat.

  Ukuran Ø8

  $$\rho h = \frac{5\ x\ (\ 45\ x\ 7{,}88\ )}{400\ x\ 80} = 5{,}54\%$$

  c. Rasio Badan

  Rasio badan merupakan perbandingan antara tinggi benda uji terhadap lebar benda uji, maka :

Rasio Badan (*a*) = 800/400 = 2

d. Rasio Pembebanan

Rasio pembebanan merupakan persen pembebanan terhadap kapasitas pembebanan benda uji, maka :

Rasio beban (*n)* = 30 kN/ 579 kN = 0,05

e. Perencanan dengan Diagram Iteraksi

Letak garis netral pada kondisi seimbang (*balanced*)

Jika Es = 200.000 MPa

Dan Ɛs = Ɛy , maka :

$$\frac{Cb}{d} = \frac{0{,}003}{0{,}003 + \varepsilon y} = \frac{0{,}003}{0{,}003 + {}^{fy}/_{Es}} = \frac{600}{600 + fy}$$

Sehingga :

$Cb = \frac{600 \,.\, d}{600 + fy}$

ab = β . Cb

Regangan yang terjadi :

$\varepsilon s1 = 0{,}003 \text{ x } \frac{c - d'}{c}$

$\varepsilon s1 = 0{,}003 \text{ x } \frac{c - {}^{h}/_{2}}{c}$

$\varepsilon s1 = 0{,}003 \text{ x } \frac{d - c}{c}$

Tegangan yang terjadi :

fs = Ɛs x Es

Cek tulangan Tekan

Ɛy = fy / Es

Ɛs = (Ɛc x (Cb-d')) / Cb

Jika tulangan sudah leleh (Ɛs > Ɛy), maka gunakan Ɛy atau (fs > fy), maka gunakan fy. Jika tulangan belum leleh Ɛs < Ɛy, maka gunakan Ɛs atau fs > fy, maka gunakan fs.

Gaya yang terjadi :

1. *Shear Wall* dengan jarak antar tulangan vertikal = 50 mm

Beton tekan : Cc= 0.85.f'c.b.a

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_1 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_2 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_3 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan belum leleh : $Cs_4 = As_1.fs$

Tulangan tekan lapis pertama (Cs_1) diasumsikan belum leleh : $Cs_5 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Nilai Pn dan Mn :

Pn = $Cc + Cs_1 + Cs_2 + Cs_3 + Cs_4 + Cs_5 - T_1 - T_2 - T_3$

Mn = Pn.e

Mn = $Cs1 . \left(\frac{h}{2} - d'\right) + Cs2 . \left(\frac{h}{2} - (d' + 50)\right) + Cs3 . \left(\frac{h}{2} - (d' + 100)\right) + Cs4 . \left(\frac{h}{2} - (d' + 150)\right) - Cs5 . \left(\frac{h}{2} - (d' + 150)\right) - T3 . \left(\frac{h}{2} + (d' + 100)\right) - T2 . (\frac{h}{2} + (d' + 50) - T1 . (\frac{h}{2} + d')$

Hasil Perhitungan Diagram Iteraksi :

A. Garis netral (kondisi *balanced*)

Ec = 0,003 mm

Cb = 273,2 mm

Ab = 232,2 mm

Cek Tulangan Tekan

ey = 0,0012

es’ = 0,0028

fs’=fy = 240 Mpa Fc’ = 20 Mpa

Momen Nominal

Mn = 4285,72 kgm Pn = 38127,94 kg

Mn = 4,28 ton Pn = 38,13 ton

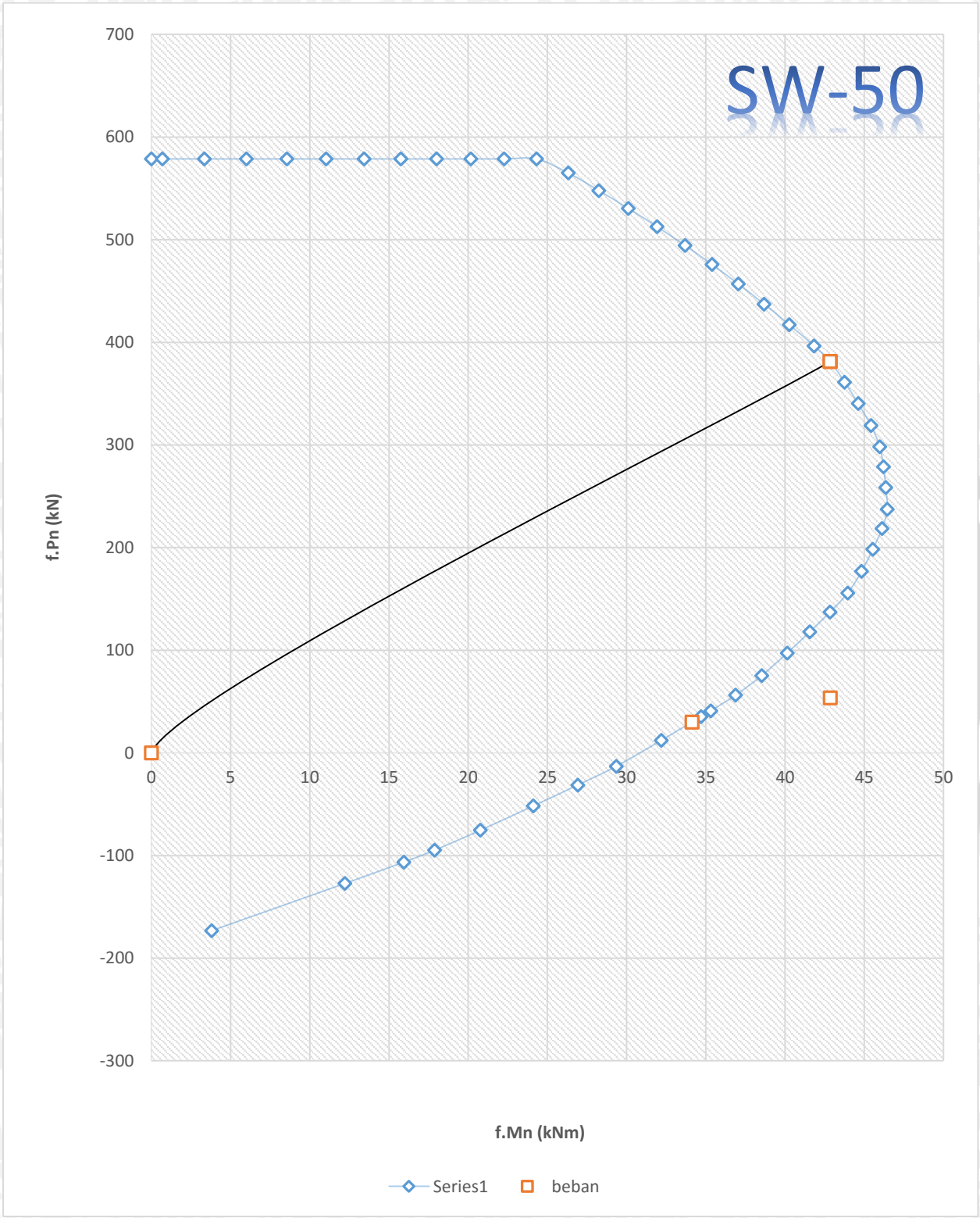
B. *Compression failure* :

c mm	εs1	εs2	εs3	εs4	εs5	εs6	εs7	εs8	a mm	Cc kN	Mc kNmm	Pn kN	Mn kNm	Ph kN
												578.68	0.00	0
480.0	0.0006	0.0009	0.0012	0.0015	0.0020	0.0023	0.0026	0.0029	408.0	554.9	-2219.5	578.68	0.69	0.86
470.0	0.0006	0.0009	0.0012	0.0015	0.0019	0.0023	0.0026	0.0029	399.5	543.3	135.8	578.68	3.35	4.19
460.0	0.0005	0.0008	0.0012	0.0015	0.0019	0.0022	0.0026	0.0029	391.0	531.8	2392.9	578.68	5.99	7.49
450.0	0.0005	0.0008	0.0011	0.0015	0.0019	0.0022	0.0026	0.0029	382.5	520.2	4551.8	578.68	8.55	10.69
440.0	0.0004	0.0007	0.0011	0.0014	0.0019	0.0022	0.0025	0.0029	374.0	508.6	6612.3	578.68	11.03	13.79
430.0	0.0003	0.0007	0.0010	0.0014	0.0018	0.0022	0.0025	0.0029	365.5	497.1	8574.6	578.68	13.43	16.79
420.0	0.0003	0.0006	0.0010	0.0013	0.0018	0.0022	0.0025	0.0029	357.0	485.5	10438.7	578.68	15.75	19.69
410.0	0.0002	0.0006	0.0009	0.0013	0.0018	0.0021	0.0025	0.0029	348.5	474.0	12204.5	578.68	18.00	22.50
400.0	0.0001	0.0005	0.0009	0.0013	0.0017	0.0021	0.0025	0.0029	340.0	462.4	13872.0	578.68	20.17	25.21
390.0	0.0001	0.0004	0.0008	0.0012	0.0017	0.0021	0.0025	0.0029	331.5	450.8	15441.3	578.68	22.27	27.84
380.0	0.0000	0.0004	0.0008	0.0012	0.0017	0.0021	0.0025	0.0029	323.0	439.3	16912.3	578.68	24.32	30.40
370.0	-0.0001	0.0003	0.0007	0.0011	0.0016	0.0020	0.0025	0.0029	314.5	427.7	18285.0	564.99	26.32	32.90
360.0	-0.0002	0.0002	0.0006	0.0011	0.0016	0.0020	0.0024	0.0029	306.0	416.2	19559.5	547.86	28.25	35.31
350.0	-0.0003	0.0002	0.0006	0.0010	0.0016	0.0020	0.0024	0.0029	297.5	404.6	20735.8	530.41	30.12	37.64
340.0	-0.0004	0.0001	0.0005	0.0009	0.0015	0.0020	0.0024	0.0028	289.0	393.0	21813.7	512.61	31.93	39.91
330.0	-0.0005	0.0000	0.0004	0.0009	0.0015	0.0019	0.0024	0.0028	280.5	381.5	22793.4	494.44	33.68	42.11
320.0	-0.0006	-0.0001	0.0004	0.0008	0.0014	0.0019	0.0024	0.0028	272.0	369.9	23674.9	475.85	35.39	44.24
310.0	-0.0007	-0.0002	0.0003	0.0008	0.0014	0.0019	0.0023	0.0028	263.5	358.4	24458.1	456.82	37.06	46.32
300.0	-0.0008	-0.0003	0.0002	0.0007	0.0013	0.0018	0.0023	0.0028	255.0	346.8	25143.0	437.28	38.68	48.35
290.0	-0.0010	-0.0004	0.0001	0.0006	0.0013	0.0018	0.0023	0.0028	246.5	335.2	25729.7	417.19	40.27	50.34
280.0	-0.0011	-0.0006	0.0000	0.0005	0.0012	0.0017	0.0023	0.0028	238.0	323.7	26218.1	396.49	41.83	52.29

C. *Tension Failure*

c mm	εs1	εs2	εs3	εs4	εs5	εs6	εs7	εs8	a mm	Cc kN	Mc kNmm	Pn kN	Mn kNm	Ph kN
263.2	-0.0014	-0.0008	-0.0002	0.0004	0.0011	0.0017	0.0022	0.0028	223.7	304.3	26817.0	361.21	43.76	54.70
253.2	-0.0015	-0.0009	-0.0003	0.0002	0.0010	0.0016	0.0022	0.0028	215.2	292.7	27042.2	340.46	44.62	55.77
243.2	-0.0017	-0.0011	-0.0005	0.0001	0.0009	0.0016	0.0022	0.0028	206.7	281.2	27169.2	318.96	45.42	56.78
233.2	-0.0019	-0.0013	-0.0006	0.0000	0.0008	0.0015	0.0021	0.0028	198.2	269.6	27197.9	298.16	45.99	57.48
223.2	-0.0021	-0.0015	-0.0008	-0.0001	0.0007	0.0014	0.0021	0.0028	189.7	258.0	27128.3	278.69	46.21	57.76
213.2	-0.0024	-0.0017	-0.0010	-0.0003	0.0006	0.0013	0.0021	0.0028	181.2	246.5	26960.5	258.48	46.37	57.96
203.2	-0.0026	-0.0019	-0.0012	-0.0004	0.0005	0.0013	0.0020	0.0027	172.7	234.9	26694.4	237.42	46.45	58.07
193.2	-0.0029	-0.0022	-0.0014	-0.0006	0.0004	0.0012	0.0020	0.0027	164.2	223.4	26330.0	218.63	46.13	57.66
183.2	-0.0033	-0.0024	-0.0016	-0.0008	0.0003	0.0011	0.0019	0.0027	155.7	211.8	25867.4	198.25	45.54	56.92
173.2	-0.0036	-0.0028	-0.0019	-0.0010	0.0001	0.0010	0.0018	0.0027	147.2	200.2	25306.6	176.85	44.83	56.04
163.2	-0.0040	-0.0031	-0.0022	-0.0013	-0.0001	0.0008	0.0018	0.0027	138.7	188.7	24647.4	155.73	43.96	54.96
153.2	-0.0045	-0.0035	-0.0025	-0.0016	-0.0003	0.0007	0.0017	0.0027	130.2	177.1	23890.1	137.30	42.84	53.55
143.2	-0.0050	-0.0040	-0.0029	-0.0019	-0.0005	0.0005	0.0016	0.0026	121.7	165.6	23034.4	117.90	41.57	51.96
133.2	-0.0056	-0.0045	-0.0034	-0.0022	-0.0008	0.0004	0.0015	0.0026	113.2	154.0	22080.5	97.33	40.14	50.17
123.2	-0.0063	-0.0051	-0.0039	-0.0027	-0.0011	0.0001	0.0014	0.0026	104.7	142.4	21028.3	75.30	38.53	48.16
113.2	-0.0071	-0.0058	-0.0045	-0.0032	-0.0014	-0.0001	0.0012	0.0025	96.2	130.9	19877.9	56.21	36.88	46.10
105.9	-0.0078	-0.0064	-0.0050	-0.0036	-0.0017	-0.0003	0.0011	0.0025	90.0	122.4	18967.9	41.07	35.31	44.14
100.8	-0.0084	-0.0069	-0.0054	-0.0039	-0.0020	-0.0005	0.0010	0.0025	85.7	116.5	18315.7	29.99	34.13	42.66
103.2	-0.0081	-0.0067	-0.0052	-0.0038	-0.0019	-0.0004	0.0010	0.0025	87.7	119.3	18629.2	35.33	34.70	43.37
93.2	-0.0093	-0.0077	-0.0061	-0.0045	-0.0024	-0.0008	0.0008	0.0024	79.2	107.8	17282.3	12.17	32.18	40.23
83.2	-0.0108	-0.0090	-0.0072	-0.0054	-0.0030	-0.0012	0.0006	0.0024	70.7	96.2	15837.1	-13.05	29.35	36.69
73.2	-0.0127	-0.0106	-0.0086	-0.0065	-0.0039	-0.0018	0.0002	0.0023	62.2	84.6	14293.6	-31.29	26.92	33.65
63.2	-0.0152	-0.0128	-0.0104	-0.0080	-0.0049	-0.0026	-0.0002	0.0022	53.7	73.1	12651.9	-51.65	24.11	30.14
53.2	-0.0186	-0.0157	-0.0129	-0.0101	-0.0064	-0.0036	-0.0008	0.0020	45.2	61.5	10911.9	-75.31	20.77	25.96
43.2	-0.0236	-0.0201	-0.0166	-0.0131	-0.0086	-0.0052	-0.0017	0.0018	36.7	50.0	9073.7	-94.81	17.88	22.35
33.2	-0.0315	-0.0270	-0.0225	-0.0180	-0.0121	-0.0076	-0.0031	0.0014	28.2	38.4	7137.1	-106.37	15.94	19.93
23.2	-0.0464	-0.0400	-0.0335	-0.0270	-0.0186	-0.0122	-0.0057	0.0007	19.7	26.8	5102.4	-127.21	12.22	15.27
13.2	-0.0838	-0.0725	-0.0611	-0.0498	-0.0350	-0.0237	-0.0123	-0.0010	11.2	15.3	2969.4	-173.18	3.80	4.75

Gambar Diagram Iteraksi :



2. *Shear Wall* dengan jarak antar tulangan vertikal = 50 mm (Teoritis)

Beton tekan : Cc= 0.85.f'c.b.a

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_1 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_2 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_3 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan belum leleh : $Cs_4 = As_1.fs$

Tulangan tekan lapis pertama (Cs_1) diasumsikan belum leleh : $Cs_5 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Nilai Pn dan Mn :

Pn = $Cc + Cs_1 + Cs_2 + Cs_3 + Cs_4 + Cs_5 - T_1 - T_2 - T_3$

Mn = Pn.e

$$Mn = Cs1 \cdot \left(\frac{h}{2} - d'\right) + Cs2 \cdot \left(\frac{h}{2} - (d' + 50)\right) + Cs3 \cdot \left(\frac{h}{2} - (d' + 100)\right) + Cs4 \cdot \left(\frac{h}{2} - (d' + 150)\right) - Cs5 \cdot \left(\frac{h}{2} - (d' + 150)\right) - T3 \cdot \left(\frac{h}{2} + (d' + 100)\right) - T2 \cdot \left(\frac{h}{2} + (d' + 50) - T1 \cdot \left(\frac{h}{2} + d'\right)\right)$$

Hasil Perhitungan Diagram Iteraksi :

A. Garis netral (kondisi *balanced*)

Ec = 0,003 mm

Cb = 234,5 mm

Ab = 199,3 mm

Cek Tulangan Tekan

ey = 0,0012

es' = 0,0028

fs'=fy = 378,9 Mpa Fc' = 13,1 Mpa

Momen Nominal

Mn	= 4414,8 kgm	Pu	= 22581,4 kg
Mn	= 4,41 tonm	Pu	= 22,58 ton

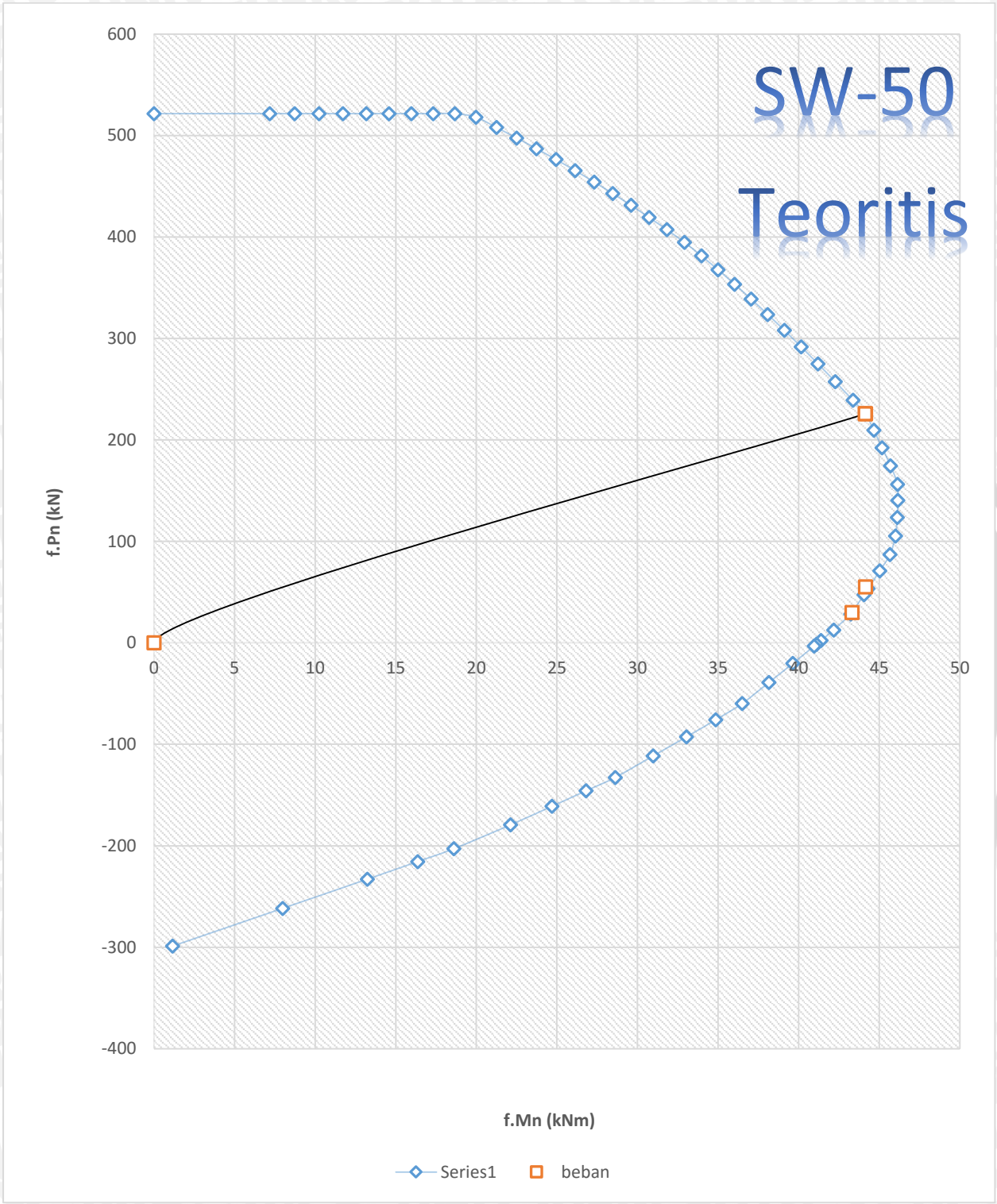
B. *Compression failure*:

C Mm	εs1	εs2	εs3	εs4	εs5	εs6	εs7	εs8	a mm	Cc kN	Mc kNmm	Pn kN	Mn kNm	Ph kN
												521.59	0.00	Pn
480.0	0.0006	0.0009	0.0012	0.0015	0.0020	0.0023	0.0026	0.0029	408.0	363.4	-1453.5	521.59	7.17	8.97
472.0	0.0006	0.0009	0.0012	0.0015	0.0019	0.0023	0.0026	0.0029	401.2	357.3	-214.4	521.59	8.72	10.90
464.0	0.0005	0.0009	0.0012	0.0015	0.0019	0.0022	0.0026	0.0029	394.4	351.3	983.5	521.59	10.24	12.80
456.0	0.0005	0.0008	0.0011	0.0015	0.0019	0.0022	0.0026	0.0029	387.6	345.2	2140.3	521.59	11.72	14.66
448.0	0.0004	0.0008	0.0011	0.0014	0.0019	0.0022	0.0025	0.0029	380.8	339.2	3255.8	521.59	13.17	16.46
440.0	0.0004	0.0007	0.0011	0.0014	0.0019	0.0022	0.0025	0.0029	374.0	333.1	4330.2	521.59	14.59	18.23
432.0	0.0003	0.0007	0.0010	0.0014	0.0018	0.0022	0.0025	0.0029	367.2	327.0	5363.4	521.59	15.97	19.97
424.0	0.0003	0.0006	0.0010	0.0014	0.0018	0.0022	0.0025	0.0029	360.4	321.0	6355.4	521.59	17.33	21.67
416.0	0.0002	0.0006	0.0010	0.0013	0.0018	0.0022	0.0025	0.0029	353.6	314.9	7306.3	521.59	18.66	23.33
408.0	0.0002	0.0006	0.0009	0.0013	0.0018	0.0021	0.0025	0.0029	346.8	308.9	8215.9	518.12	19.97	24.96
400.0	0.0001	0.0005	0.0009	0.0013	0.0017	0.0021	0.0025	0.0029	340.0	302.8	9084.4	507.93	21.25	26.56
392.0	0.0001	0.0005	0.0008	0.0012	0.0017	0.0021	0.0025	0.0029	333.2	296.8	9911.7	497.57	22.51	28.13
384.0	0.0000	0.0004	0.0008	0.0012	0.0017	0.0021	0.0025	0.0029	326.4	290.7	10697.8	487.03	23.74	29.67
376.0	-0.0001	0.0003	0.0007	0.0011	0.0017	0.0021	0.0025	0.0029	319.6	284.6	11442.7	476.31	24.95	31.19
368.0	-0.0001	0.0003	0.0007	0.0011	0.0016	0.0020	0.0024	0.0029	312.8	278.6	12146.4	465.38	26.14	32.67
360.0	-0.0002	0.0002	0.0006	0.0011	0.0016	0.0020	0.0024	0.0029	306.0	272.5	12809.0	454.23	27.31	34.14
352.0	-0.0003	0.0002	0.0006	0.0010	0.0016	0.0020	0.0024	0.0029	299.2	266.5	13430.3	442.85	28.46	35.58
344.0	-0.0003	0.0001	0.0005	0.0010	0.0015	0.0020	0.0024	0.0028	292.4	260.4	14010.5	431.23	29.60	36.99
336.0	-0.0004	0.0000	0.0005	0.0009	0.0015	0.0020	0.0024	0.0028	285.6	254.4	14549.5	419.34	30.72	38.40
328.0	-0.0005	0.0000	0.0004	0.0009	0.0015	0.0019	0.0024	0.0028	278.8	248.3	15047.4	407.16	31.82	39.78
320.0	-0.0006	-0.0001	0.0004	0.0008	0.0014	0.0019	0.0024	0.0028	272.0	242.3	15504.0	394.68	32.92	41.15
312.0	-0.0007	-0.0002	0.0003	0.0008	0.0014	0.0019	0.0024	0.0028	265.2	236.2	15919.5	381.39	33.97	42.46
304.0	-0.0008	-0.0003	0.0002	0.0007	0.0013	0.0018	0.0023	0.0028	258.4	230.1	16293.7	367.62	35.00	43.75
296.0	-0.0009	-0.0004	0.0001	0.0006	0.0013	0.0018	0.0023	0.0028	251.6	224.1	16626.8	353.44	36.03	45.04
288.0	-0.0010	-0.0005	0.0001	0.0006	0.0013	0.0018	0.0023	0.0028	244.8	218.0	16918.7	338.81	37.06	46.32
280.0	-0.0011	-0.0006	0.0000	0.0005	0.0012	0.0017	0.0023	0.0028	238.0	212.0	17169.5	323.69	38.08	47.60
272.0	-0.0012	-0.0007	-0.0001	0.0004	0.0012	0.0017	0.0023	0.0028	231.2	205.9	17379.0	308.03	39.11	48.89
264.0	-0.0013	-0.0008	-0.0002	0.0004	0.0011	0.0017	0.0022	0.0028	224.4	199.9	17547.4	291.79	40.15	50.19
256.0	-0.0015	-0.0009	-0.0003	0.0003	0.0010	0.0016	0.0022	0.0028	217.6	193.8	17674.6	274.92	41.20	51.51
248.0	-0.0016	-0.0010	-0.0004	0.0002	0.0010	0.0016	0.0022	0.0028	210.8	187.7	17760.6	257.35	42.28	52.84
240.0	-0.0018	-0.0012	-0.0005	0.0001	0.0009	0.0015	0.0022	0.0028	204.0	181.7	17805.4	239.01	43.37	54.21

C. *Tension Failure*:

c mm	εs1	εs2	εs3	εs4	εs5	εs6	εs7	εs8	a mm	Cc kN	Mc kNmm	Pn kN	Mn kNm	Ph kN
226.5	-0.0021	-0.0014	-0.0007	-0.0001	0.0008	0.0014	0.0021	0.0028	192.5	171.4	17787.4	209.47	44.67	55.83
218.5	-0.0023	-0.0016	-0.0009	-0.0002	0.0007	0.0014	0.0021	0.0028	185.7	165.4	17721.3	192.36	45.18	56.48
210.5	-0.0025	-0.0017	-0.0010	-0.0003	0.0006	0.0013	0.0020	0.0028	178.9	159.3	17614.0	174.42	45.70	57.13
202.5	-0.0027	-0.0019	-0.0012	-0.0004	0.0005	0.0013	0.0020	0.0027	172.1	153.3	17465.6	156.20	46.15	57.68
194.5	-0.0029	-0.0021	-0.0014	-0.0006	0.0004	0.0012	0.0020	0.0027	165.3	147.2	17276.0	140.33	46.15	57.69
186.5	-0.0032	-0.0023	-0.0015	-0.0007	0.0003	0.0011	0.0019	0.0027	158.5	141.2	17045.1	123.63	46.13	57.66
178.5	-0.0034	-0.0026	-0.0017	-0.0009	0.0002	0.0010	0.0019	0.0027	151.7	135.1	16773.2	105.39	46.01	57.51
170.5	-0.0037	-0.0029	-0.0020	-0.0011	0.0001	0.0009	0.0018	0.0027	144.9	129.0	16460.0	87.13	45.67	57.09
162.5	-0.0041	-0.0031	-0.0022	-0.0013	-0.0001	0.0008	0.0018	0.0027	138.1	123.0	16105.6	70.88	45.03	56.29
154.5	-0.0044	-0.0035	-0.0025	-0.0015	-0.0003	0.0007	0.0017	0.0027	131.3	116.9	15710.1	53.58	44.32	55.39
151.7	-0.0046	-0.0036	-0.0026	-0.0016	-0.0003	0.0007	0.0017	0.0027	128.9	114.8	15564.2	47.34	44.05	55.07
144.4	-0.0049	-0.0039	-0.0029	-0.0018	-0.0005	0.0006	0.0016	0.0026	122.7	109.3	15152.6	29.98	43.31	54.13
143.7	-0.0050	-0.0039	-0.0029	-0.0019	-0.0005	0.0005	0.0016	0.0026	122.1	108.8	15113.3	28.33	43.24	54.04
135.7	-0.0055	-0.0044	-0.0032	-0.0021	-0.0007	0.0004	0.0015	0.0026	115.3	102.7	14621.2	12.74	42.17	52.72
130.4	-0.0058	-0.0047	-0.0035	-0.0024	-0.0009	0.0003	0.0014	0.0026	110.8	98.7	14269.1	2.26	41.38	51.73
128.6	-0.0059	-0.0048	-0.0036	-0.0024	-0.0009	0.0003	0.0014	0.0026	109.3	97.3	14147.2	-1.37	41.11	51.38
127.7	-0.0060	-0.0048	-0.0036	-0.0025	-0.0009	0.0002	0.0014	0.0026	108.5	96.7	14087.9	-3.13	40.97	51.21
119.7	-0.0066	-0.0053	-0.0041	-0.0028	-0.0012	0.0001	0.0013	0.0026	101.7	90.6	13513.4	-20.32	39.64	49.54
111.7	-0.0073	-0.0059	-0.0046	-0.0032	-0.0015	-0.0002	0.0012	0.0025	94.9	84.6	12897.8	-39.10	38.15	47.69
103.7	-0.0081	-0.0066	-0.0052	-0.0037	-0.0018	-0.0004	0.0010	0.0025	88.1	78.5	12241.0	-59.84	36.49	45.61
95.7	-0.0090	-0.0074	-0.0059	-0.0043	-0.0023	-0.0007	0.0009	0.0025	81.3	72.4	11542.9	-75.87	34.85	43.57
87.7	-0.0101	-0.0084	-0.0067	-0.0050	-0.0027	-0.0010	0.0007	0.0024	74.5	66.4	10803.7	-92.56	33.04	41.31
79.7	-0.0114	-0.0095	-0.0076	-0.0058	-0.0033	-0.0014	0.0005	0.0023	67.7	60.3	10023.4	-111.39	30.98	38.72
71.7	-0.0130	-0.0109	-0.0088	-0.0067	-0.0040	-0.0019	0.0002	0.0023	60.9	54.3	9201.8	-132.62	28.62	35.77
63.7	-0.0150	-0.0127	-0.0103	-0.0079	-0.0049	-0.0025	-0.0002	0.0022	54.1	48.2	8339.1	-145.81	26.81	33.51
55.7	-0.0176	-0.0149	-0.0122	-0.0095	-0.0060	-0.0033	-0.0006	0.0021	47.3	42.2	7435.1	-161.05	24.69	30.86
47.7	-0.0211	-0.0179	-0.0148	-0.0116	-0.0075	-0.0044	-0.0012	0.0019	40.5	36.1	6490.0	-179.36	22.12	27.65
39.7	-0.0259	-0.0221	-0.0183	-0.0146	-0.0097	-0.0059	-0.0021	0.0017	33.7	30.1	5503.7	-202.82	18.61	23.26
31.7	-0.0332	-0.0285	-0.0237	-0.0190	-0.0129	-0.0081	-0.0034	0.0013	26.9	24.0	4476.3	-215.59	16.36	20.45
23.7	-0.0454	-0.0391	-0.0328	-0.0264	-0.0182	-0.0119	-0.0055	0.0008	20.1	17.9	3407.6	-232.89	13.24	16.55
15.7	-0.0701	-0.0605	-0.0510	-0.0414	-0.0290	-0.0195	-0.0099	-0.0003	13.3	11.9	2297.8	-261.64	7.99	9.98
7.7	-0.1460	-0.1265	-0.1071	-0.0876	-0.0623	-0.0428	-0.0233	-0.0038	6.5	5.8	1146.8	-298.86	1.15	1.43

Gambar Diagram Iteraksi :



3. *Shear Wall* dengan jarak antar tulangan vertikal = 40 mm

Beton tekan : Cc= 0.85.f'c.b.a

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_1 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_2 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_3 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_4 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan belum leleh : $Cs_5 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Nilai Pn dan Mn :

Pn = $Cc + Cs_1 + Cs_2 + Cs_3 + Cs_4 + Cs_5 - T_1 - T_2 - T_3$

Mn = Pn.e

$$Mn = Cs1 \cdot \left(\frac{h}{2} - d'\right) + Cs2 \cdot \left(\frac{h}{2} - (d' + 40)\right) + Cs3 \cdot \left(\frac{h}{2} - (d' + 80)\right) + Cs4 \cdot \left(\frac{h}{2} - (d' + 130)\right) - Cs5 \cdot \left(\frac{h}{2} - (d' + 130)\right) - T3 \cdot \left(\frac{h}{2} + (d' + 80)\right) - T2 \cdot \left(\frac{h}{2} + (d' + 40)\right) - T1 \cdot \left(\frac{h}{2} + d'\right)$$

Hasil Perhitungan Diagram Iteraksi :

A. Garis netral (kondisi *balanced*)

Ec = 0,003 mm

Cb = 273,2 mm

Ab = 232,2 mm

Cek Tulangan Tekan

ey = 0,0012

es' = 0,0028

fs'=fy = 240 Mpa Fc' = 20 Mpa

Momen Nominal

Mn	= 4508 kgm	Pn	= 37102,9 kg
Mn	= 4,51 tm	Pn	= 37,1 ton

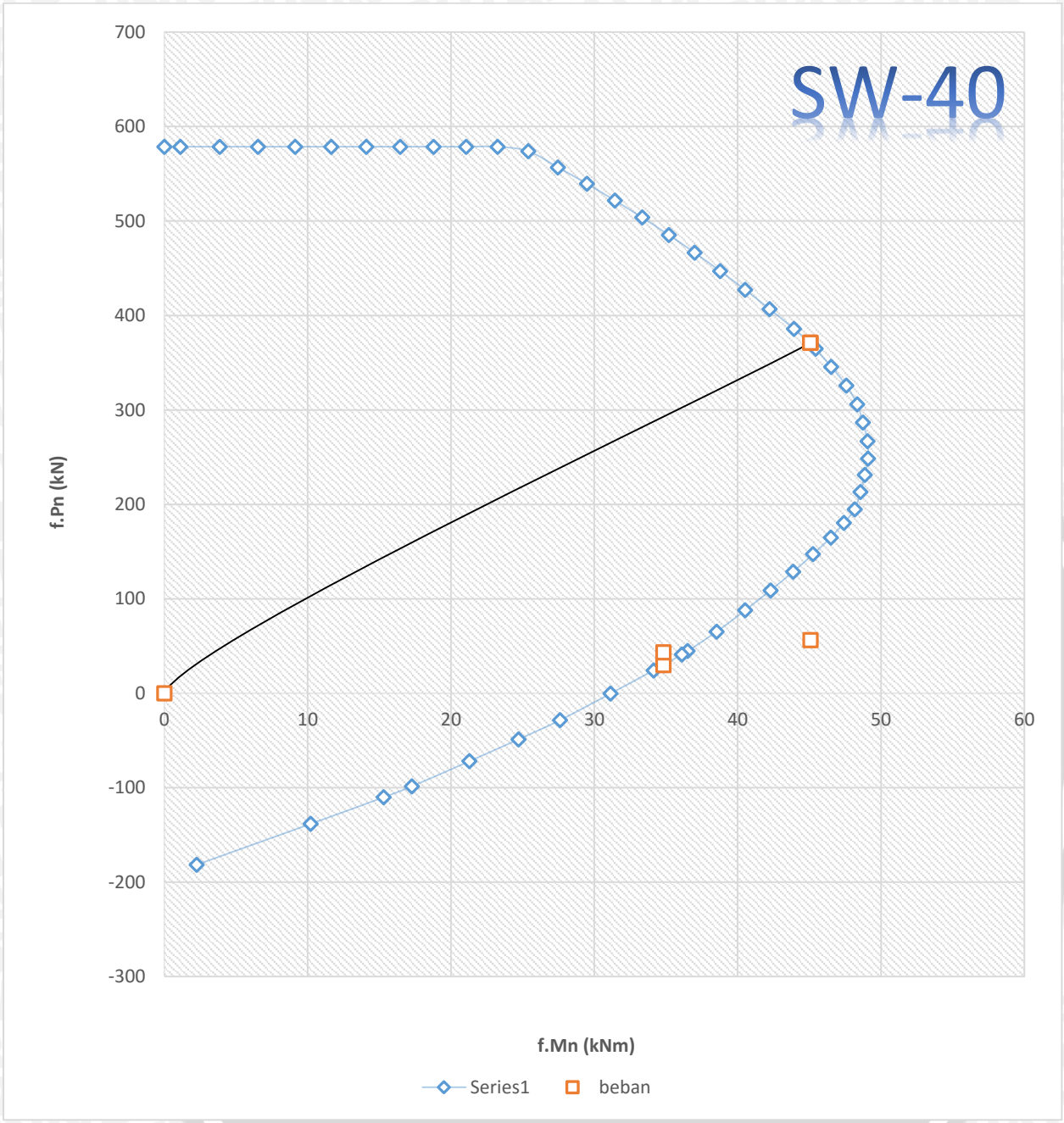
B. *Compression failure*:

c mm	εs1	εs2	εs3	εs4	εs5	εs6	εs7	εs8	a mm	Cc kN	Mc kNmm	Pn kN	Mn kNm	Ph kN
												578.68	0.00	0.00
480.0	0.0006	0.0009	0.0011	0.0014	0.0021	0.0024	0.0026	0.0029	408.0	554.9	-2219.5	578.68	1.11	1.39
470.0	0.0006	0.0008	0.0011	0.0014	0.0021	0.0024	0.0026	0.0029	399.5	543.3	135.8	578.68	3.87	4.83
460.0	0.0005	0.0008	0.0010	0.0014	0.0020	0.0024	0.0026	0.0029	391.0	531.8	2392.9	578.68	6.54	8.18
450.0	0.0005	0.0007	0.0010	0.0013	0.0020	0.0024	0.0026	0.0029	382.5	520.2	4551.8	578.68	9.14	11.42
440.0	0.0004	0.0007	0.0009	0.0013	0.0020	0.0023	0.0026	0.0029	374.0	508.6	6612.3	578.68	11.65	14.56
430.0	0.0003	0.0006	0.0009	0.0012	0.0020	0.0023	0.0026	0.0029	365.5	497.1	8574.6	578.68	14.09	17.61
420.0	0.0003	0.0006	0.0008	0.0012	0.0019	0.0023	0.0026	0.0029	357.0	485.5	10438.7	578.68	16.46	20.57
410.0	0.0002	0.0005	0.0008	0.0012	0.0019	0.0023	0.0026	0.0029	348.5	474.0	12204.5	578.68	18.79	23.49
400.0	0.0001	0.0004	0.0007	0.0011	0.0019	0.0023	0.0026	0.0029	340.0	462.4	13872.0	578.68	21.06	26.33
390.0	0.0001	0.0004	0.0007	0.0011	0.0019	0.0023	0.0026	0.0029	331.5	450.8	15441.3	578.68	23.26	29.08
380.0	0.0000	0.0003	0.0006	0.0010	0.0018	0.0022	0.0025	0.0029	323.0	439.3	16912.3	573.89	25.39	31.74
370.0	-0.0001	0.0002	0.0005	0.0010	0.0018	0.0022	0.0025	0.0029	314.5	427.7	18285.0	556.83	27.47	34.33
360.0	-0.0002	0.0001	0.0005	0.0009	0.0018	0.0022	0.0025	0.0029	306.0	416.2	19559.5	539.48	29.48	36.85
350.0	-0.0003	0.0001	0.0004	0.0008	0.0017	0.0022	0.0025	0.0029	297.5	404.6	20735.8	521.79	31.43	39.29
340.0	-0.0004	0.0000	0.0003	0.0008	0.0017	0.0021	0.0025	0.0028	289.0	393.0	21813.7	503.74	33.34	41.67
330.0	-0.0005	-0.0001	0.0003	0.0007	0.0017	0.0021	0.0025	0.0028	280.5	381.5	22793.4	485.30	35.19	43.99
320.0	-0.0006	-0.0002	0.0002	0.0006	0.0016	0.0021	0.0025	0.0028	272.0	369.9	23674.9	466.43	37.00	46.26
310.0	-0.0007	-0.0003	0.0001	0.0006	0.0016	0.0021	0.0024	0.0028	263.5	358.4	24458.1	447.09	38.78	48.47
300.0	-0.0008	-0.0004	0.0000	0.0005	0.0015	0.0020	0.0024	0.0028	255.0	346.8	25143.0	427.22	40.52	50.65
290.0	-0.0010	-0.0005	-0.0001	0.0004	0.0015	0.0020	0.0024	0.0028	246.5	335.2	25729.7	406.79	42.24	52.79
280.0	-0.0011	-0.0007	-0.0002	0.0003	0.0014	0.0020	0.0024	0.0028	238.0	323.7	26218.1	385.72	43.93	54.92

C. ***Tension Failure*** **:**

c mm	εs1	εs2	εs3	εs4	εs5	εs6	εs7	εs8	a mm	Cc kN	Mc kNmm	Pn kN	Mn kNm	Ph kN
270.0	-0.0013	-0.0008	-0.0004	0.0002	0.0014	0.0019	0.0024	0.0028	229.5	312.1	26608.2	365.0	45.4	56.7995
260.0	-0.0014	-0.0010	-0.0005	0.0001	0.0013	0.0019	0.0023	0.0028	221.0	300.6	26900.1	345.7	46.5	58.164
250.0	-0.0016	-0.0011	-0.0006	0.0000	0.0012	0.0018	0.0023	0.0028	212.5	289.0	27093.8	325.8	47.6	59.4856
240.0	-0.0018	-0.0013	-0.0008	-0.0002	0.0012	0.0018	0.0023	0.0028	204.0	277.4	27189.1	306.0	48.3	60.4257
230.0	-0.0020	-0.0015	-0.0009	-0.0003	0.0011	0.0017	0.0023	0.0028	195.5	265.9	27186.2	286.7	48.7	60.9209
220.0	-0.0022	-0.0017	-0.0011	-0.0004	0.0010	0.0017	0.0022	0.0028	187.0	254.3	27085.1	266.8	49.1	61.3386
210.0	-0.0025	-0.0019	-0.0013	-0.0006	0.0009	0.0016	0.0022	0.0028	178.5	242.8	26885.7	248.5	49.1	61.3725
200.0	-0.0027	-0.0021	-0.0015	-0.0008	0.0008	0.0015	0.0021	0.0027	170.0	231.2	26588.0	231.2	48.9	61.0994
190.0	-0.0030	-0.0024	-0.0018	-0.0010	0.0007	0.0015	0.0021	0.0027	161.5	219.6	26192.1	213.3	48.6	60.7138
180.0	-0.0034	-0.0027	-0.0020	-0.0012	0.0005	0.0014	0.0020	0.0027	153.0	208.1	25697.9	194.8	48.2	60.2066
170.0	-0.0038	-0.0030	-0.0023	-0.0015	0.0004	0.0013	0.0020	0.0027	144.5	196.5	25105.4	180.4	47.4	59.2752
160.0	-0.0042	-0.0034	-0.0027	-0.0017	0.0002	0.0012	0.0019	0.0027	136.0	185.0	24414.7	165.0	46.5	58.1248
150.0	-0.0047	-0.0039	-0.0031	-0.0021	0.0001	0.0011	0.0019	0.0027	127.5	173.4	23625.8	147.3	45.3	56.5813
140.0	-0.0052	-0.0043	-0.0035	-0.0024	-0.0002	0.0009	0.0018	0.0026	119.0	161.8	22738.5	128.7	43.9	54.8354
130.0	-0.0058	-0.0049	-0.0040	-0.0028	-0.0004	0.0008	0.0017	0.0026	110.5	150.3	21753.0	109.0	42.3	52.8687
120.0	-0.0066	-0.0056	-0.0046	-0.0033	-0.0007	0.0006	0.0016	0.0026	102.0	138.7	20669.3	88.0	40.5	50.6568
110.0	-0.0074	-0.0063	-0.0053	-0.0039	-0.0010	0.0003	0.0014	0.0025	93.5	127.2	19487.3	65.2	38.5	48.1661
100.0	-0.0085	-0.0073	-0.0061	-0.0046	-0.0014	0.0001	0.0013	0.0025	85.0	115.6	18207.0	44.7	36.5	45.6468
97.9	-0.0087	-0.0075	-0.0063	-0.0047	-0.0015	0.0000	0.0012	0.0025	83.2	113.2	17925.7	41.0	36.1	45.1335
92.5	-0.0094	-0.0081	-0.0068	-0.0052	-0.0018	-0.0002	0.0011	0.0024	78.6	106.9	17182.3	30.0	34.8	43.5227
90.0	-0.0098	-0.0084	-0.0071	-0.0054	-0.0019	-0.0003	0.0011	0.0024	76.5	104.0	16828.5	24.3	34.1	42.6686
80.0	-0.0113	-0.0098	-0.0083	-0.0065	-0.0025	-0.0007	0.0008	0.0023	68.0	92.5	15351.7	-0.3	31.1	38.918
70.0	-0.0134	-0.0117	-0.0100	-0.0078	-0.0033	-0.0012	0.0005	0.0023	59.5	80.9	13776.6	-28.5	27.6	34.5004
60.0	-0.0161	-0.0141	-0.0121	-0.0096	-0.0044	-0.0019	0.0001	0.0021	51.0	69.4	12103.3	-48.8	24.7	30.8827
50.0	-0.0200	-0.0176	-0.0152	-0.0122	-0.0059	-0.0029	-0.0005	0.0020	42.5	57.8	10331.8	-71.9	21.3	26.6089
40.0	-0.0257	-0.0227	-0.0197	-0.0159	-0.0081	-0.0043	-0.0013	0.0017	34.0	46.2	8461.9	-98.5	17.3	21.5855
30.0	-0.0353	-0.0313	-0.0273	-0.0223	-0.0118	-0.0068	-0.0028	0.0013	25.5	34.7	6493.8	-110.1	15.3	19.1254
20.0	-0.0544	-0.0484	-0.0424	-0.0349	-0.0191	-0.0116	-0.0056	0.0004	17.0	23.1	4427.5	-138.2	10.2	12.7584
10.0	-0.1118	-0.0998	-0.0878	-0.0728	-0.0413	-0.0263	-0.0143	-0.0023	8.5	11.6	2262.9	-181.5	2.3	2.82859

Gambar Diagram Iteraksi :



4. *Shear Wall* dengan jarak antar tulangan vertikal = 40 mm (Teoritis)

Beton tekan : Cc= 0.85.f'c.b.a

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_1 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_2 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_3 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_4 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan belum leleh : $Cs_5 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Nilai Pn dan Mn :

Pn = $Cc + Cs_1 + Cs_2 + Cs_3 + Cs_4 + Cs_5 - T_1 - T_2 - T_3$

Mn = Pn.e

$$Mn = Cs1 \cdot \left(\frac{h}{2} - d'\right) + Cs2 \cdot \left(\frac{h}{2} - (d' + 40)\right) + Cs3 \cdot \left(\frac{h}{2} - (d' + 80)\right) + Cs4 \cdot \left(\frac{h}{2} - (d' + 130)\right) - Cs5 \cdot \left(\frac{h}{2} - (d' + 130)\right) - T3 \cdot \left(\frac{h}{2} + (d' + 80)\right) - T2 \cdot \left(\frac{h}{2} + (d' + 40)\right) - T1 \cdot \left(\frac{h}{2} + d'\right)$$

Hasil Perhitungan Diagram Iteraksi :

A. Garis netral (kondisi *balanced*)

Ec = 0,003 mm

Cb = 234,5 mm

Ab = 199,3 mm

Cek Tulangan Tekan

ey = 0,0012

es' = 0,0028

fs'=fy = 378,9 Mpa Fc' = 21,4 Mpa

Momen Nominal

Mn = 5927,1 kgm Pn = 33628,4 kg

Mn = 59,27 tm Pn = 33,63 ton

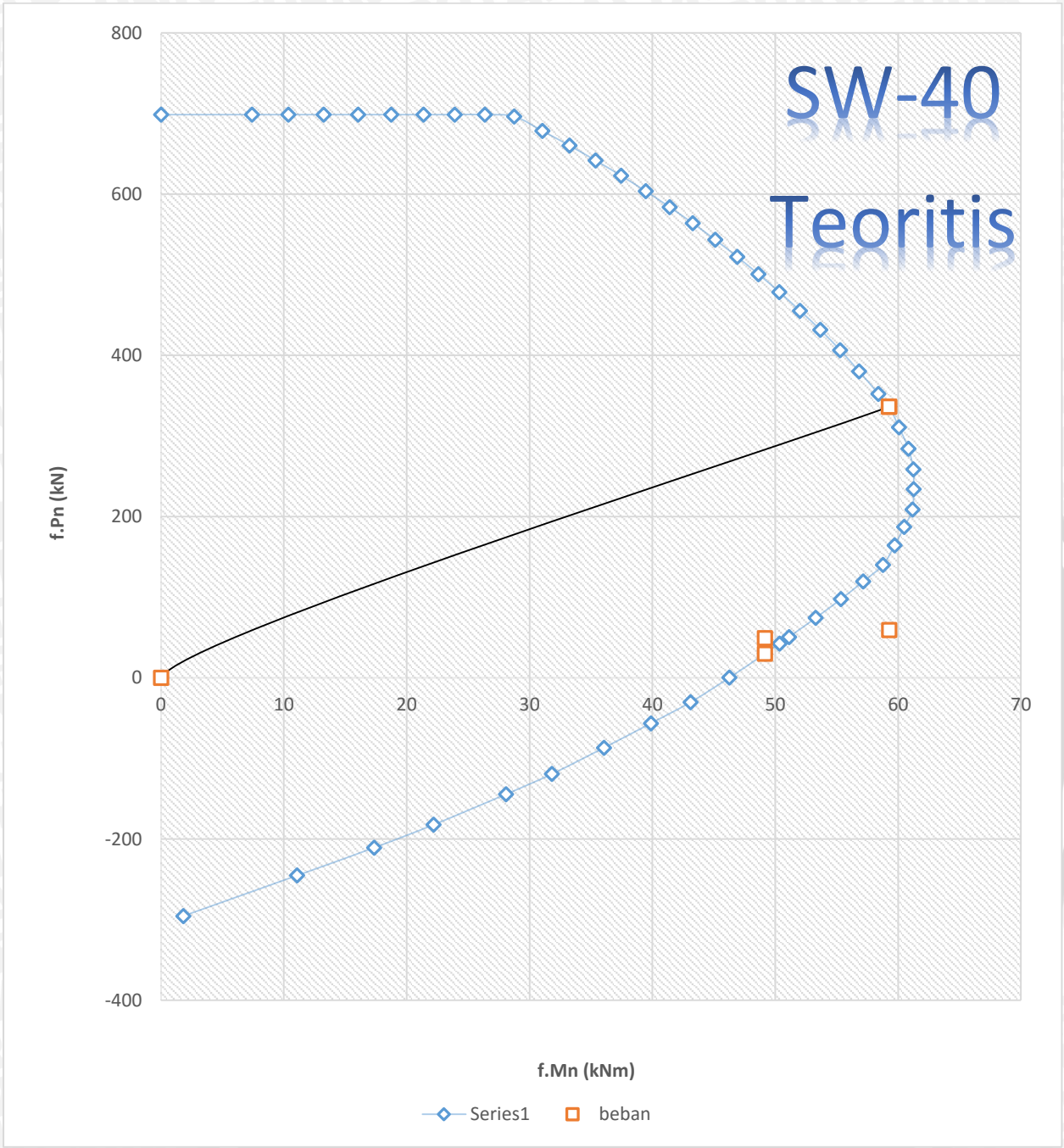
B. *Compression failure*:

c mm	εs1	εs2	εs3	εs4	εs5	εs6	εs7	εs8	a mm	Cc kN	Mc kNmm	Pn kN	Mn kNm	Ph kN
												698.54	0.00	0.00
480.0	0.0006	0.0009	0.0011	0.0014	0.0021	0.0024	0.0026	0.0029	408.0	594.8	-2379.2	698.54	7.42	7.42
470.0	0.0006	0.0008	0.0011	0.0014	0.0021	0.0024	0.0026	0.0029	399.5	582.4	145.6	698.54	10.38	10.38
460.0	0.0005	0.0008	0.0010	0.0014	0.0020	0.0024	0.0026	0.0029	391.0	570.0	2565.1	698.54	13.25	13.25
450.0	0.0005	0.0007	0.0010	0.0013	0.0020	0.0024	0.0026	0.0029	382.5	557.6	4879.3	698.54	16.04	16.04
440.0	0.0004	0.0007	0.0009	0.0013	0.0020	0.0023	0.0026	0.0029	374.0	545.2	7088.1	698.54	18.74	18.74
430.0	0.0003	0.0006	0.0009	0.0012	0.0020	0.0023	0.0026	0.0029	365.5	532.8	9191.6	698.54	21.37	21.37
420.0	0.0003	0.0006	0.0008	0.0012	0.0019	0.0023	0.0026	0.0029	357.0	520.5	11189.8	698.54	23.91	23.91
410.0	0.0002	0.0005	0.0008	0.0012	0.0019	0.0023	0.0026	0.0029	348.5	508.1	13082.6	698.54	26.37	26.37
400.0	0.0001	0.0004	0.0007	0.0011	0.0019	0.0023	0.0026	0.0029	340.0	495.7	14870.1	696.26	28.76	28.76
390.0	0.0001	0.0004	0.0007	0.0011	0.0019	0.0023	0.0026	0.0029	331.5	483.3	16552.3	678.35	31.04	31.04
380.0	0.0000	0.0003	0.0006	0.0010	0.0018	0.0022	0.0025	0.0029	323.0	470.9	18129.1	660.15	33.25	33.25
370.0	-0.0001	0.0002	0.0005	0.0010	0.0018	0.0022	0.0025	0.0029	314.5	458.5	19600.7	641.63	35.39	35.39
360.0	-0.0002	0.0001	0.0005	0.0009	0.0018	0.0022	0.0025	0.0029	306.0	446.1	20966.8	622.78	37.46	37.46
350.0	-0.0003	0.0001	0.0004	0.0008	0.0017	0.0022	0.0025	0.0029	297.5	433.7	22227.7	603.55	39.46	39.46
340.0	-0.0004	0.0000	0.0003	0.0008	0.0017	0.0021	0.0025	0.0028	289.0	421.3	23383.2	583.92	41.40	41.40
330.0	-0.0005	-0.0001	0.0003	0.0007	0.0017	0.0021	0.0025	0.0028	280.5	408.9	24433.4	563.86	43.28	43.28
320.0	-0.0006	-0.0002	0.0002	0.0006	0.0016	0.0021	0.0025	0.0028	272.0	396.5	25378.3	543.31	45.12	45.12
310.0	-0.0007	-0.0003	0.0001	0.0006	0.0016	0.0021	0.0024	0.0028	263.5	384.1	26217.9	522.24	46.90	46.90
300.0	-0.0008	-0.0004	0.0000	0.0005	0.0015	0.0020	0.0024	0.0028	255.0	371.8	26952.1	500.59	48.64	48.64
290.0	-0.0010	-0.0005	-0.0001	0.0004	0.0015	0.0020	0.0024	0.0028	246.5	359.4	27580.9	478.30	50.34	50.34
280.0	-0.0011	-0.0007	-0.0002	0.0003	0.0014	0.0020	0.0024	0.0028	238.0	347.0	28104.5	455.31	52.02	52.02
270.0	-0.0013	-0.0008	-0.0004	0.0002	0.0014	0.0019	0.0024	0.0028	229.5	334.6	28522.7	431.52	53.68	53.68
260.0	-0.0014	-0.0010	-0.0005	0.0001	0.0013	0.0019	0.0023	0.0028	221.0	322.2	28835.6	406.48	55.28	55.28
250.0	-0.0016	-0.0011	-0.0006	0.0000	0.0012	0.0018	0.0023	0.0028	212.5	309.8	29043.2	379.94	56.84	56.84
240.0	-0.0018	-0.0013	-0.0008	-0.0002	0.0012	0.0018	0.0023	0.0028	204.0	297.4	29145.4	352.21	58.40	58.40

C. ***Tension Failure*:**

c mm	εs1	εs2	εs3	εs4	εs5	εs6	εs7	εs8	a mm	Cc kN	Mc kNmm	Pn kN	Mn kNm	Ph kN
224.5	-0.0021	-0.0016	-0.0010	-0.0004	0.0010	0.0017	0.0022	0.0028	190.8	278.1	29095.2	310.8	60.1	60.073
214.5	-0.0024	-0.0018	-0.0012	-0.0005	0.0009	0.0016	0.0022	0.0028	182.3	265.8	28928.4	284.1	60.8	60.850
204.5	-0.0026	-0.0020	-0.0014	-0.0007	0.0008	0.0016	0.0022	0.0027	173.8	253.4	28656.3	258.6	61.2	61.238
194.5	-0.0029	-0.0023	-0.0017	-0.0009	0.0007	0.0015	0.0021	0.0027	165.3	241.0	28278.8	234.1	61.3	61.263
184.5	-0.0032	-0.0026	-0.0019	-0.0011	0.0006	0.0014	0.0021	0.0027	156.8	228.6	27796.0	208.8	61.2	61.174
174.5	-0.0036	-0.0029	-0.0022	-0.0013	0.0005	0.0013	0.0020	0.0027	148.3	216.2	27207.9	187.0	60.5	60.501
164.5	-0.0040	-0.0032	-0.0025	-0.0016	0.0003	0.0012	0.0020	0.0027	139.8	203.8	26514.4	164.2	59.7	59.714
154.5	-0.0044	-0.0037	-0.0029	-0.0019	0.0001	0.0011	0.0019	0.0027	131.3	191.4	25715.6	140.0	58.8	58.766
144.5	-0.0049	-0.0041	-0.0033	-0.0022	-0.0001	0.0010	0.0018	0.0026	122.8	179.0	24811.5	119.4	57.2	57.161
134.5	-0.0055	-0.0046	-0.0037	-0.0026	-0.0003	0.0008	0.0017	0.0026	114.3	166.6	23802.1	97.6	55.3	55.346
124.5	-0.0062	-0.0053	-0.0043	-0.0031	-0.0006	0.0006	0.0016	0.0026	105.8	154.2	22687.3	74.3	53.3	53.297
115.1	-0.0070	-0.0059	-0.0049	-0.0036	-0.0008	0.0005	0.0015	0.0025	97.8	142.6	21543.1	50.7	51.1	51.126
112.0	-0.0073	-0.0062	-0.0051	-0.0038	-0.0010	0.0004	0.0015	0.0025	95.2	138.7	21144.7	42.4	50.4	50.350
107.5	-0.0077	-0.0066	-0.0054	-0.0040	-0.0011	0.0003	0.0014	0.0025	91.3	133.1	20549.4	30.0	49.2	49.170
97.5	-0.0088	-0.0075	-0.0063	-0.0048	-0.0015	0.0000	0.0012	0.0025	82.8	120.8	19150.2	0.2	46.3	46.277
87.5	-0.0101	-0.0087	-0.0074	-0.0057	-0.0021	-0.0003	0.0010	0.0024	74.3	108.4	17645.6	-30.3	43.1	43.112
77.5	-0.0118	-0.0103	-0.0087	-0.0068	-0.0027	-0.0008	0.0008	0.0023	65.8	96.0	16035.7	-56.5	39.9	39.882
67.5	-0.0140	-0.0122	-0.0105	-0.0082	-0.0036	-0.0013	0.0004	0.0022	57.3	83.6	14320.5	-86.7	36.1	36.067
57.5	-0.0170	-0.0149	-0.0128	-0.0102	-0.0047	-0.0021	0.0000	0.0021	48.8	71.2	12499.9	-119.3	31.8	31.821
47.5	-0.0212	-0.0187	-0.0161	-0.0130	-0.0063	-0.0032	-0.0006	0.0019	40.3	58.8	10574.0	-144.4	28.1	28.080
37.5	-0.0276	-0.0244	-0.0212	-0.0172	-0.0088	-0.0048	-0.0016	0.0016	31.8	46.4	8542.8	-182.3	22.2	22.183
27.5	-0.0388	-0.0344	-0.0301	-0.0246	-0.0131	-0.0077	-0.0033	0.0011	23.3	34.0	6406.2	-210.7	17.3	17.347
17.5	-0.0628	-0.0559	-0.0490	-0.0404	-0.0224	-0.0138	-0.0069	0.0000	14.8	21.6	4164.4	-245.2	11.1	11.084
7.5	-0.1510	-0.1349	-0.1188	-0.0987	-0.0564	-0.0363	-0.0202	-0.0040	6.3	9.2	1817.1	-295.5	1.8	1.817

Gambar Diagram Iteraksi :



5. *Shear Wall* dengan jarak antar tulangan vertikal = 30 mm

Beton tekan : Cc= 0.85.f'c.b.a

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_1 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_2 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_3 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_4 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan belum leleh : $Cs_5 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Nilai Pn dan Mn :

Pn = $Cc + Cs_1 + Cs_2 + Cs_3 + Cs_4 + Cs_5 - T_1 - T_2 - T_3$

Mn = Pn.e

$$Mn = Cs1 \cdot \left(\frac{h}{2} - d'\right) + Cs2 \cdot \left(\frac{h}{2} - (d' + 30)\right) + Cs3 \cdot \left(\frac{h}{2} - (d' + 60)\right) + Cs4 \cdot \left(\frac{h}{2} - (d' + 100)\right) - Cs5 \cdot \left(\frac{h}{2} - (d' + 100)\right) - T3 \cdot \left(\frac{h}{2} + (d' + 60)\right) - T2 \cdot \left(\frac{h}{2} + (d' + 30) - T1 \cdot \left(\frac{h}{2} + d'\right)\right)$$

Hasil Perhitungan Diagram Iteraksi :

A. Garis netral (kondisi *balanced*)

Ec = 0,003 mm

Cb = 273,2 mm

Ab = 232,2 mm

Cek Tulangan Tekan

ey = 0,0012

es' = 0,0028

fs'=fy = 240 Mpa Fc' = 20 Mpa

Momen Nominal

Mn	= 4809,7 kgm	Pn	= 35778,3 kg
Mn	= 4,81 tm	Pn	= 35,78 ton

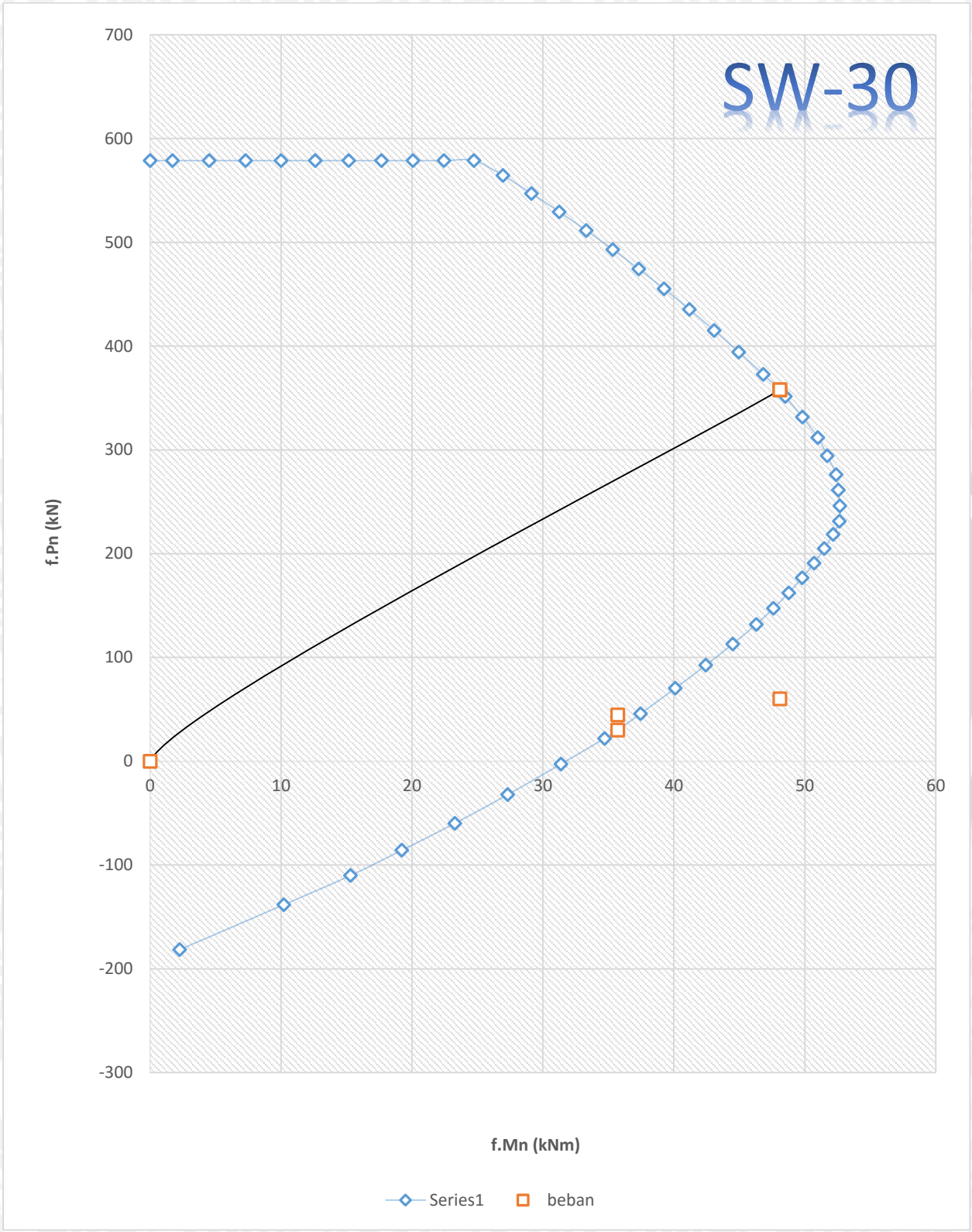
B. ***Compression failure***

c mm	εs1	εs2	εs3	εs4	εs5	εs6	εs7	εs8	a mm	Cc kN	Mc kNmm	Pn kN	Mn kNm	pH kN
												578.68	0.00	
480.0	0.0006	0.0008	0.0010	0.0012	0.0023	0.0025	0.0027	0.0029	408.0	554.9	-2219.5	578.68	1.71	0.00
470.0	0.0006	0.0008	0.0009	0.0012	0.0023	0.0025	0.0027	0.0029	399.5	543.3	135.8	578.68	4.51	0.00
460.0	0.0005	0.0007	0.0009	0.0012	0.0022	0.0025	0.0027	0.0029	391.0	531.8	2392.9	578.68	7.29	0.00
450.0	0.0005	0.0007	0.0009	0.0011	0.0022	0.0025	0.0027	0.0029	382.5	520.2	4551.8	578.68	9.99	0.00
440.0	0.0004	0.0006	0.0008	0.0011	0.0022	0.0025	0.0027	0.0029	374.0	508.6	6612.3	578.68	12.62	0.00
430.0	0.0003	0.0005	0.0008	0.0010	0.0022	0.0025	0.0027	0.0029	365.5	497.1	8574.6	578.68	15.18	0.00
420.0	0.0003	0.0005	0.0007	0.0010	0.0022	0.0024	0.0027	0.0029	357.0	485.5	10438.7	578.68	17.66	0.00
410.0	0.0002	0.0004	0.0006	0.0009	0.0021	0.0024	0.0027	0.0029	348.5	474.0	12204.5	578.68	20.08	0.00
400.0	0.0001	0.0004	0.0006	0.0009	0.0021	0.0024	0.0026	0.0029	340.0	462.4	13872.0	578.68	22.43	0.00
390.0	0.0001	0.0003	0.0005	0.0008	0.0021	0.0024	0.0026	0.0029	331.5	450.8	15441.3	578.68	24.72	0.00
380.0	0.0000	0.0002	0.0005	0.0008	0.0021	0.0024	0.0026	0.0029	323.0	439.3	16912.3	564.36	26.95	0.00
370.0	-0.0001	0.0001	0.0004	0.0007	0.0020	0.0024	0.0026	0.0029	314.5	427.7	18285.0	547.05	29.13	0.00
360.0	-0.0002	0.0001	0.0003	0.0006	0.0020	0.0024	0.0026	0.0029	306.0	416.2	19559.5	529.42	31.24	0.00
350.0	-0.0003	0.0000	0.0002	0.0006	0.0020	0.0023	0.0026	0.0029	297.5	404.6	20735.8	511.45	33.31	0.00
340.0	-0.0004	-0.0001	0.0002	0.0005	0.0020	0.0023	0.0026	0.0028	289.0	393.0	21813.7	493.10	35.33	0.00
330.0	-0.0005	-0.0002	0.0001	0.0004	0.0019	0.0023	0.0026	0.0028	280.5	381.5	22793.4	474.33	37.32	0.00
320.0	-0.0006	-0.0003	0.0000	0.0004	0.0019	0.0023	0.0026	0.0028	272.0	369.9	23674.9	455.12	39.26	0.00
310.0	-0.0007	-0.0004	-0.0001	0.0003	0.0019	0.0023	0.0025	0.0028	263.5	358.4	24458.1	435.41	41.18	0.00
300.0	-0.0008	-0.0005	-0.0002	0.0002	0.0018	0.0022	0.0025	0.0028	255.0	346.8	25143.0	415.16	43.07	0.00
290.0	-0.0010	-0.0006	-0.0003	0.0001	0.0018	0.0022	0.0025	0.0028	246.5	335.2	25729.7	394.31	44.95	0.00
280.0	-0.0011	-0.0008	-0.0005	0.0000	0.0017	0.0022	0.0025	0.0028	238.0	323.7	26218.1	372.80	46.82	0.00

C. *Tension Failure*

c mm	εs1	εs2	εs3	εs4	εs5	εs6	εs7	εs8	a mm	Cc kN	Mc kNmm	Pn kN	Mn kNm	pH kN
270.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	229.5	312.1	26608.2	351.55	48.52	0.00
260.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	221.0	300.6	26900.1	331.76	49.81	0.00
250.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	212.5	289.0	27093.8	311.92	50.99	0.00
240.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	204.0	277.4	27189.1	294.28	51.72	0.00
230.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	195.5	265.9	27186.2	276.24	52.39	0.00
220.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	187.0	254.3	27085.1	261.31	52.57	0.00
210.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	178.5	242.8	26885.7	246.06	52.67	0.00
200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	170.0	231.2	26588.0	231.20	52.65	0.00
190.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	161.5	219.6	26192.1	218.53	52.16	0.00
180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.0	208.1	25697.9	204.90	51.49	0.00
170.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	144.5	196.5	25105.4	191.02	50.71	0.00
160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	136.0	185.0	24414.7	176.85	49.80	0.00
150.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	127.5	173.4	23625.8	162.34	48.77	0.00
140.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	119.0	161.8	22738.5	147.41	47.61	0.00
130.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	110.5	150.3	21753.0	131.95	46.30	0.00
120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	102.0	138.7	20669.3	113.08	44.50	0.00
110.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.5	127.2	19487.3	92.61	42.44	0.00
100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	85.0	115.6	18207.0	70.36	40.11	0.00
90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	76.5	104.0	16828.5	45.73	37.45	0.00
84.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.6	97.3	15983.9	30.02	35.72	0.00
80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	68.0	92.5	15351.7	21.98	34.70	0.00
70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59.5	80.9	13776.6	-2.66	31.38	0.00
60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.0	69.4	12103.3	-32.18	27.31	0.00
50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.5	57.8	10331.8	-59.82	23.28	0.00
40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.0	46.2	8461.9	-85.71	19.22	0.00
30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.5	34.7	6493.8	-110.08	15.30	0.00
20.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.0	23.1	4427.5	-138.23	10.21	0.00
10.0	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	8.5	11.6	2262.9	-181.46	2.26	0.00

Gambar Diagram Iteraksi :



6. *Shear Wall* dengan jarak antar tulangan vertikal = 30 mm (Teoritis)

Beton tekan : Cc= 0.85.f'c.b.a

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_1 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_2 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_3 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan sudah leleh : $Cs_4 = As_1.fy$

Tulangan tekan lapis pertama (Cs_1) diasumsikan belum leleh : $Cs_5 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Tulangan tarik lapis pertama (T_1) diasumsikan belum leleh : $T_1 = As_1.fs$

Nilai Pn dan Mn :

Pn = $Cc + Cs_1 + Cs_2 + Cs_3 + Cs_4 + Cs_5 - T_1 - T_2 - T_3$

Mn = Pn.e

$$Mn = Cs1 \cdot \left(\frac{h}{2} - d'\right) + Cs2 \cdot \left(\frac{h}{2} - (d' + 30)\right) + Cs3 \cdot \left(\frac{h}{2} - (d' + 60)\right) + Cs4 \cdot \left(\frac{h}{2} - (d' + 100)\right) - Cs5 \cdot \left(\frac{h}{2} - (d' + 100)\right) - T3 \cdot \left(\frac{h}{2} + (d' + 60)\right) - T2 \cdot \left(\frac{h}{2} + (d' + 30) - T1 \cdot \left(\frac{h}{2} + d'\right)\right.$$

Hasil Perhitungan Diagram Iteraksi :

A. Garis netral (kondisi *balanced*)

Ec = 0,003 mm

Cb = 273,2 mm

Ab = 232,2 mm

Cek Tulangan Tekan

ey = 0,0012

es' = 0,0028

fs'=fy = 378,9 Mpa Fc' = 17,6 Mpa

Momen Nominal

Mn	= 5923 kgm	Pn	= 27950 kg
Mn	= 59,23 tm	Pn	= 27,95 ton

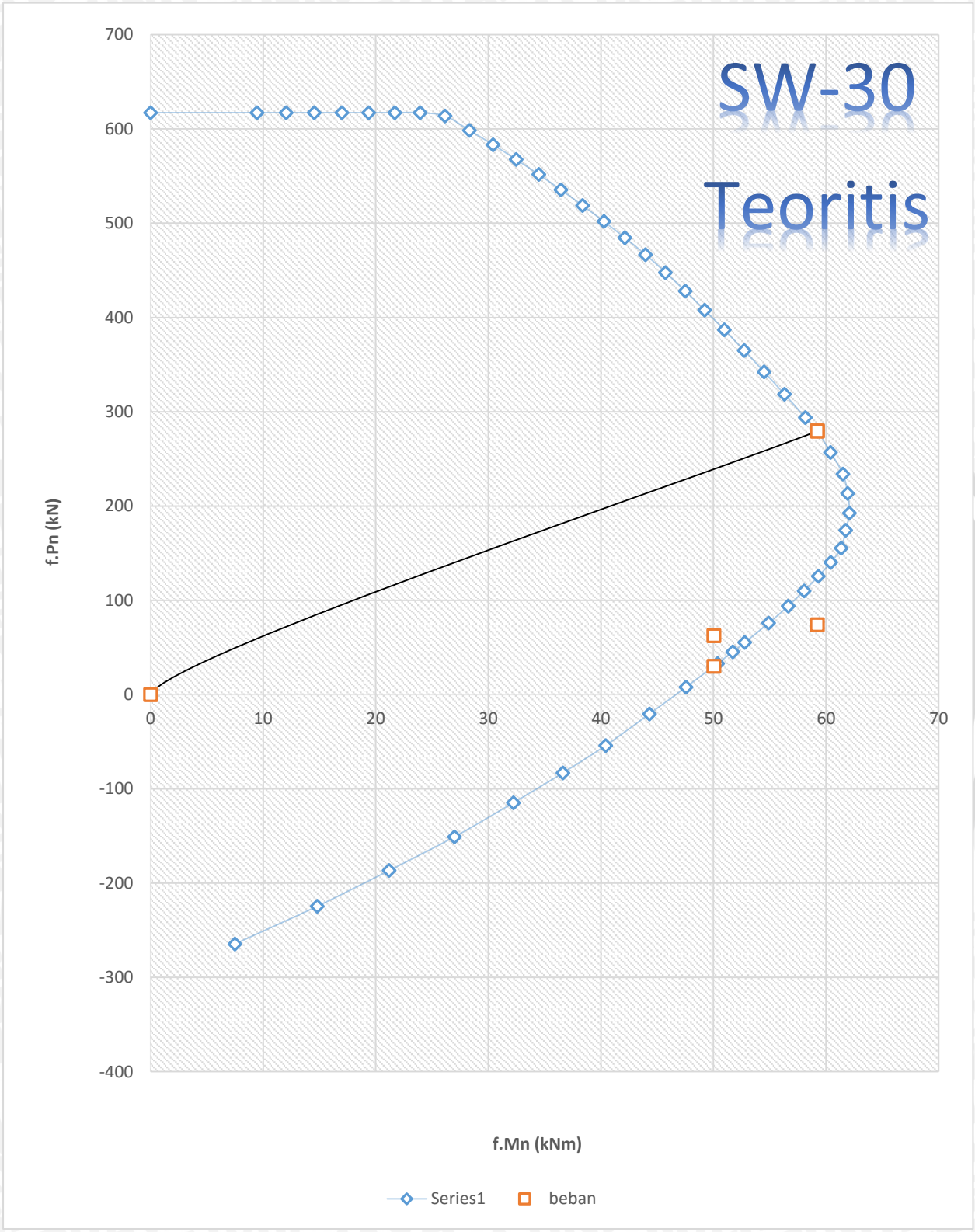
B. ***Compression failure***

c mm	εs1	εs2	εs3	εs4	εs5	εs6	εs7	εs8	a mm	Cc kN	Mc kNmm	Pn kN	Mn kNm	pH kN
												617.27	0.00	0.8125
480.0	0.0006	0.0008	0.0010	0.0012	0.0023	0.0025	0.0027	0.0029	408.0	488.5	-1954.1	617.3	9.5	11.827
470.0	0.0006	0.0008	0.0009	0.0012	0.0023	0.0025	0.0027	0.0029	399.5	478.3	119.6	617.3	12.0	15.042
460.0	0.0005	0.0007	0.0009	0.0012	0.0022	0.0025	0.0027	0.0029	391.0	468.2	2106.7	617.3	14.5	18.175
450.0	0.0005	0.0007	0.0009	0.0011	0.0022	0.0025	0.0027	0.0029	382.5	458.0	4007.3	617.3	17.0	21.23
440.0	0.0004	0.0006	0.0008	0.0011	0.0022	0.0025	0.0027	0.0029	374.0	447.8	5821.5	617.3	19.4	24.207
430.0	0.0003	0.0005	0.0008	0.0010	0.0022	0.0025	0.0027	0.0029	365.5	437.6	7549.1	617.3	21.7	27.11
420.0	0.0003	0.0005	0.0007	0.0010	0.0022	0.0024	0.0027	0.0029	357.0	427.5	9190.2	617.3	24.0	29.939
410.0	0.0002	0.0004	0.0006	0.0009	0.0021	0.0024	0.0027	0.0029	348.5	417.3	10744.8	613.8	26.2	32.698
400.0	0.0001	0.0004	0.0006	0.0009	0.0021	0.0024	0.0026	0.0029	340.0	407.1	12212.9	598.6	28.3	35.39
390.0	0.0001	0.0003	0.0005	0.0008	0.0021	0.0024	0.0026	0.0029	331.5	396.9	13594.4	583.3	30.4	38.018
380.0	0.0000	0.0002	0.0005	0.0008	0.0021	0.0024	0.0026	0.0029	323.0	386.7	14889.5	567.7	32.5	40.585
370.0	-0.0001	0.0001	0.0004	0.0007	0.0020	0.0024	0.0026	0.0029	314.5	376.6	16098.1	551.7	34.5	43.095
360.0	-0.0002	0.0001	0.0003	0.0006	0.0020	0.0024	0.0026	0.0029	306.0	366.4	17220.1	535.5	36.4	45.553
350.0	-0.0003	0.0000	0.0002	0.0006	0.0020	0.0023	0.0026	0.0029	297.5	356.2	18255.7	518.9	38.4	47.963
340.0	-0.0004	-0.0001	0.0002	0.0005	0.0020	0.0023	0.0026	0.0028	289.0	346.0	19204.7	501.9	40.3	50.33
330.0	-0.0005	-0.0002	0.0001	0.0004	0.0019	0.0023	0.0026	0.0028	280.5	335.9	20067.3	484.5	42.1	52.66
320.0	-0.0006	-0.0003	0.0000	0.0004	0.0019	0.0023	0.0026	0.0028	272.0	325.7	20843.3	466.7	44.0	54.961
310.0	-0.0007	-0.0004	-0.0001	0.0003	0.0019	0.0023	0.0025	0.0028	263.5	315.5	21532.8	447.8	45.7	57.175
300.0	-0.0008	-0.0005	-0.0002	0.0002	0.0018	0.0022	0.0025	0.0028	255.0	305.3	22135.8	428.1	47.5	59.361
290.0	-0.0010	-0.0006	-0.0003	0.0001	0.0018	0.0022	0.0025	0.0028	246.5	295.1	22652.3	407.8	49.2	61.538
280.0	-0.0011	-0.0008	-0.0005	0.0000	0.0017	0.0022	0.0025	0.0028	238.0	285.0	23082.3	386.8	51.0	63.716
270.0	-0.0013	-0.0009	-0.0006	-0.0001	0.0017	0.0021	0.0025	0.0028	229.5	274.8	23425.8	365.0	52.7	65.907
260.0	-0.0014	-0.0011	-0.0007	-0.0003	0.0016	0.0021	0.0025	0.0028	221.0	264.6	23682.8	342.3	54.5	68.126
250.0	-0.0016	-0.0012	-0.0009	-0.0004	0.0016	0.0021	0.0024	0.0028	212.5	254.4	23853.2	318.6	56.3	70.389
240.0	-0.0018	-0.0014	-0.0010	-0.0005	0.0015	0.0020	0.0024	0.0028	204.0	244.3	23937.2	293.8	58.2	72.714

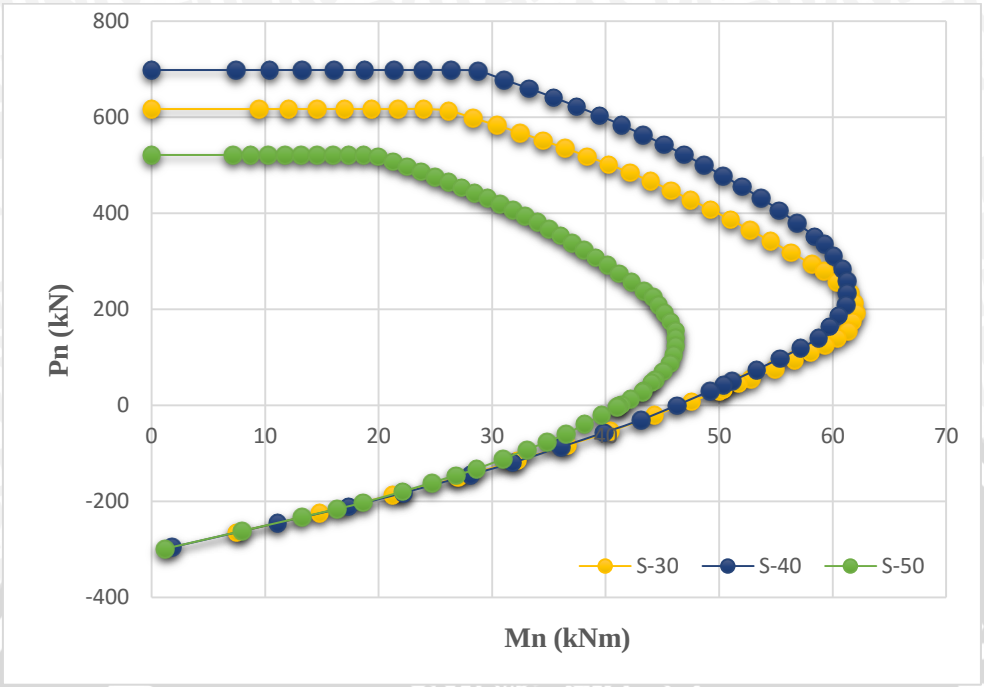
C. *Tension Failure*

c mm	εs1	εs2	εs3	εs4	εs5	εs6	εs7	εs8	a mm	Cc kN	Mc kNmm	Pn kN	Mn kNm	pH kN
224.5	-0.0021	-0.0017	-0.0013	-0.0008	0.0014	0.0020	0.0024	0.0028	190.8	228.4	23896.0	257.0	60.4	75.506
214.5	-0.0024	-0.0019	-0.0015	-0.0010	0.0014	0.0019	0.0023	0.0028	182.3	218.3	23759.0	234.1	61.5	76.867
204.5	-0.0026	-0.0022	-0.0017	-0.0011	0.0013	0.0019	0.0023	0.0027	173.8	208.1	23535.5	213.3	61.9	77.405
194.5	-0.0029	-0.0024	-0.0020	-0.0014	0.0012	0.0018	0.0023	0.0027	165.3	197.9	23225.5	192.7	62.1	77.595
184.5	-0.0032	-0.0027	-0.0022	-0.0016	0.0011	0.0017	0.0022	0.0027	156.8	187.7	22828.9	174.5	61.7	77.186
174.5	-0.0036	-0.0031	-0.0025	-0.0019	0.0010	0.0017	0.0022	0.0027	148.3	177.6	22345.9	155.3	61.3	76.678
164.5	-0.0040	-0.0034	-0.0029	-0.0022	0.0009	0.0016	0.0021	0.0027	139.8	167.4	21776.4	140.3	60.4	75.538
154.5	-0.0044	-0.0038	-0.0033	-0.0025	0.0007	0.0015	0.0021	0.0027	131.3	157.2	21120.3	125.5	59.3	74.148
144.5	-0.0049	-0.0043	-0.0037	-0.0029	0.0006	0.0014	0.0020	0.0026	122.8	147.0	20377.8	110.1	58.1	72.571
134.5	-0.0055	-0.0049	-0.0042	-0.0033	0.0004	0.0013	0.0019	0.0026	114.3	136.8	19548.7	93.8	56.6	70.79
124.5	-0.0062	-0.0055	-0.0048	-0.0038	0.0002	0.0011	0.0019	0.0026	105.8	126.7	18633.1	75.8	54.9	68.631
114.5	-0.0070	-0.0062	-0.0055	-0.0044	-0.0001	0.0010	0.0018	0.0025	97.3	116.5	17631.1	55.4	52.8	65.979
109.9	-0.0074	-0.0066	-0.0058	-0.0047	-0.0002	0.0009	0.0017	0.0025	93.4	111.8	17145.7	45.4	51.7	64.651
103.2	-0.0081	-0.0072	-0.0064	-0.0052	-0.0004	0.0007	0.0016	0.0025	87.7	105.0	16399.5	30.0	50.0	62.541
104.5	-0.0080	-0.0071	-0.0063	-0.0051	-0.0004	0.0008	0.0016	0.0025	88.8	106.3	16542.5	33.0	50.4	62.952
94.5	-0.0091	-0.0082	-0.0072	-0.0060	-0.0007	0.0005	0.0015	0.0024	80.3	96.1	15367.4	8.0	47.6	59.463
84.5	-0.0106	-0.0095	-0.0085	-0.0070	-0.0012	0.0002	0.0013	0.0024	71.8	86.0	14105.8	-20.5	44.3	55.388
74.5	-0.0124	-0.0112	-0.0100	-0.0084	-0.0017	-0.0001	0.0011	0.0023	63.3	75.8	12757.7	-54.0	40.4	50.534
64.5	-0.0148	-0.0134	-0.0120	-0.0101	-0.0025	-0.0006	0.0008	0.0022	54.8	65.6	11323.1	-83.1	36.6	45.779
54.5	-0.0181	-0.0164	-0.0148	-0.0126	-0.0035	-0.0013	0.0004	0.0020	46.3	55.4	9801.9	-114.7	32.2	40.283
44.5	-0.0228	-0.0208	-0.0188	-0.0161	-0.0049	-0.0022	-0.0002	0.0018	37.8	45.2	8194.3	-150.8	27.0	33.748
34.5	-0.0303	-0.0277	-0.0251	-0.0216	-0.0072	-0.0037	-0.0011	0.0015	29.3	35.1	6500.2	-186.6	21.2	26.494
24.5	-0.0439	-0.0402	-0.0366	-0.0317	-0.0114	-0.0065	-0.0028	0.0009	20.8	24.9	4719.5	-224.6	14.8	18.502
14.5	-0.0764	-0.0701	-0.0639	-0.0556	-0.0214	-0.0131	-0.0069	-0.0006	12.3	14.7	2852.4	-264.6	7.5	9.3581

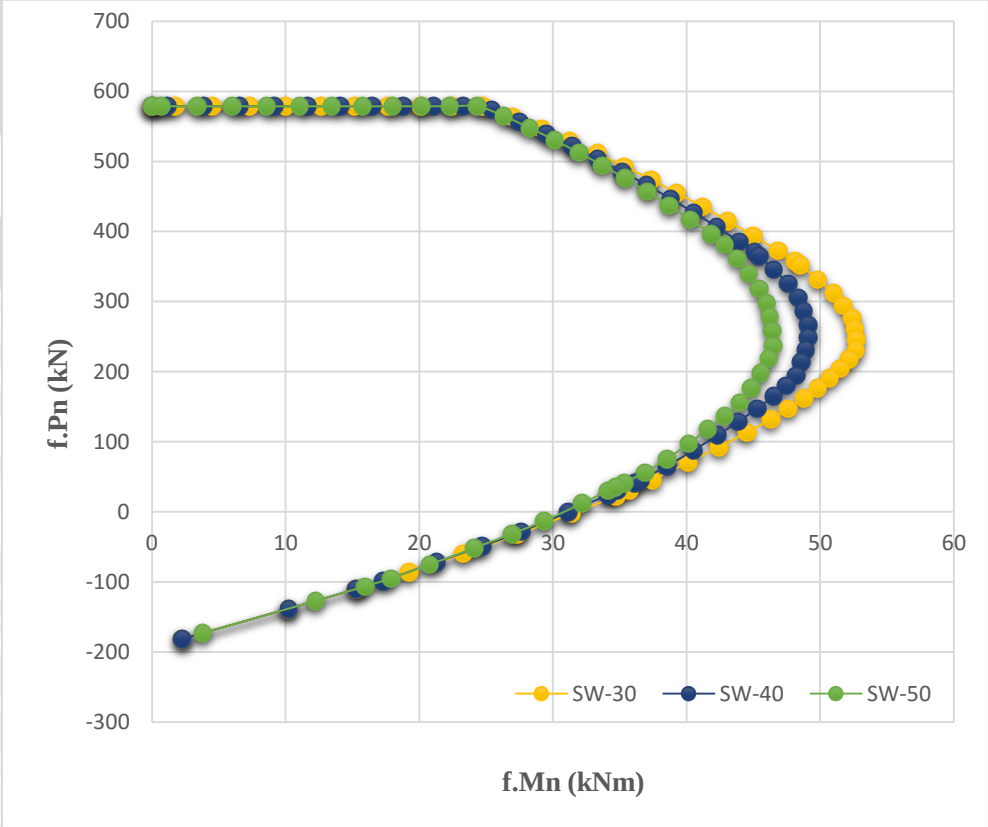
Gambar Diagram Iteraksi :



Perbandingan Diagram Iterasi teoritis SW-50, SW-40 dan SW-30:



Perbandingan Diagram Iterasi desain SW-50, SW-40 dan SW-30:



1.2 Perhitungan Beban Rencana

Perhitungan beban rencana dilakukan untuk 3 (tiga) variasi dinding geser dimana beban aksial bernilai sama untuk ketiga variasi. Mutu beton yang digunakan pada setiap spesimen merupakan hasil dari *analog hammer test.*

Karena beberapa keterbatasan pada alat uji maka beban rencana aksial merupakan 50% dari 0.1 P beban aksial sentris, maka :

(kn) P_{no} = 0.8 x (0.85.fc'.b.h + As (fy – 0.85.fc')) x 0.001

Dari rumus diatas maka nilai beban aksial untuk setiap spesimen uji pada masing-masing kelompok adalah sebagai berikut :

Shear Wall	Rasio badan (a)	Pv (%)	ρh (%)	F'c (Mpa)	Pu (Kg)
SW – 50	2	2,44	5,54	20	3000
SW – 40	2	2,44	5,54	20	3000
SW - 30	2	2,44	5,54	20	3000

1.3 Perhitungan *Mix Design* Dinding Geser

NO	URAIAN	TABEL / GRAFIK	NILAI	
1	Kuat tekan yang disyaratkan (28 HR, 5%)	SNI (rasio = 1)	20	Mpa
2	Deviasi standar	SNI (Mutu Baik)	4.2	
3	Nilai Tambah (Margin)	(K=1,64)	6.888	Mpa
4	Kuat tekan rata2 yg ditargetkan	(1) + (3)	26.888	Mpa
5	Jenis Semen	Ditetapkan	Normal (Tipe I)	
6	Jenis Agregat Kasar	Ditetapkan	Batu pecah	
	Jenis Agregat Halus	Ditetapkan	Pasir	
7	Faktor Air semen Bebas	Tabel 2, Grafik 1/2	0.55	
8	Faktor air semen Maksimum	Ditetapkan	0.6	
9	Slump	Ditetapkan	60 - 180 mm	
10	Ukuran Agregat Maksimum	Ditetapkan	20	
11	Kadar Air Bebas	TABEL 6	225	kg/m3
12	Jumlah semen	(11) : (8)	375	kg/m3
13	Jumlah Semen Maksimum	Ditetapkan	-	
14	Jumlah Semen Minimum	Ditetapkan	275 kg/m3	
15	FAS yg disesuaikan	-	-	
16	Susunan besar butir agregat halus	Grafik 3 - 6	Zona 1	
17	Persen agregat halus	Grafik 13 - 15	45%	
18	Berat Jenis Relatif Agregat (SSD)	Diketahui	2.7	kg/m3
19	Berat isi beton	Grafik 16	2375	kg/m3
20	Kadar agregat gabungan	(19) - (11) - (12)	1775.000	kg/m3
21	Kadar agregat halus	(17) * (20)	798.750	kg/m3
22	Kadar agregat kasar	(20) - (21)	976.250	kg/m3

*berdasarkan buku praktikum beton teknik sipil Universitas Brawijaya

	Dinding Geser			
Banyaknya Bahan	Semen	Air	Ag. Halus	Ag. Kasar
(Teoritis)	(kg)	(kg/lt)	(kg)	(kg)
Tiap m3 dg ketelitian 5kg (Teoritis)	375.00	225.00	798.75	976.25
Tiap campuran uji 0,198 m3	15.60	9.36	33.23	40.61
Jumlah (Kg)		98.80		
Proporsi (Teoritis)	1.00	0.60	2.13	2.60

Dari hasil mix design beton akan menjadi acuan kerja pada pengecoran lapangan. Pada kondisi pengecoran, dikarenakan kapasitas volume molen pengaduk tidak besar maka pengecoran dilakukan sebanyak 3 (tiga) kali.

LAMPIRAN 2

HASIL PENGUJIAN BAHAN PENYUSUN DINDING GESER

2.1 Uji Tekan Silinder Beton

Cara Perhitungan :

F'ci = P x i / A

Keterangan :

F'c : Mutu Beton (Kg/cm^2)

P : Beban (Kg) , merupakan hasil pembacaan dari alat uji tekan

A : Luas Penampang silinder (cm^2)

I : Faktor umur beton

Berikut merupakan hasil perhitungan dari uji tekan beton silinder :

NO	Benda Uji	BERAT	d	A	t	V	BERAT ISI	BEBAN MAX	KUAT TEKAN 28 hari	fci	(fci - fcr)	(fci - fcr)²
		Kg	cm	cm2	cm	cm3	kg/cm^3	kg	kg/cm²	kg/cm²	kg/cm²	kg/cm²
1	SW-50	12.40	15	176.63	30	5298.75	0.0023	19400	109.84	109.84	-75.14	5646.55
2	SW-50	12.30	15	176.63	30	5298.75	0.0023	29100	164.76	164.76	-20.22	409.05
3	SW-50	12.40	15	176.63	30	5298.75	0.0023	20900	118.33	118.33	-66.65	4442.35
4	SW-30	12.20	15	176.63	30	5298.75	0.0023	30200	170.98	170.98	-2.83	8.01
5	SW-30	12.50	15	176.63	30	5298.75	0.0024	35900	203.26	203.26	29.44	866.77
6	SW-30	12.35	15	176.63	30	5298.75	0.0023	27200	154.00	154.00	-19.82	392.67
7	SW-40	12.30	15	176.63	30	5298.75	0.0023	31200	176.65	176.65	2.83	8.01
8	SW-40	12.45	15	176.63	30	5298.75	0.0023	28900	163.62	163.62	-10.19	103.86
9	SW-40	12.20	15	176.63	30	5298.75	0.0023	53500	302.90	302.90	129.09	16663.47
		111.10					0.0023	276300	fcr :	173.81	-33.50	28540.73

Dari hasil uji kuat tekan beton maka didapatkan Fcr (kuat tekan rata-rata) pada spesimen benda uji SW-50, SW-40 dan SW-30 adalah 173,81 kg/cm^2. Setiap spesimen diambil 3 sampel dikarenakan pengecoran yang dilakukan 3 fase untuk satu benda uji dan juga untuk keakuratan data.

Sehingga rata2 kuat tekan beton untuk SW 50, SW 40 dan SW 30 adalah sebagai berikut :

Benda Uji	KUAT TEKAN 28 hari kg/cm²	KUAT TEKAN 28 hari Mpa
SW-50	109.837	10.98
SW-50	164.756	16.48
SW-50	118.330	11.83
		13.10
SW-30	170.984	17.10
SW-30	203.255	20.33
SW-30	153.999	15.40
		17.61
SW-40	176.645	17.66
SW-40	163.623	16.36
SW-40	302.902	30.29
		21.44

2.2 Analog Hammer test

SUDUT PUKULAN		0°	0°	0°
KODE BIDANG UJI		SW - 50	SW - 40	SW - 30
TITIK TEMBAKAN KE				
NILAI LENTING PALU BETON (R)	1	40	36	34
	2	40	35	36
	3	38	33	36
	4	38	32	38
	5	40	36	34
	6	36	32	38
	7	36	34	36
	8	36	34	34
	9	40	34	36
	10	36	34	34
Jumlah N		10	10	10
R MAKSIMUM		40	36	38
R MINIMUM		36	32	34
R RATA-RATA		38.0	34.0	35.6
R RATA-RATA TERKOREKSI		38.0	34.0	35.6
PERKIRAAN KUAT TEKAN BETON TERKOREKSI		355.04	302.19	326.35
Koreksi ke silinder	0.83	29.47	25.08	27.09

Dari pengujian kuat tekan silinder dan pengujian *analog hammer test* maka hasilnya dibandingkan untuk menentukan kuat tekan beton aktual.

Benda Uji	*Analog Hammer Test*	Uji Tekan Silinder
	Mpa	Mpa
SW-50	29.5	13.10
SW-40	25.1	21.44
SW-30	27.1	17.61

Nilai mutu beton yang digunakan adalah uji tekan silinder untuk masing-masing benda uji dikarenakan nilai hasil kuat tekan lebih realistis dengan keadaan di lapangan serta pengujian dengan *analog hammer test* harus dikali dengan berbagai faktor koreksi sehingga kemungkinan untuk mendapat data yang akurat juga tergoloh susah. Pada pengujian kuat tekan beton, setiap spesimen memiliki nilai yang bervariasi serta jarak serta nilai simpangan korelasi yang besar sehingga fapat mempengaruhi hasil.

2.3 Uji Slump

Benda Uji	Slump (cm)	Umur Beton (hari)	Berat (kg)
	9.5		12.4
SW-50	19		12.3
	17		12.4
	15		12.3
SW-40	14.5	28	12.45
	12.5		12.2
	10.5		12.2
SW-30	16		12.5
	17		12.35

Berdasarkan tabel tersebut diketahui pula nilai slump berkisar antara 9,5-19 cm untuk semua variasi dinding geser. Keberagaman dari nilai uji slump ini dikarenakan pada saat pengecoran agregat halus ataupun agregat kasar yang digunakan dalam kondisi cukup kering atau basah sehingga kadar air pada campuran beton beragam. Berikut adalah cakupan nilai standar berdasarkan PBI 1971 untuk struktur dinding.

No	Elemen Struktur	Slump maks (cm)	Slump min (cm)
1	Plat pondasi, pondasi telapak bertulang	12,5	5,0
2	Pondasi telapak tidak bertulang, kaison dan konstruksi di bawah tanah	9,0	2,5
3	Plat [lantai], balok, kolom dan dinding	15,0	7,5
4	Jalan beton bertulang	7,5	5,0
5	Pembetonan massal	7,5	2,5

2.4 Uji Tarik Baja Tulangan

Pengujian Uji tarik tulangan dilakukan pada tulangan baja polos dengan diameter 8mm. Penggunaan tulangan polos 8mm digunakan pada pondasi maupun dinding geser serta untuk tulangan vertikal dan tulangan horizontal.

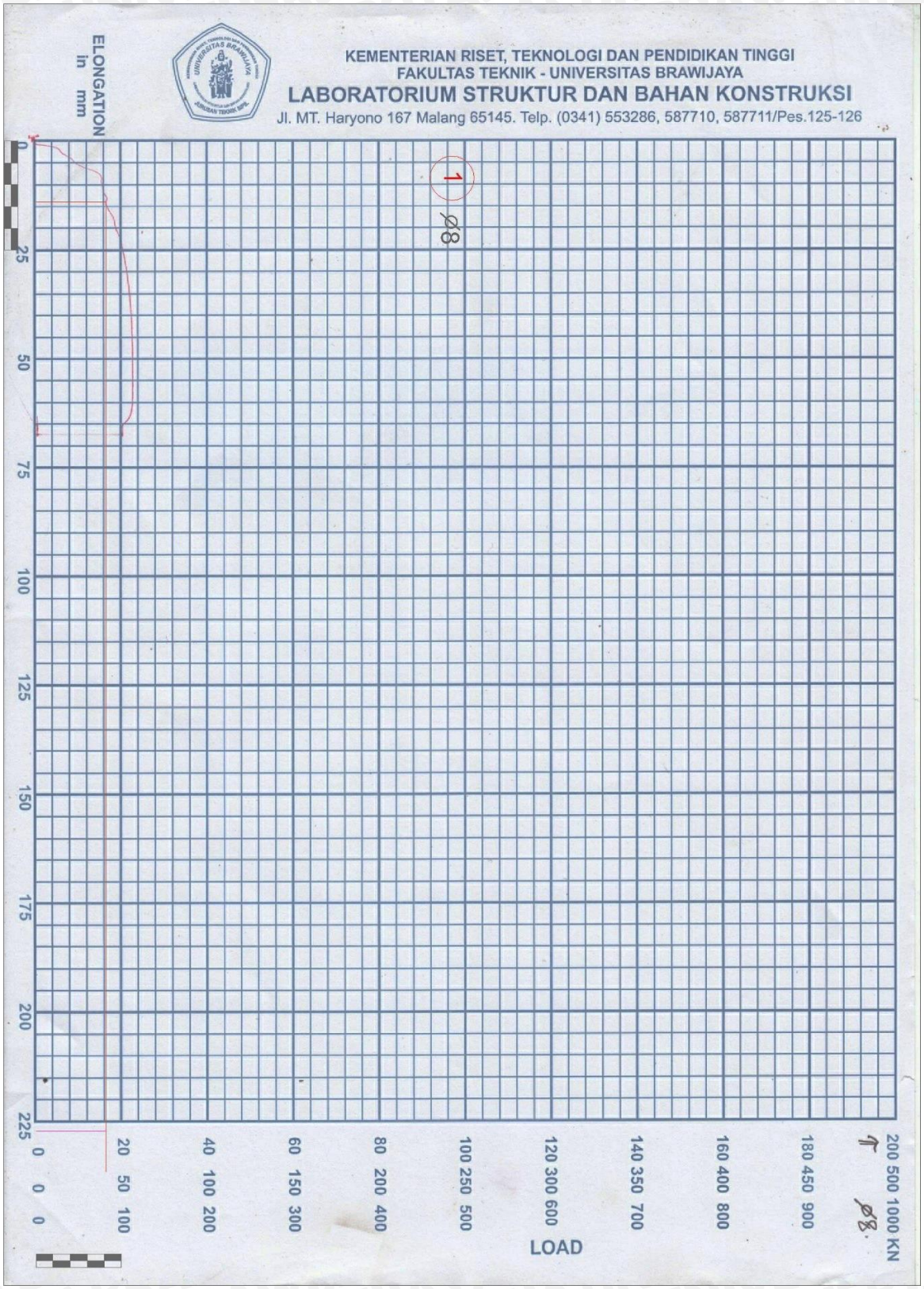
No Tulangan	Diameter (mm)	Diameter Aktual (mm2)	A (mm2)	P (N)	fy (Mpa)
1	Ø8	7.88	48.744104	16406	336.57
2	Ø8	7.88	48.744104	19660	403.33
3	Ø8	7.88	48.744104	19335	396.66
				fy	**378.86**

Untuk mengetahui nilai tegangan leleh tulangan, maka didapatkan dari beban disaat awal leleh dibagi dengan luas tulangan.

1. Tulangan Ø8 (1)

Elongasi (mm)	Beban (N)	Regangan	Tegangan (Mpa)
0	0	0	0
0.3855266	264.7153772	0.002409541	5.430716275
0.493921	718.8206177	0.003087006	14.74682305
0.5687913	2182.287743	0.003554946	44.77029514
0.6470141	3376.735177	0.004043838	69.27474663
0.7274718	4405.46648	0.004546699	90.37948142
0.9654926	5617.131174	0.006034329	115.2371502
1.2124531	5967.932853	0.007577832	122.4339531
1.6426783	7067.685355	0.01026674	144.9957093
1.8907563	7846.766383	0.011817227	160.978793
2.2539335	8856.128269	0.014087084	181.6861583
2.7914357	10093.61885	0.017446473	207.0736531
3.2831218	11983.21317	0.020519511	245.8392538
4.1201055	15372.86129	0.025750659	315.3789134
4.9213302	15598.83783	0.030758314	320.0148907
6.9148936	16976.21866	0.043218085	348.2722762
7.4065797	16593.13462	0.046291123	340.4131909
9.5185947	18706.55332	0.059491217	383.7706167
14.476801	21220.27332	0.090480008	435.3403453
18.509744	22195.20069	0.115685902	455.3412759
22.849991	22802.10911	0.142812444	467.7921864
23.718264	22937.69504	0.148239149	470.5737728
24.816735	22948.45583	0.155104595	470.7945336
28.000402	23049.60723	0.175002514	472.8696854
29.39612	23058.21586	0.183725751	473.046294
30.621983	22950.60798	0.191387393	470.8386858
32.288128	22905.41268	0.2018008	469.9114903
32.868094	22683.74045	0.205425588	465.3638174
33.483819	22317.87367	0.209273869	457.8579493
33.867111	21874.52922	0.211669442	448.7626034
34.257107	21256.86	0.214106919	436.0909321
34.514125	20880.23243	0.21571328	428.3643032
34.729796	20634.88647	0.217061226	423.3309564

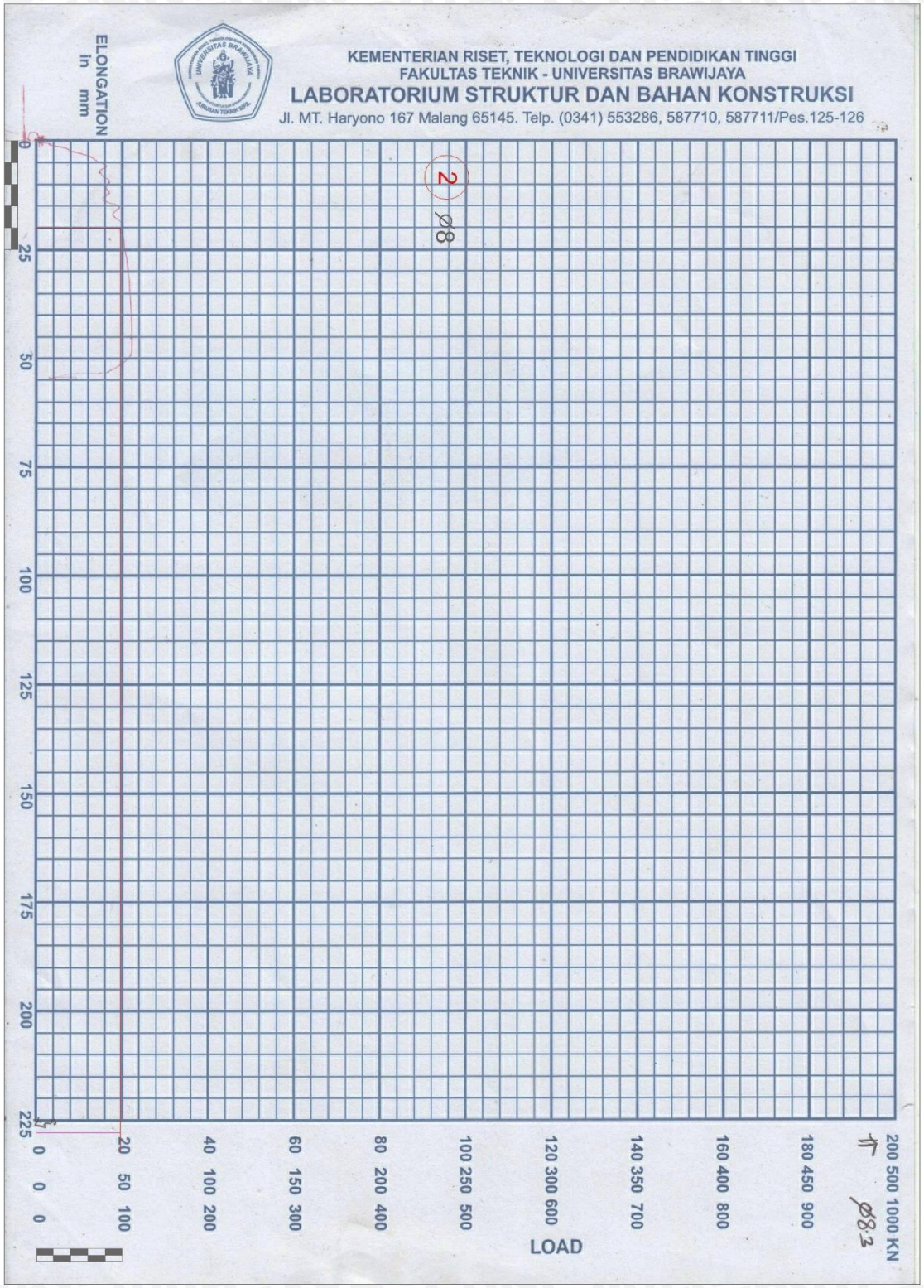
Hasil *universal tension test machine* labotorium teknik sipil universitas brawijaya :



2. Tulangan Ø8 (2)

Elongasi (mm)	Beban (N)	Regangan	Tegangan (Mpa)
0	0	0	0
0.196674	609.060583	0.001229215	12.49506265
0.308421	2898.9562	0.001927633	59.47296603
0.492804	3273.43162	0.003080022	67.15544271
0.97108	7151.6195	0.00606925	146.7176437
1.519757	9734.20854	0.00949848	199.7002415
1.877347	12568.6	0.011733417	257.8486426
2.395852	14225.7613	0.014974075	291.8458096
3.057393	16552.2436	0.019108707	339.5742997
3.728992	14852.0392	0.023306197	304.6940895
4.362596	15848.4881	0.027266226	325.1365418
4.909038	17202.1952	0.030681488	352.9082535
5.551582	16343.4843	0.03469739	335.2915398
6.24106	17169.9128	0.039006627	352.2459711
6.973002	15603.1422	0.043581262	320.1031951
7.545146	17505.6494	0.047157161	359.1337088
7.983193	19492.0908	0.049894958	399.8861569
8.956508	18045.841	0.055978176	370.2159021
10.08292	20256.1067	0.063018226	415.5601754
10.6707	19659.9591	0.066691903	403.3300258
11.7133	20467.0182	0.07320814	419.8870876
13.22859	20783.3853	0.082678683	426.3774558
14.80087	21327.8812	0.09250542	437.5479535
15.7116	21437.6412	0.098197524	439.7997139
16.79778	21715.2696	0.104986143	445.4953432
17.60571	21865.9206	0.110035703	448.5859947
18.60696	21954.159	0.116293525	450.3962335
19.27409	22040.2453	0.120463079	452.1623201
19.92446	22132.7881	0.12452787	454.0608632
20.69104	22276.9827	0.129319015	457.0190582
21.73588	223157215	0.13584922	4578137.972
22.66673	22378.1341	0.141667039	459.09421
23.19864	22399.6557	0.144991507	459.5357316
23.8803	22371.6776	0.149251855	458.9617535
24.56083	22479.2855	0.153505219	461.1693617
25.38441	22403.96	0.158652557	459.6240359
25.73529	22328.6345	0.160845588	458.0787102
26.04707	22081.1363	0.162794174	453.0012112
26.52087	21510.8146	0.165755464	441.3008875
27.10196	20273.324	0.169387236	415.9133927
27.64616	18575.2717	0.17278853	381.0773347
27.96576	16959.0014	0.174786005	347.9190589

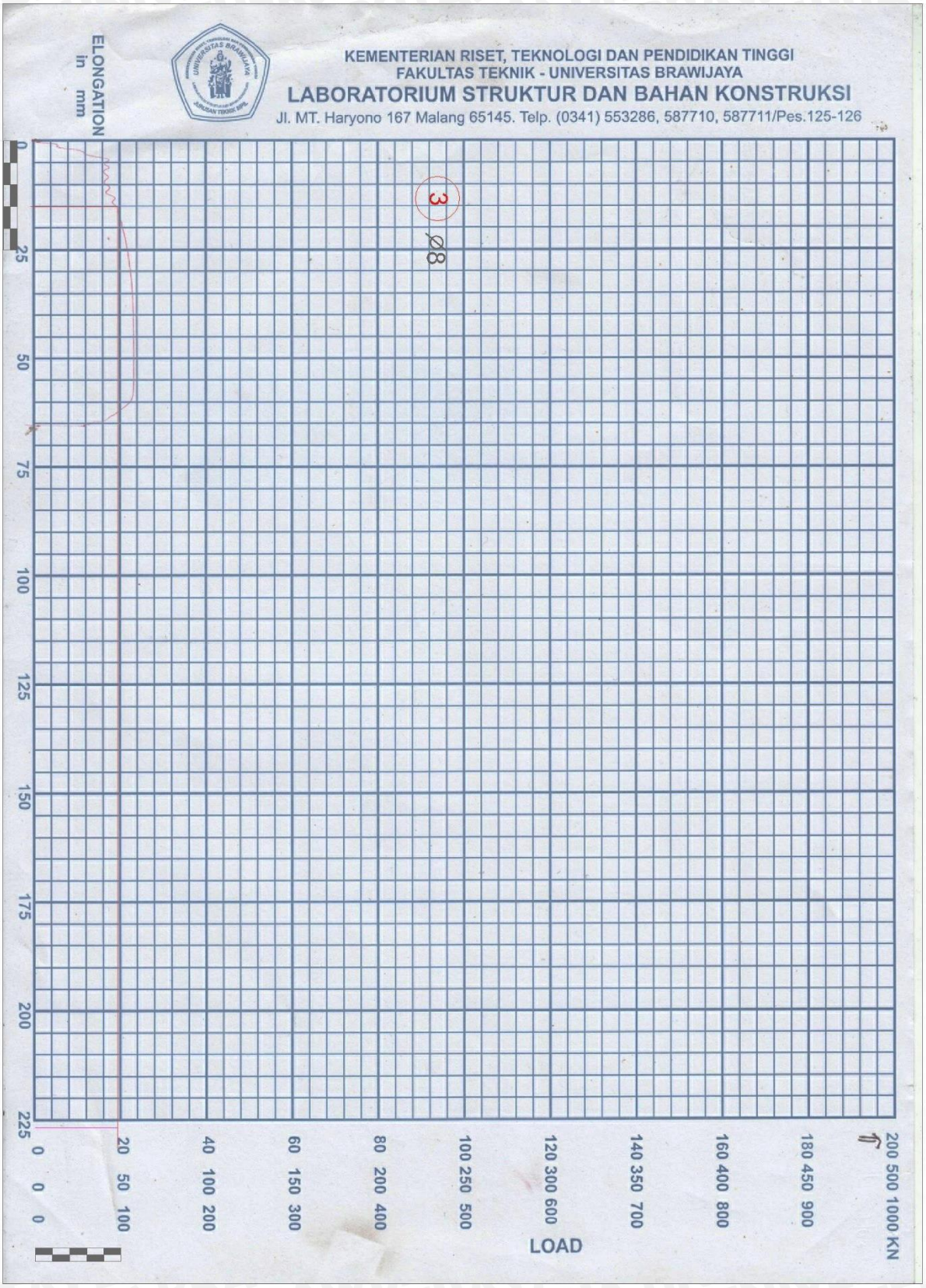
Hasil *universal tension test machine* labotorium teknik sipil universitas brawijaya :



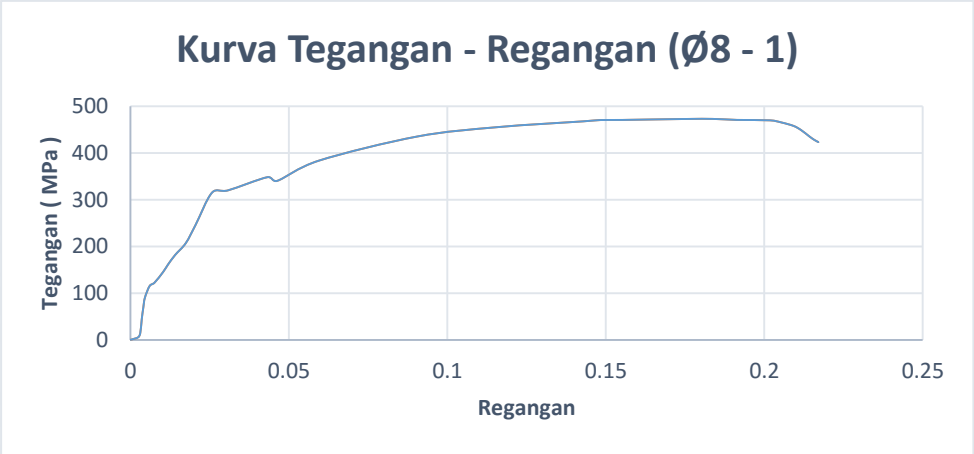
3. Tulangan Ø8 (3)

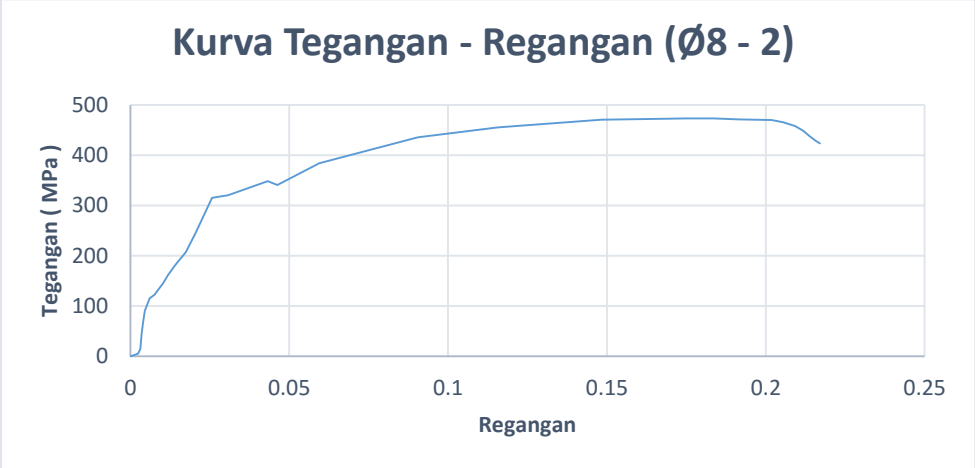
Elongasi (mm)	Beban (N)	Regangan	Tegangan (Mpa)
0	0	0	0
0.196674	609.060583	0.001229215	12.49506265
0.308421	2898.9562	0.001927633	59.47296603
0.492804	3273.43162	0.003080022	67.15544271
0.97108	7151.6195	0.00606925	146.7176437
1.519757	9734.20854	0.00949848	199.7002415
1.877347	12568.6	0.011733417	257.8486426
2.395852	14225.7613	0.014974075	291.8458096
3.057393	16552.2436	0.019108707	339.5742997
3.728992	14852.0392	0.023306197	304.6940895
4.362596	15848.4881	0.027266226	325.1365418
4.909038	17202.1952	0.030681488	352.9082535
5.551582	16343.4843	0.03469739	335.2915398
6.24106	17169.9128	0.039006627	352.2459711
6.973002	15603.1422	0.043581262	320.1031951
7.545146	17505.6494	0.047157161	359.1337088
7.983193	19492.0908	0.049894958	399.8861569
8.956508	18045.841	0.055978176	370.2159021
10.08292	20256.1067	0.063018226	415.5601754
10.6707	19659.9591	0.066691903	403.3300258
11.7133	20467.0182	0.07320814	419.8870876
13.22859	20783.3853	0.082678683	426.3774558
14.80087	21327.8812	0.09250542	437.5479535
15.7116	21437.6412	0.098197524	439.7997139
16.79778	21715.2696	0.104986143	445.4953432
17.60571	21865.9206	0.110035703	448.5859947
18.60696	21954.159	0.116293525	450.3962335
19.27409	22040.2453	0.120463079	452.1623201
19.92446	22132.7881	0.12452787	454.0608632
20.69104	22276.9827	0.129319015	457.0190582
21.73588	223157215	0.13584922	4578137.972
22.66673	22378.1341	0.141667039	459.09421
23.19864	22399.6557	0.144991507	459.5357316
23.8803	22371.6776	0.149251855	458.9617535
24.56083	22479.2855	0.153505219	461.1693617
25.38441	22403.96	0.158652557	459.6240359
25.73529	22328.6345	0.160845588	458.0787102
26.04707	22081.1363	0.162794174	453.0012112
26.52087	21510.8146	0.165755464	441.3008875
27.10196	20273.324	0.169387236	415.9133927
27.64616	18575.2717	0.17278853	381.0773347
27.96576	16959.0014	0.174786005	347.9190589

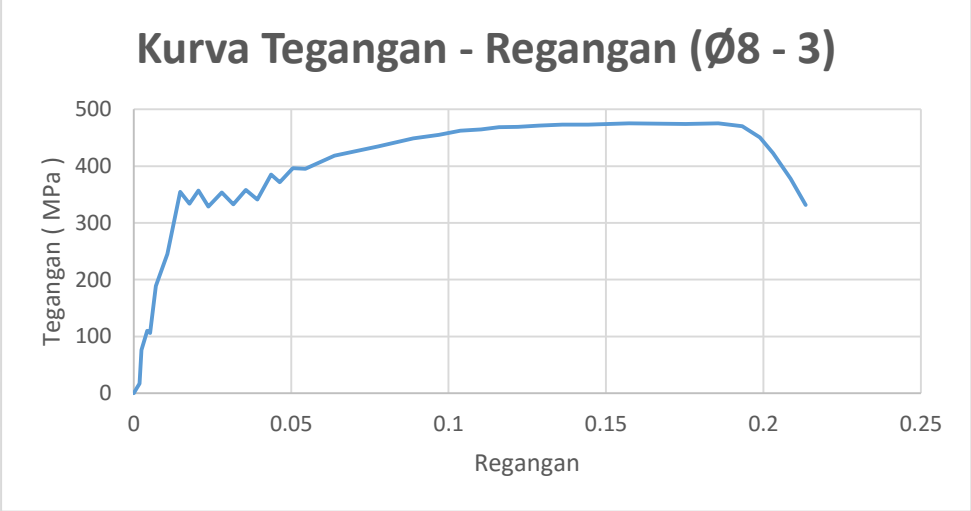
Hasil *universal tension test machine* labotorium teknik sipil universitas brawijaya :



Dari hasil uji tarik terhadap tiga sampel tulangan Ø8 maka didapat kurva diagram tergangan – regangan sebagai berikut :







LAMPIRAN 3

DATA PENGUJIAN SIKLIK

3.1 Analisa Pengujian Pembebanan Siklik

1. Benda Uji SW-50

NO	DRIFT	SIMPANGAN	BEBAN	Δ_2	Δ_3	Δ_4	Δ_5	Δ_6	Δ_7	Δ_8	Δ_9
	%	mm	Kg	mm	mm	mm	mm	mm	mm	mm	mm
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
2	0.25	2.00	1046.00	0.00	0.00	-22.00	-11.00	41.00	12.50	1.71	2.2
3	0.00	0.00	0.00	0.00	0.00					0.43	0.48
4	-0.25	-2.00	-1350.00	0.00	0.00	-4.00	-11.00	39.00	3.00	-1.28	-1.47
5	0.00	0.00	480.00	-0.08	0.01	-11.00	-8.00	47.00	8.00	0.82	0.99
6	0.25	2.00	1410.00	-0.12	0.01	-21.50	-8.50	49.80	14.00	2.47	3.16
7	0.00	0.00	600.00	-0.12	0.01	-17.00	-8.00	48.00	9.00	1.2	1.45
8	-0.25	-2.00	-1416.00	-0.14	-0.02	-5.00	-6.00	34.00	4.00	-1.26	-1.47
9	0.00	0.00	500.00	-0.18	-0.02	-9.50	-8.00	48.00	8.50	0.94	1.15
10	0.50	4.00	1990.00	-0.23	-0.02	-29.00	-9.50	44.00	22.00	4.11	5.25
11	0.00	0.00	0.00	-0.26	-0.02	-19.50	-8.00	50.00	6.00	0.57	0.67
12	-0.50	-4.00	-2600.00	-0.26	-0.11	9.50	-17.00	35.00	-36.00	-2.96	-3.28
13	0.00	0.00	370.00	-0.29	-0.11	-11.00	-22.00	52.00	6.00	0.65	0.83
14	0.50	4.00	2034.00	-0.30	-0.04	-28.00	-23.50	59.00	23.50	4.03	5.14
15	0.00	0.00	450.00	-0.30	-0.03	-10.10	-21.50	55.00	11.00	1.14	1.42

16	-0.50	-4.00	-2200.00	-0.30	-0.11	11.00	-18.50	39.00	-23.00	-2.8	-3.08
17	0.00	0.00	316.00	-0.34	-0.10	-9.50	-22.00	-52.70	7.90	0.65	0.85
18	0.75	6.00	2500.00	-0.37	-0.03	-37.00	-26.00	62.50	31.00	5.54	6.96
19	0.00	0.00	150.00	-0.41	-0.03	-12.50	-27.00	56.00	11.00	0.84	1.1
20	-0.75	-6.00	-3328.00	-0.41	-0.24	29.90	-18.00	25.00	49.90	-4.5	-4.78
21	0.00	0.00	730.00	-0.42	-0.14	-14.00	-29.00	52.00	9.50	1.16	1.57
22	0.75	6.00	2901.00	-0.51	-0.05	-43.00	34.00	63.00	40.00	6.31	7.88
23	0.00	0.00	403.00	-0.52	-0.08	-9.50	-30.00	57.00	16.50	1.16	1.49
24	-0.75	-6.00	-3284.00	-0.52	-0.30	-62.50	-25.90	26.00	55.00	-4.42	-4.63
25	0.00	0.00	540.00	-0.58	-0.20	5.50	-34.00	57.00	19.00	1.02	1.38

NO	DRIFT	SIMPANGAN	BEBAN	Δ_2	Δ_3	Δ_4	Δ_5	Δ_6	Δ_7	Δ_8	Δ_9
	%	mm	Kg	mm	mm	mm	mm	mm	mm	mm	mm
26	1.00	8.00	3400.00	-0.84	-0.08	-30.50	-43.00	74.00	53.00	7.69	9.48
27	0.00	0.00	504.00	-0.91	-0.19	19.00	-36.00	67.00	25.50	1.46	1.84
28	-1.00	-8.00	-4190.00	-0.81	-0.46	-20.00	-31.00	19.00	33.00	-5.62	-5.94
29	0.00	0.00	570.00	-0.94	-0.37	29.90	-42.00	64.00	27.00	1.22	1.64
30	1.00	8.00	3222.00	-1.24	-0.30	3.00	-50.00	-16.00	-38.00	7.47	9.12
31	0.00	0.00	343.00	-1.51	-0.37	-33.50	-43.00	-21.00	31.00	1.23	1.64
32	-1.00	-8.00	-4088.00	-1.37	-0.71	28.00	-39.00	26.00	31.00	-5.73	-5.81

33	0.00	0.00	705.00	-1.92	-0.64	2.80	-48.00	-13.00	38.00	1.04	1.35
34	1.50	12.00	4345.00	-3.14	-0.50	-19.00	-66.00	23.00	-10.00	10.37	12.51
35	0.00	0.00	369.00	-4.46	-0.71	-5.00	47.00	14.00	43.00	1.27	1.42
36	-1.50	-12.00	-5302.00	-4.35	-1.23	-11.00	-47.00	8.50	55.00	-8.77	-8.95
37	0.00	0.00	692.00	-5.42	-1.05	27.00	32.00	-4.00	31.00	0.64	0.86
38	1.50	12.00	4296.00	-8.19	-0.88	-27.00	14.00	29.00	-7.50	10.23	12
39	0.00	0.00	396.00	-8.25	-0.91	-38.00	25.00	-7.50	40.00	1.03	1.19
40	-1.50	-12.00	-5244.00	-8.08	-1.50	-42.00	-60.00	0.00	-44.00	-8.96	-9.13
41	0.00	0.00	714.00	-8.85	-1.34	-10.00	25.00	3.00	40.00	0.98	1.18
42	2.00	16.00	4750.00	-9.91	-1.14	10.00	-1.00	41.00	21.00	12.98	15.01
43	0.00	0.00	-288.00	-9.71	-1.33	29.00	21.00	8.00	38.00	-0.15	-0.17
44	-2.00	-16.00	-5750.00	-9.41	197.88	-35.00	30.80	34.00	-6.00	-12.92	-12.65
45	0.00	0.00	773.00	-10.45	-1.63	-24.00	15.00	68.00	40.50	-0.11	0.57
46	2.00	16.00	4690.00	-12.43	-1.47	-19.00	-10.00	23.00	16.00	12.9	14.85
47	0.00	0.00	-400.00	-12.43	-1.65	54.00	19.00	73.00	-4.00	-0.9	-0.84
48	-2.00	-16.00	-4998.00	error	-2.25	-22.00	27.00	21.00	-31.50	-12.86	-12.49
49	0.00	0.00	938.00	error	-1.81	-35.00	-1.00	50.00	19.00	-0.35	0.39
52	-2.50	-20.00	-6540.00	error	-2.58	-21.00	23.00	-20.00	14.00	-16.39	-15.82

NO	DRIFT	SIMPANGAN	BEBAN	Δ_2	Δ_3	Δ_4	Δ_5	Δ_6	Δ_7	Δ_8	Δ_9
	%	mm	Kg	mm	mm	mm	mm	mm	mm	mm	mm
60	**-3.00**	**-24.00**	**-6780.00**	**error**	**-2.53**	**-21.00**	**23.00**	**-20.00**	**14.00**	**error**	**-17.34**
68	-4.00	-32.00	-6326.00	error	-2.62	-21.00	70.00	10.00	-9.00	error	-22.52
76	-5.00	-40.00	-3726.00	error	error	error	error	error	error	error	error

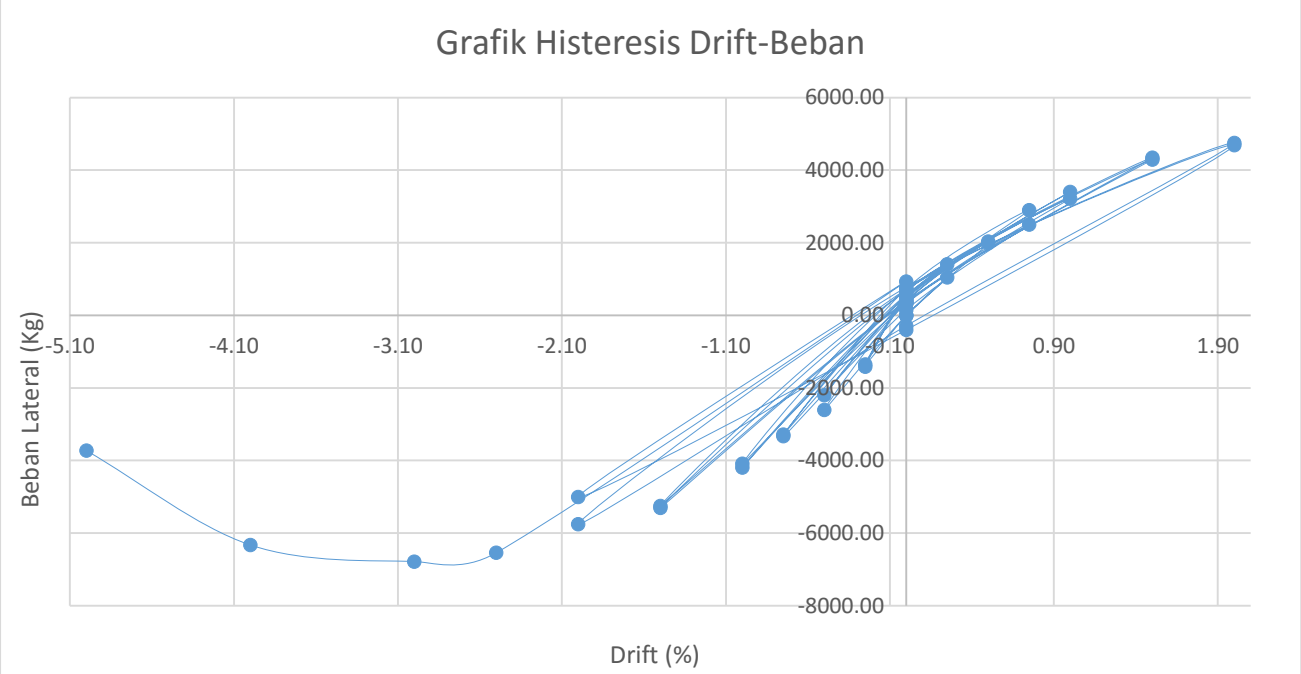
Pada setiap *drift*, baik arah (+) maupun (-) dilakukan pembebanan dua kali. Untuk diperoleh beban lateral pada setiap *drift* pembebanan siklik tersebut, maka dihitung rata-rata beban lateral yang terjadi pada setiap *drift.*

Contohnya pada *drift* 2%. Dilakukan pembebanan dengan *drift 2%* pada siklus 42 dan 46. Dari hasil pengujian diperoleh beban lateral sebesar 4750 kg dan 4690 kg. Maka diambil rata-rata beban lateral pada siklus tersebut sebesar 4720 kg.

Tabel Rata-Rata Beban Lateral Setiap Drift Benda Uji SW-50 :

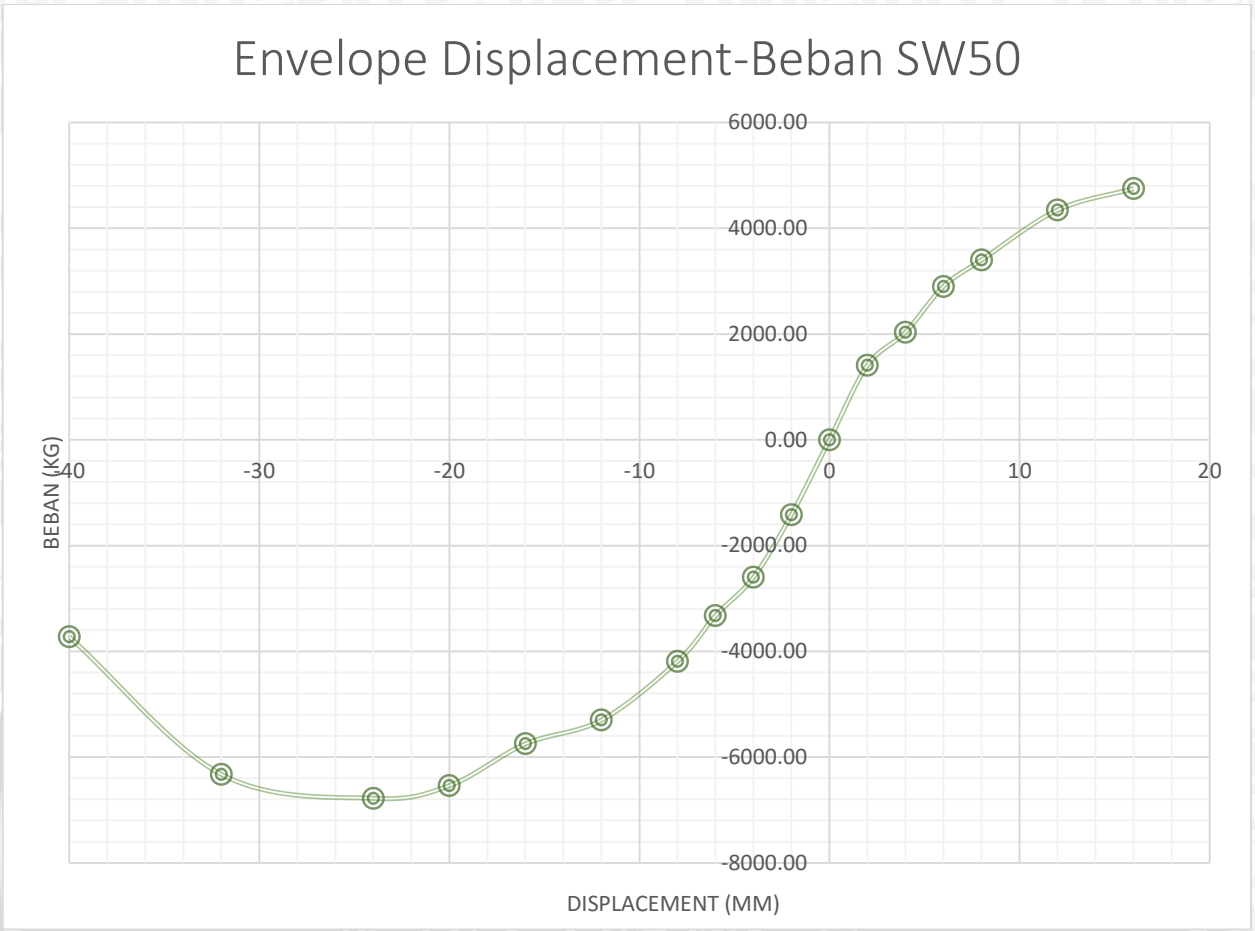
Drift	Simpangan	Beban
%	mm	kg
0	0	0.00
0.25	2	1228.00
0	0	540.00
-0.25	-2	-1383.00
0	0	250.00
0.5	4	2012.00
0	0	410.00
-0.5	-4	-2400.00
0	0	233.00
0.75	6	2700.50
0	0	566.50
-0.75	-6	-3306.00
0	0	522.00
1	8	3311.00
0	0	456.50
-1	-8	-4139.00
0	0	537.00
1.5	12	4320.50
0	0	544.00
-1.5	-12	-5273.00
0	0	213.00
2	16	4720.00
0	0	186.50
-2	-16	-5374.00
0	0	938.00
-2.5	-20	-6540.00
-3	-24	-6780.00
-4	-32	-6326.00

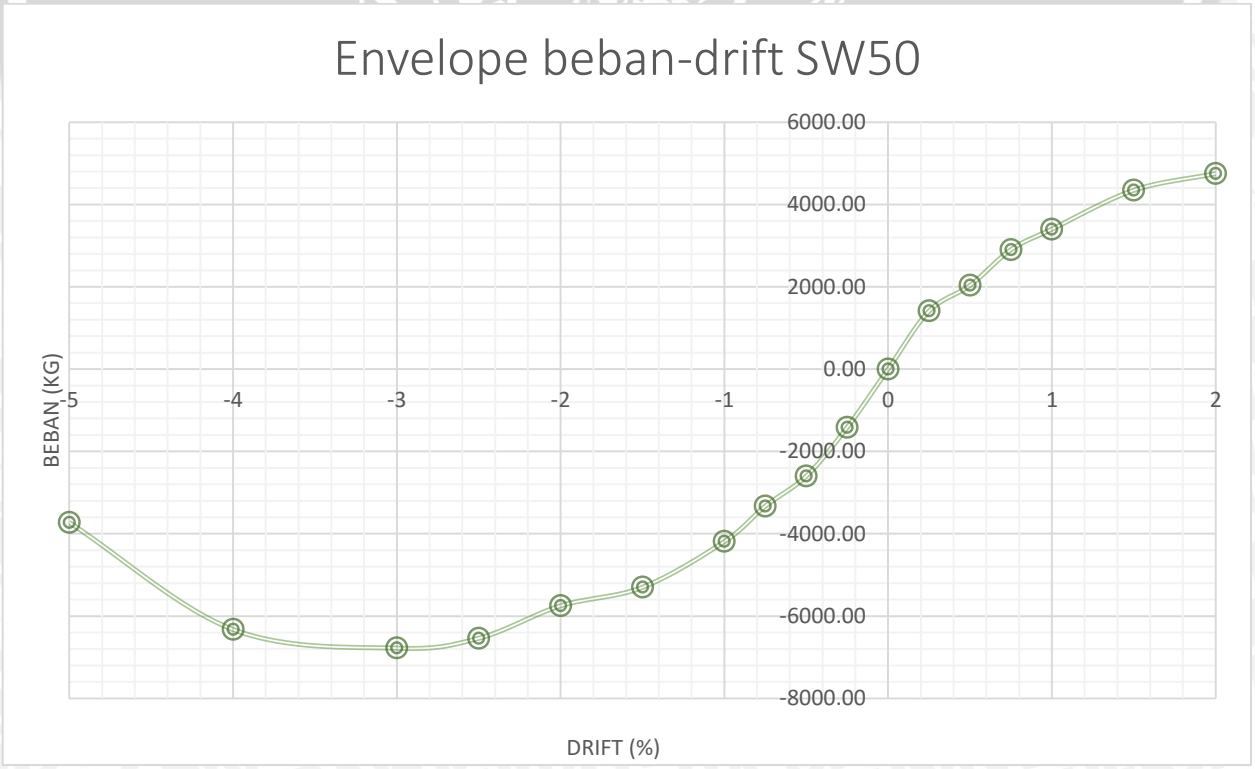
-5	-40	-3726.00



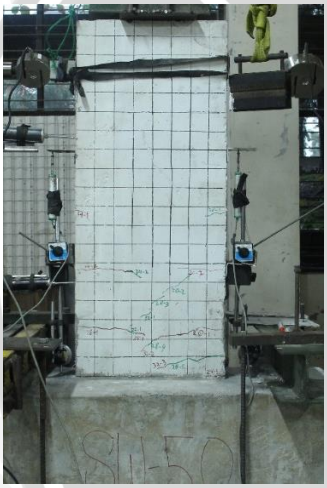
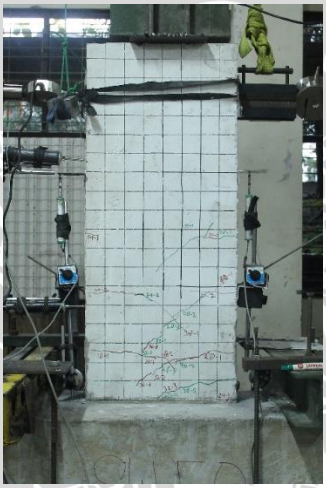
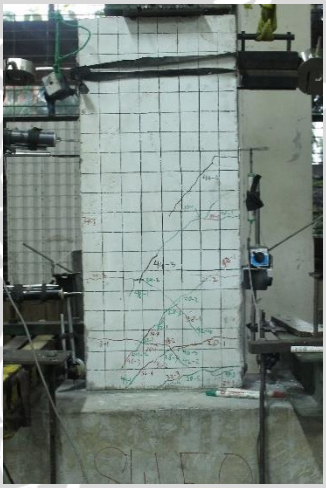
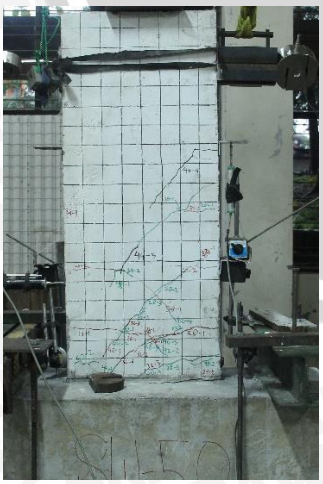
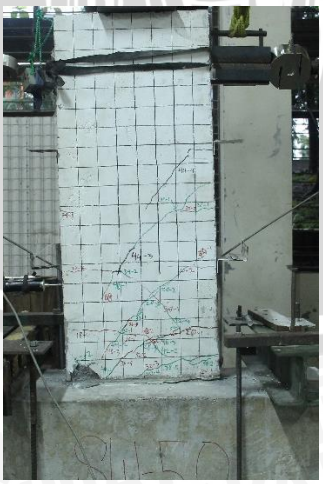
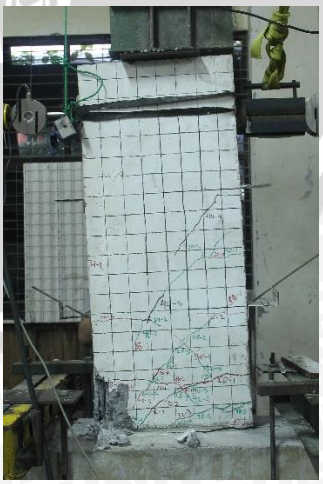
Untuk diperoleh grafik *envelope* dari grafik histerisis yang telah ada, maka diambil beban puncak pada setiap drift.

DRIFT (%)	BEBAN (KG)	DISPLACEMENT (MM)
2	4750.00	16
1.5	4345.00	12
1	3400.00	8
0.75	2901.00	6
0.5	2034.00	4
0.25	1410.00	2
0	0	0
-0.25	-1416.00	-2
-0.5	-2600.00	-4
-0.75	-3328.00	-6
-1	-4190.00	-8
-1.5	-5302.00	-12
-2	-5750.00	-16
-2.5	-6540.00	-20
-3	-6780.00	-24
-4	-6326.00	-32
-5	-3726.00	-40


Envelope Displacement-Beban SW50
6000.00
4000.00
2000.00
0.00
-2000.00
-4000.00
-6000.00
-8000.00
BEBAN (KG)
-40
-30
-20
-10
0
10
20
DISPLACEMENT (MM)


Envelope beban-drift SW50
6000.00
4000.00
2000.00
0.00
-2000.00
-4000.00
-6000.00
-8000.00
BEBAN (KG)
-5
-4
-3
-2
-1
0
1
2
DRIFT (%)

Visualisasi eksperimental SW-50:

Drift 0,25% 	Drift 0,5% 	Drift 0,75% 
Drift 1% 	Drift 1,5% 	Drift 2% 
Drift 3% 	Drift 4% 	Drift 5% 

2. Benda Uji SW-40

NO.	DRIFT	SIMPANGAN	BEBAN	Δ_2	Δ_3	Δ_4	Δ_5	Δ_6	Δ_7	Δ_8	Δ_9
	%	mm	Kg	mm	mm	mm	mm	mm	mm	mm	mm
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
2	0.25	2.00	1103.00	-0.17	-0.02	22.00	-1.00	-13.00	5.00	2.32	0
3	0.00	0.00	-396.00	-0.15	-0.08	27.00	6.00	-13.00	3.00	-0.26	-0.16
4	-0.25	-2.00	-1108.00	-0.10	-0.11	28.00	0.70	-14.20	1.00	-1.77	-2.12
5	0.00	0.00	0.00	-0.11	-0.11	23.00	-0.20	-14.00	5.00	0.05	-2.11
6	0.25	2.00	1302.00	-0.13	-0.11	17.00	-1.00	-13.00	11.00	2.82	0.14
7	0.00	0.00	-296.00	-0.13	-0.20	24.00	-1.00	-14.00	5.00	-0.15	-3.55
8	-0.25	-2.00	-1182.00	-0.13	-0.20	28.00	0.80	-15.00	2.00	-1.92	-5.75
9	0.00	0.00	0.00	-0.13	-0.20	23.00	-1.00	-14.00	6.00	0.07	-3.29
10	0.50	4.00	1498.00	-0.17	-0.19	13.00	-1.50	-13.00	13.00	3.26	-0.08
11	0.00	0.00	-346.00	-0.15	-0.19	20.00	-1.00	-14.00	6.00	-0.26	-3.72
12	-0.50	-4.00	-1758.00	-0.12	-0.25	31.00	2.00	-17.00	-2.00	-3.74	-7.97
13	0.00	0.00	0.00	-0.16	-0.25	21.50	-2.00	-9.50	8.00	-0.11	-3.53
14	0.50	4.00	1585.00	-0.17	-0.25	12.00	-2.00	-13.00	15.00	3.14	-0.52
15	0.00	0.00	-335.00	-0.16	-0.27	22.00	-2.00	-14.00	8.00	-0.22	-3.68
16	-0.50	-4.00	-1896.00	-0.13	-0.29	33.00	1.00	-17.00	-2.00	-3.84	-8.08
17	0.00	0.00	0.00	-0.17	-0.31	21.00	-3.00	16.50	10.00	-0.08	-3.48

18	0.75	6.00	2115.00	-0.20	-0.31	7.00	-3.50	-13.00	22.00	4.8	1.33
19	0.00	0.00	-480.00	-0.20	-0.32	23.00	-3.00	-16.50	10.00	-0.44	-3.9
20	-0.75	-6.00	-2650.00	-0.14	-0.40	40.00	0.50	-22.00	-8.00	-5.64	-10.21
21	0.00	0.00	0.00	-0.18	-0.45	24.00	-6.00	-18.00	14.00	-0.35	-3.84
22	0.75	6.00	2208.00	-0.23	-0.45	8.00	-8.00	-16.00	30.00	4.68	1.15
23	0.00	0.00	-444.00	-0.23	-0.45	25.00	-6.00	-21.00	15.50	-0.55	-4
24	-0.75	-6.00	-2734.00	-0.22	-0.52	42.00	-3.00	-26.00	-3.00	-5.71	-10.24
25	0.00	0.00	-230.00	-0.26	-0.54	25.00	-8.00	-22.00	19.00	-0.33	-3.79

NO.	DRIFT	SIMPANGAN	BEBAN	Δ_2	Δ_3	Δ_4	Δ_5	Δ_6	Δ_7	Δ_8	Δ_9
	%	mm	Kg	mm	mm	mm	mm	mm	mm	mm	mm
26	1.00	8.00	2710.00	-0.38	-0.54	6.00	-10.00	-28.00	-51.00	6.27	3.13
27	0.00	0.00	-520.00	-0.39	-0.65	37.00	-8.50	-36.00	28.00	-0.61	-3.98
28	-1.00	-8.00	-3648.00	-0.39	-1.14	-29.00	-9.00	47.00	17.00	-7.67	-12.36
29	0.00	0.00	120.00	-0.53	-1.35	44.00	-20.00	-40.00	-37.00	-0.45	-4.49
30	1.00	8.00	2910.00	-0.59	-1.35	22.00	-24.00	59.00	-11.00	6.12	3.28
31	0.00	0.00	-490.00	-0.59	-1.47	60.00	-21.00	48.00	-34.80	-0.86	-4.09
32	-1.00	-8.00	-3876.00	-0.60	-2.12	-8.00	-19.00	33.00	41.00	-7.95	-12.48
33	0.00	0.00	86.00	-0.69	-2.21	63.50	68.20	46.00	-10.80	-0.81	-4.53
34	1.50	12.00	4110.00	-0.87	-2.07	30.10	58.50	41.00	33.00	9.56	8.08

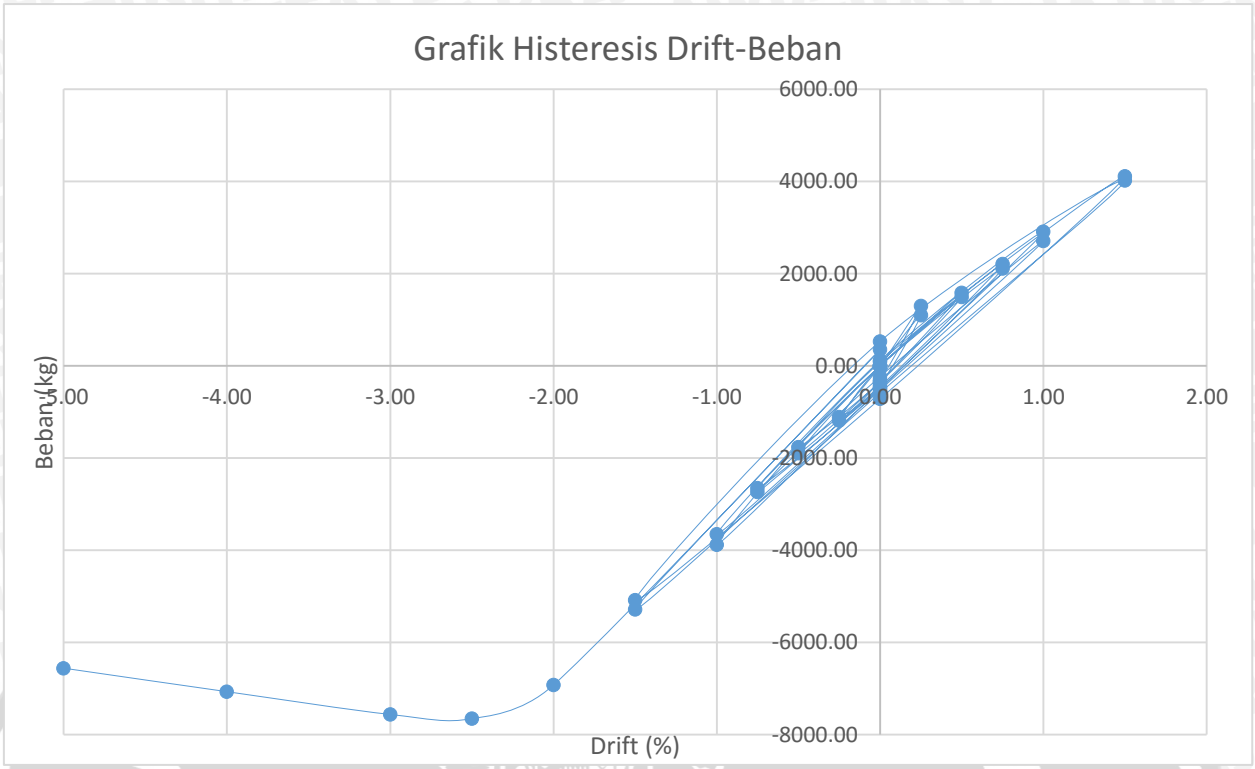
35	0.00	0.00	-712.00	-1.08	-2.18	12.00	67.50	25.00	-9.50	-1.28	-4.25
36	-1.50	-12.00	-5080.00	-1.65	-5.56	-3.00	12.50	-14.00	50.20	-11.72	-16.01
37	0.00	0.00	533.00	-1.87	-5.57	50.50	-5.20	20.80	34.00	-1.14	-5.55
38	1.50	12.00	4026.00	-2.04	-5.33	-8.00	-17.00	17.50	-21.00	9.3	7.55
39	0.00	0.00	-582.00	-2.07	-5.54	-8.00	-8.00	5.00	36.00	-1.31	-3.86
40	-1.50	-12.00	-5282.00	-2.06	-6.19	52.00	-3.00	-31.00	-31.50	-11.69	-15.68
41	0.00	0.00	356.00	-2.09	-8.73	-4.20	69.00	-2.50	-17.00	-1.02	-5.17
44	-2.00	-16.00	-6920.00	-2.37	-9.74	56.00	71.00	41.00	10.00	-15.52	-19.12
52	**-2.50**	-20.00	**-7650.00**	-2.38	-9.91	**17.00**	**-24.00**	**39.00**	**47.00**	-19.32	-22.59
60	-3.00	-24.00	-7560.00	-2.51	-10.18	17.00	52.00	17.00	54.00	-23.19	7.57
68	-4.00	-32.00	-7066.00	error	error	error	62.00	-15.00	37.00	error	error
76	-5.00	-40.00	-6556.00	error	error	error	-6.50	-25.00	29.00	error	error

Pada setiap *drift*, baik arah (+) maupun (-) dilakukan pembebanan dua kali. Untuk diperoleh beban lateral pada setiap *drift* pembebanan siklik tersebut, maka dihitung rata-rata beban lateral yang terjadi pada setiap *drift.*

Contohnya pada *drift* -1,5%. Dilakukan pembebanan dengan *drift -1,5%* pada siklus 42 dan 46. Dari hasil pengujian diperoleh beban lateral sebesar 5080 kg dan 5282 kg. Maka diambil rata-rata beban lateral pada siklus tersebut sebesar 5181 kg.

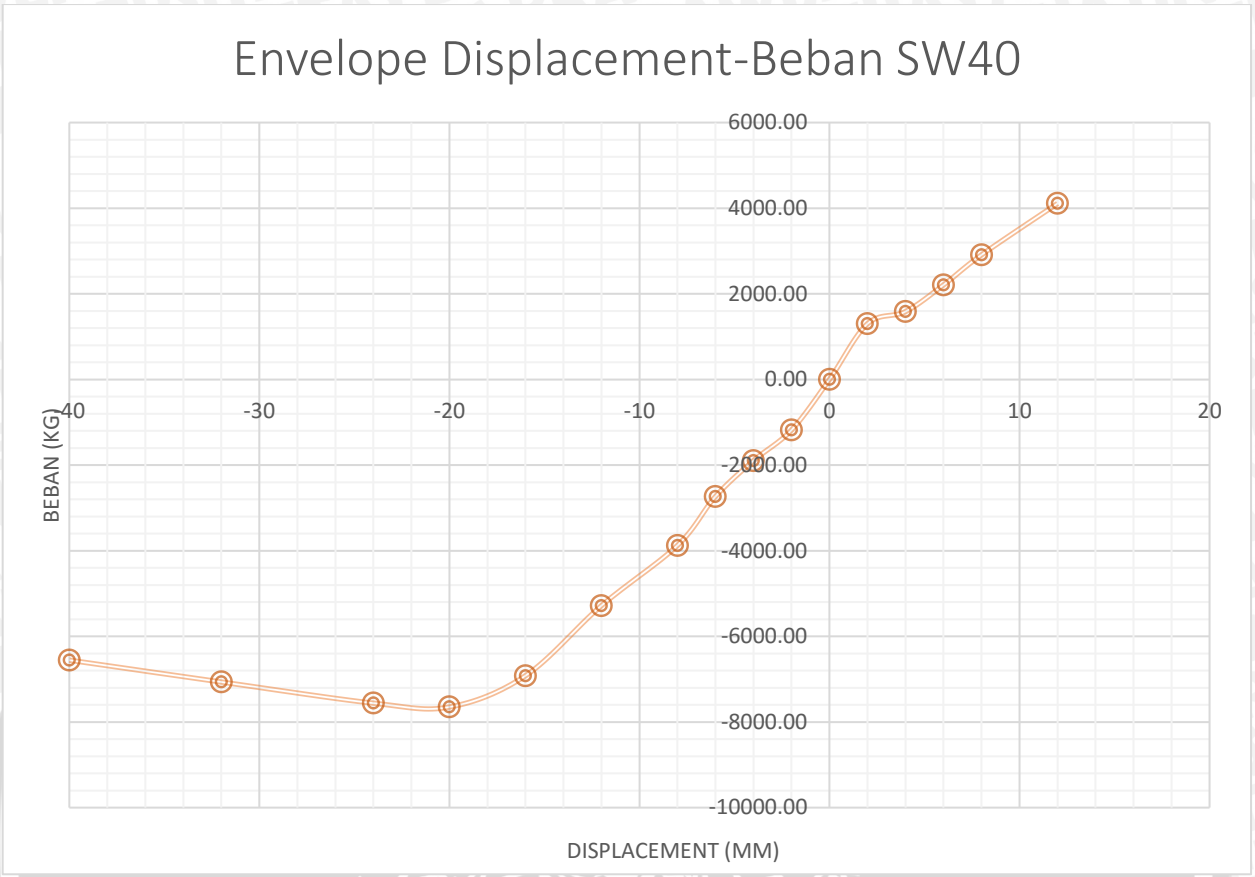
Tabel Rata-Rata Beban Lateral Setiap Drift Benda Uji SW-40.

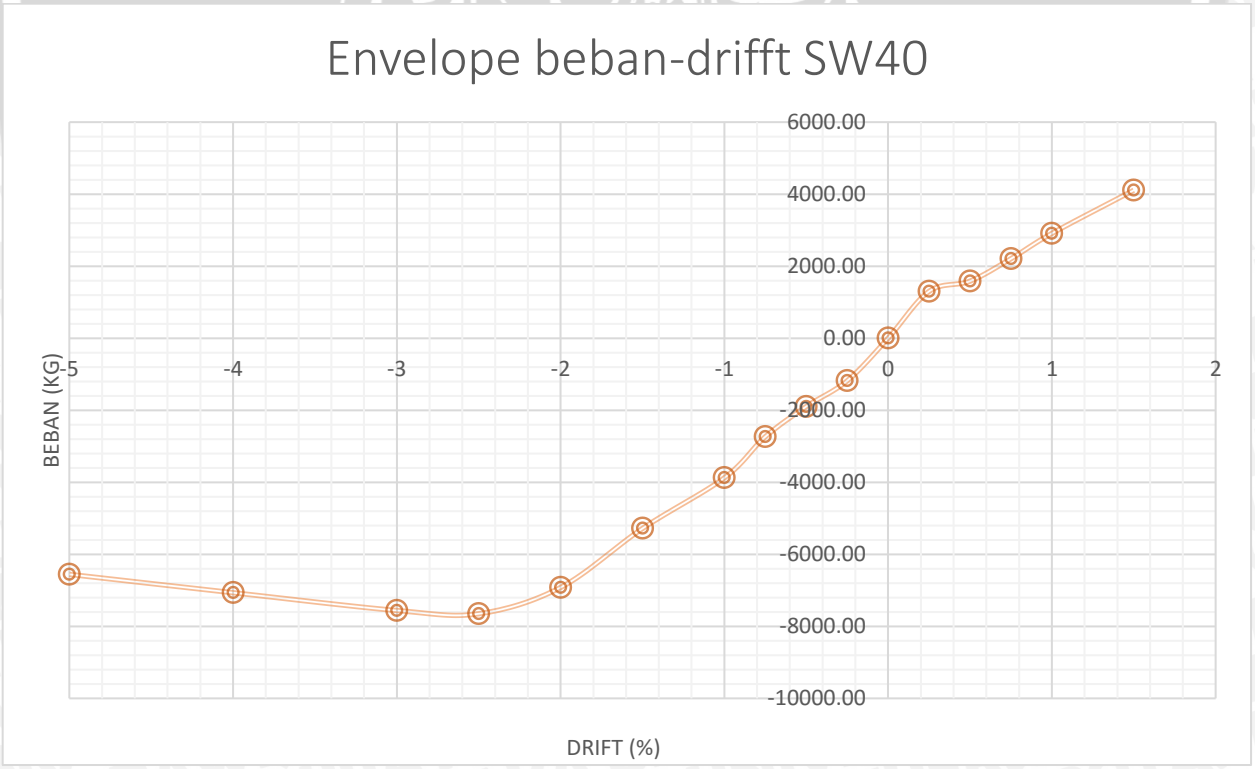
Drift	Simpangan	Beban
%	mm	kg
0	0	-198.00
0.25	2	1202.50
0	0	-148.00
-0.25	-2	-1145.00
0	0	-173.00
0.5	4	1541.50
0	0	-167.50
-0.5	-4	-1827.00
0	0	-240.00
0.75	6	2161.50
0	0	-222.00
-0.75	-6	-2692.00
0	0	-375.00
1	8	2810.00
0	0	-185.00
-1	-8	-3762.00
0	0	-313.00
1.5	12	4068.00
0	0	-24.50
-1.5	-12	-5181.00
0	0	356.00
2	16	0.00
0	0	0.00
-2	-16	-6920.00
0	0	0.00
-2.5	-20	-7650.00
-3	-24	-7560.00
-4	-32	-7066.00
-5	-40	-6556.00



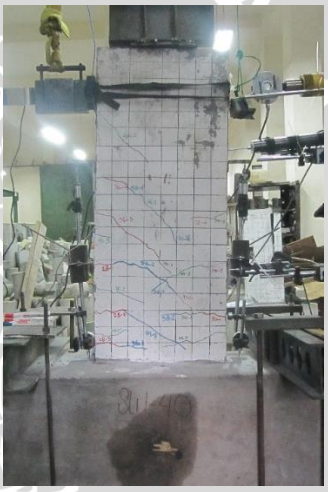
Untuk diperoleh grafik *envelope* dari grafik histerisis yang telah ada, maka diambil beban puncak pada setiap drift.

DRIFT (%)	BEBAN (KG)	DISPLACEMENT (MM)
2		16
1.5	4110.00	12
1	2910.00	8
0.75	2208.00	6
0.5	1585.00	4
0.25	1302.00	2
0	0	0
-0.25	-1182.00	-2
-0.5	-1896.00	-4
-0.75	-2734.00	-6
-1	-3876.00	-8
-1.5	-5282.00	-12
-2	-6920.00	-16
-2.5	-7650.00	-20
-3	-7560.00	-24
-4	-7066.00	-32
-5	-6556.00	-40


Envelope Displacement-Beban SW40
6000.00
4000.00
2000.00
0.00
-2000.00
-4000.00
-6000.00
-8000.00
-10000.00
-40
-30
-20
-10
0
10
20
BEBAN (KG)
DISPLACEMENT (MM)


Envelope beban-drifft SW40
6000.00
4000.00
2000.00
0.00
-2000.00
-4000.00
-6000.00
-8000.00
-10000.00
-5
-4
-3
-2
-1
0
1
2
BEBAN (KG)
DRIFT (%)

Visualisasi Eksperimental SW-40:

Drift 0,25% 	Drift 0,5% 	Drift 0,75% 
Drift 1% 	Drift 1,5% 	Drift 2% 
Drift 3% 	Drift 4% 	Drift 5% 

3. Benda Uji SW-30

NO	DRIFT	SIMPANGAN	BEBAN	Δ_2	Δ_3	Δ_4	Δ_5	Δ_6	Δ_7	Δ_8	Δ_9
	%	mm	Kg	mm	mm	mm	mm	mm	mm	mm	mm
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
2	0.25	2.00	1388.00	0.00	0.03	-4.00	0.00	0.00	6.00	1.82	2.38
3	0.00	0.00	-360.00	0.00	0.00	3.00	0.00	0.00	-1.50	-0.09	-0.2
4	-0.25	-2.00	-1872.00	0.00	-0.03	10.00	0.00	0.00	-10.50	-1.54	-2.06
5	0.00	0.00	340.00	0.00	-0.02	4.00	0.00	0.00	-3.00	-0.08	-0.13
6	0.25	2.00	903.00	0.01	0.01	-1.00	0.00	0.00	2.50	1.07	1.39
7	0.00	0.00	-390.00	0.01	-0.01	5.00	0.00	0.00	-4.00	-0.26	-0.41
8	-0.25	-2.00	-2010.00	0.01	-0.05	14.00	0.00	0.00	-14.00	-1.94	-2.54
9	0.00	0.00	-220.00	0.01	-0.02	5.00	-0.50	0.00	-4.00	-0.28	-0.37
10	0.50	4.00	2060.00	0.01	0.04	-9.00	-2.00	0.00	12.00	2.76	3.7
11	0.00	0.00	-596.00	0.01	-0.03	6.00	-1.00	0.00	-3.00	3.4	-0.57
12	-0.50	-4.00	-3290.00	0.02	-0.20	25.00	2.00	-1.00	-26.00	-3.42	-4.47
13	0.00	0.00	0.00	0.01	-0.10	7.00	-1.00	-1.00	-4.00	-0.26	-0.33
14	0.50	4.00	2180.00	0.01	0.00	-8.00	-3.00	-1.00	13.00	2.74	3.68
15	0.00	0.00	-522.00	0.01	-0.15	7.50	-3.00	-1.80	-4.00	-0.42	-0.59
16	-0.50	-4.00	-3232.00	0.02	-0.30	26.00	1.00	-1.00	-28.00	-3.51	-4.48
17	0.00	0.00	-226.00	0.04	-0.18	9.50	-2.00	-1.50	-5.00	-0.51	-0.63

18	0.75	6.00	3022.00	-0.07	-0.02	-23.00	-5.00	-1.50	22.50	4.2	5.6
19	0.00	0.00	-548.00	-0.01	-0.16	5.00	-4.50	-1.50	-5.00	-0.46	-0.66
20	-0.75	-6.00	-3888.00	0.04	-0.48	35.00	0.80	-4.00	52.00	-5.14	-6.47
21	0.00	0.00	0.00	0.04	-0.25	6.00	-3.00	-6.00	-7.00	-0.46	-0.54
22	0.75	6.00	3260.00	-0.12	-0.06	-31.00	-7.00	-5.00	28.00	4.67	6.21
23	0.00	0.00	-484.00	-0.02	-0.21	4.00	-5.00	-5.00	-4.50	-0.38	-0.52
24	-0.75	-6.00	-3780.00	0.03	-0.52	36.00	1.00	-8.00	54.00	-4.96	-6.2
25	0.00	0.00	0.00	-0.02	-0.27	6.00	-4.00	-8.00	-5.00	-0.43	-0.5

NO	DRIFT	SIMPANGAN	BEBAN	Δ_2	Δ_3	Δ_4	Δ_5	Δ_6	Δ_7	Δ_8	Δ_9
	%	**mm**	**Kg**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**
26	1.00	8.00	3630.00	-0.12	-0.08	-37.50	-11.00	-4.00	34.00	5.31	7.07
27	0.00	0.00	-610.00	-0.02	-0.28	9.00	-6.00	-1.00	-7.00	-0.56	-0.68
28	-1.00	-8.00	-4558.00	0.04	-0.73	49.00	2.00	14.00	33.80	-6.77	-8.33
29	0.00	0.00	0.00	-0.05	-0.36	9.00	-4.50	-14.00	-8.00	-0.57	-0.6
30	1.00	8.00	3610.00	-0.13	-0.11	59.00	-12.00	-6.00	37.00	5.31	7.06
31	0.00	0.00	-644.00	-0.08	-0.32	10.00	-5.00	-6.00	-5.00	-0.63	-0.74
32	-1.00	-8.00	-4358.00	-0.05	-0.78	50.00	3.00	-6.00	-5.00	-6.54	-8.04
33	0.00	0.00	0.00	-0.09	-0.37	8.50	-4.50	-16.00	-5.00	-0.52	-0.52
34	1.50	12.00	4878.00	-0.33	-0.07	34.00	-22.00	-2.00	55.00	8.65	11.99

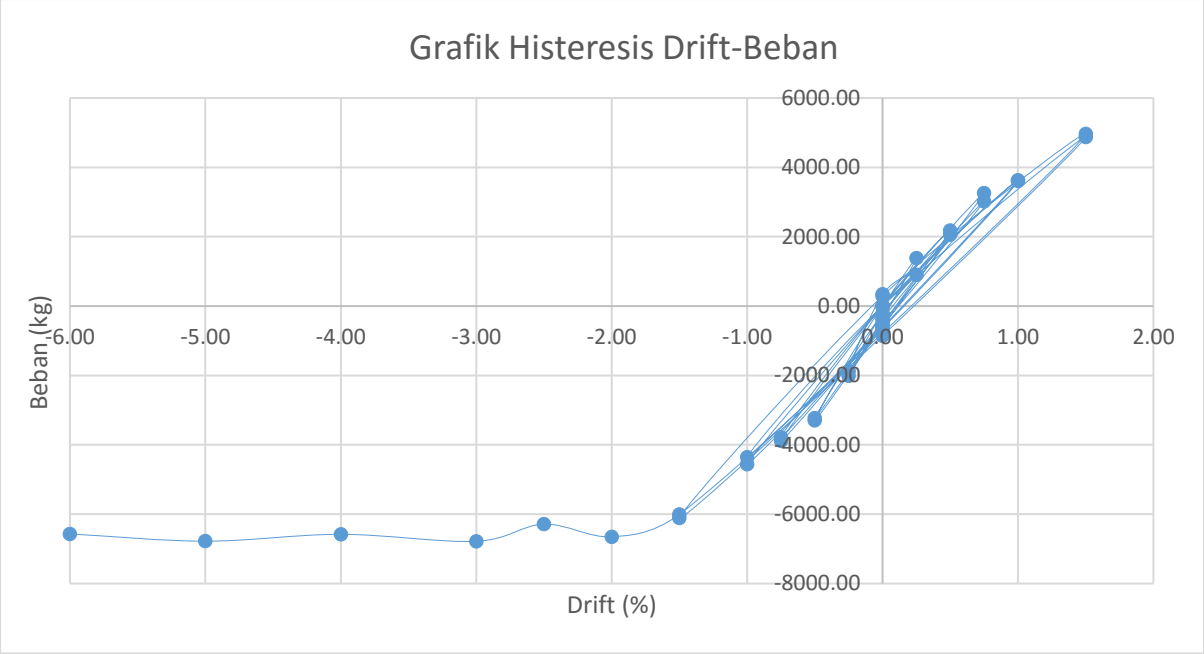
35	0.00	0.00	-854.00	-0.26	-0.40	15.00	-8.00	-4.00	-10.00	-0.12	0.54
36	-1.50	-12.00	-6110.00	-0.19	-1.36	-22.00	3.00	48.00	-5.50	-9.48	-10.8
37	0.00	0.00	290.00	-0.26	-0.56	14.00	-8.00	-26.00	-2.00	0.13	0.74
38	1.50	12.00	4964.00	-0.53	-0.21	32.00	-28.00	-4.00	-36.00	8.95	12.31
39	0.00	0.00	-778.00	-0.44	-0.57	20.00	-10.00	-8.00	-5.50	-0.21	0.53
40	-1.50	-12.00	-6004.00	-0.33	-1.55	-16.00	2.00	30.00	-3.00	-9.58	-10.7
44	-2.00	-16.00	-6650.00	-0.34	-1.90	-8.00	2.50	20.00	29.00	-12.72	-15.32
52	-2.50	-20.00	-6286.00	-0.40	-2.19	-48.00	7.00	-1.00	-27.00	-15.59	-18.13
60	**-3.00**	-24.00	**-6782.00**	-0.40	-2.20	**8.00**	**22.00**	**-3.50**	**1.00**	-18.45	-20.8
68	-4.00	-32.00	-6580.00	-0.46	-3.45	44.00	8.00	-32.00	39.00	-24.08	-25.63
76	-5.00	-40.00	-6778.00	-0.48	-4.01	-3.00	20.00	-35.00	39.00	-29.49	-30.25
84	-6.00	-48.00	-6570.00	error	error	error	error	error	error	error	error

Pada setiap *drift*, baik arah (+) maupun (-) dilakukan pembebanan dua kali. Untuk diperoleh beban lateral pada setiap *drift* pembebanan siklik tersebut, maka dihitung rata-rata beban lateral yang terjadi pada setiap *drift.*

Contohnya pada *drift* -1,5%. Dilakukan pembebanan dengan *drift -1,5%* pada siklus 40 dan 36. Dari hasil pengujian diperoleh beban lateral sebesar 6004 kg dan 6110 kg. Maka diambil rata-rata beban lateral pada siklus tersebut sebesar 6057

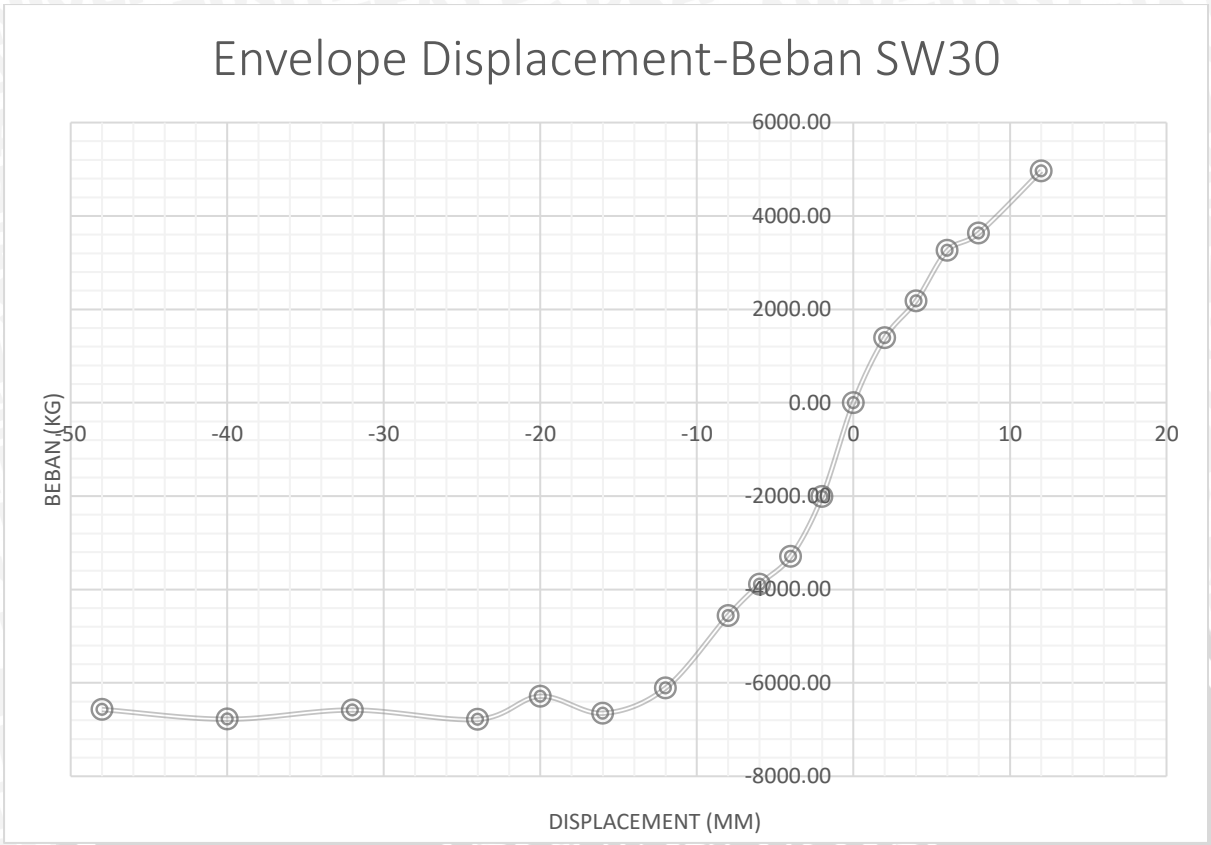
Tabel Rata-Rata Beban Lateral Setiap Drift Benda Uji SW-30.

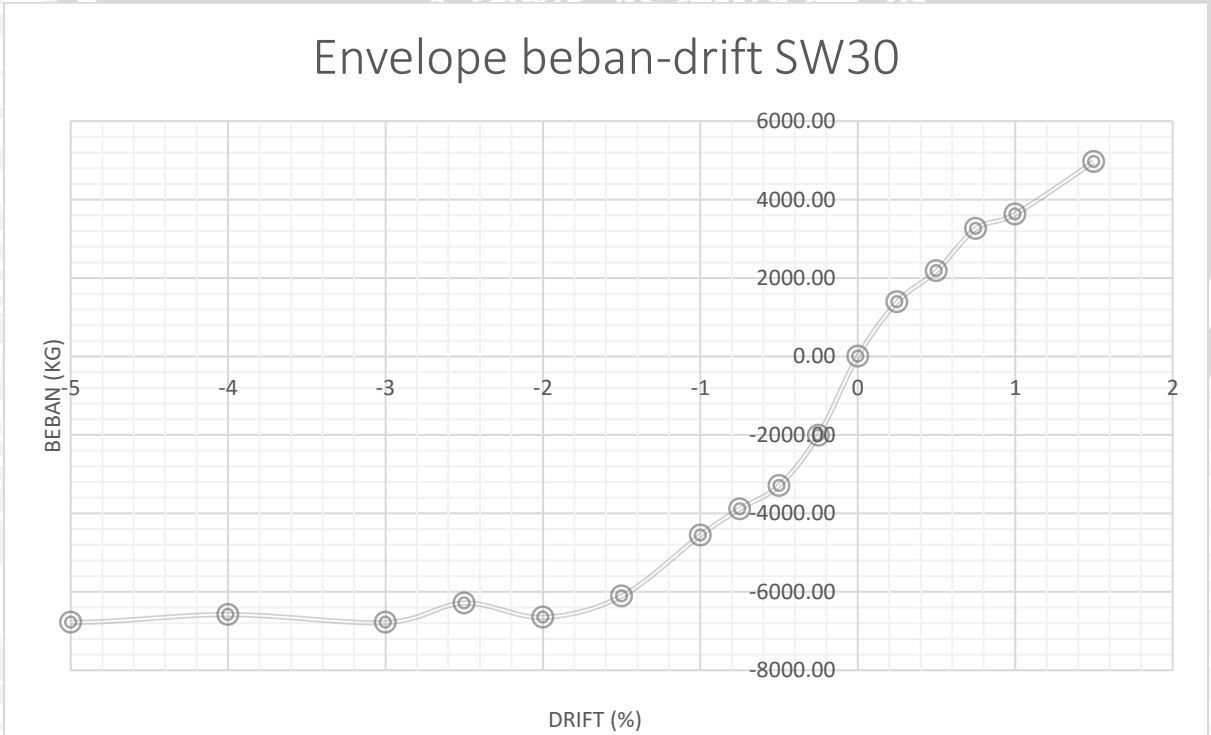
Drift	Simpangan	Beban
%	mm	kg
0	0	-180.00
0.25	2	1145.50
0	0	-25.00
-0.25	-2	-1941.00
0	0	-408.00
0.5	4	2120.00
0	0	-261.00
-0.5	-4	-3261.00
0	0	-387.00
0.75	6	3141.00
0	0	-242.00
-0.75	-6	-3834.00
0	0	-305.00
1	8	3620.00
0	0	-322.00
-1	-8	-4458.00
0	0	-427.00
1.5	12	4921.00
0	0	-244.00
-1.5	-12	-6057.00
0	0	0.00
2	#N/A	#N/A
0	0	0.00
-2	-16	-6650.00
0	0	0.00
-2.5	-20	-6286.00
-3	-24	-6782.00
-4	-32	-6580.00
-5	-40	-6778.00
-6	-48	-6570.00



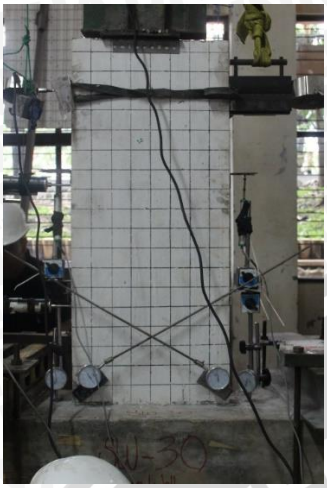
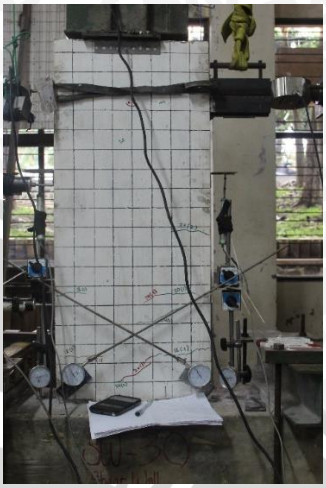
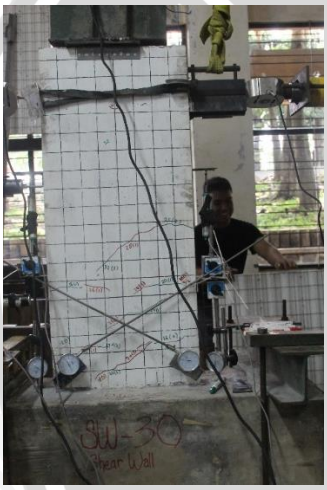
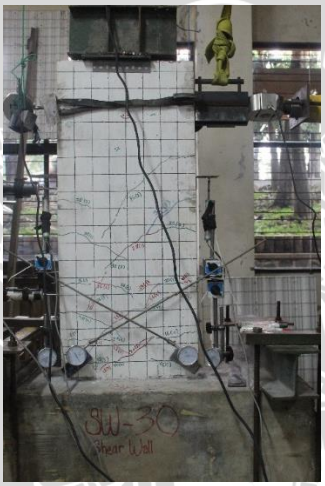
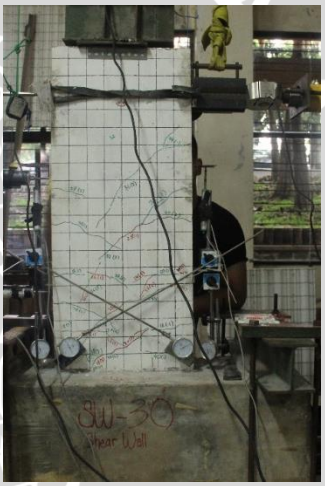
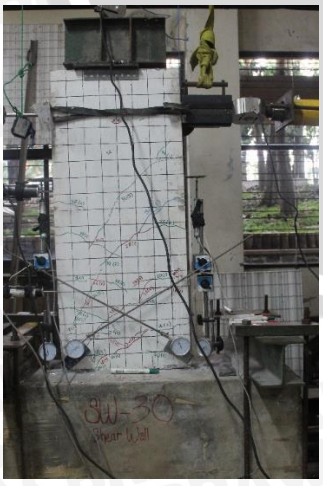
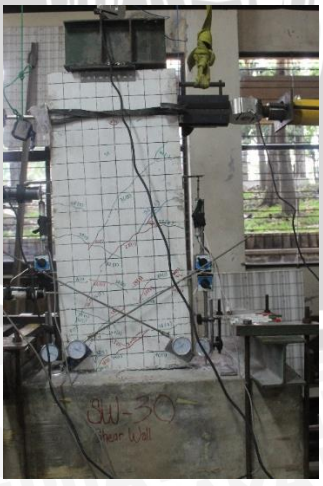
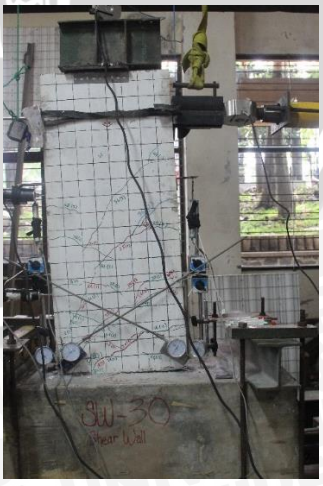
Untuk diperoleh grafik *envelope* dari grafik histerisis yang telah ada, maka diambil beban puncak pada setiap drift.

DRIFT (%)	BEBAN (KG)	DISPLACEMENT (MM)
2		16
1.5	4964.00	12
1	3630.00	8
0.75	3260.00	6
0.5	2180.00	4
0.25	1388.00	2
0	0	0
-0.25	-2010.00	-2
-0.5	-3290.00	-4
-0.75	-3888.00	-6
-1	-4558.00	-8
-1.5	-6110.00	-12
-2	-6650.00	-16
-2.5	-6286.00	-20
-3	-6782.00	-24
-4	-6580.00	-32
-5	-6778.00	-40
-6	-6570.00	-48

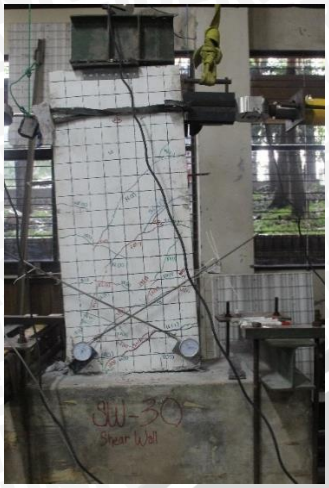

Envelope Displacement-Beban SW30
6000.00
4000.00
2000.00
0.00
-2000.00
-4000.00
-6000.00
-8000.00
-50
-40
-30
-20
-10
0
10
20
BEBAN (KG)
DISPLACEMENT (MM)


Envelope beban-drift SW30
6000.00
4000.00
2000.00
0.00
-2000.00
-4000.00
-6000.00
-8000.00
-5
-4
-3
-2
-1
0
1
2
BEBAN (KG)
DRIFT (%)

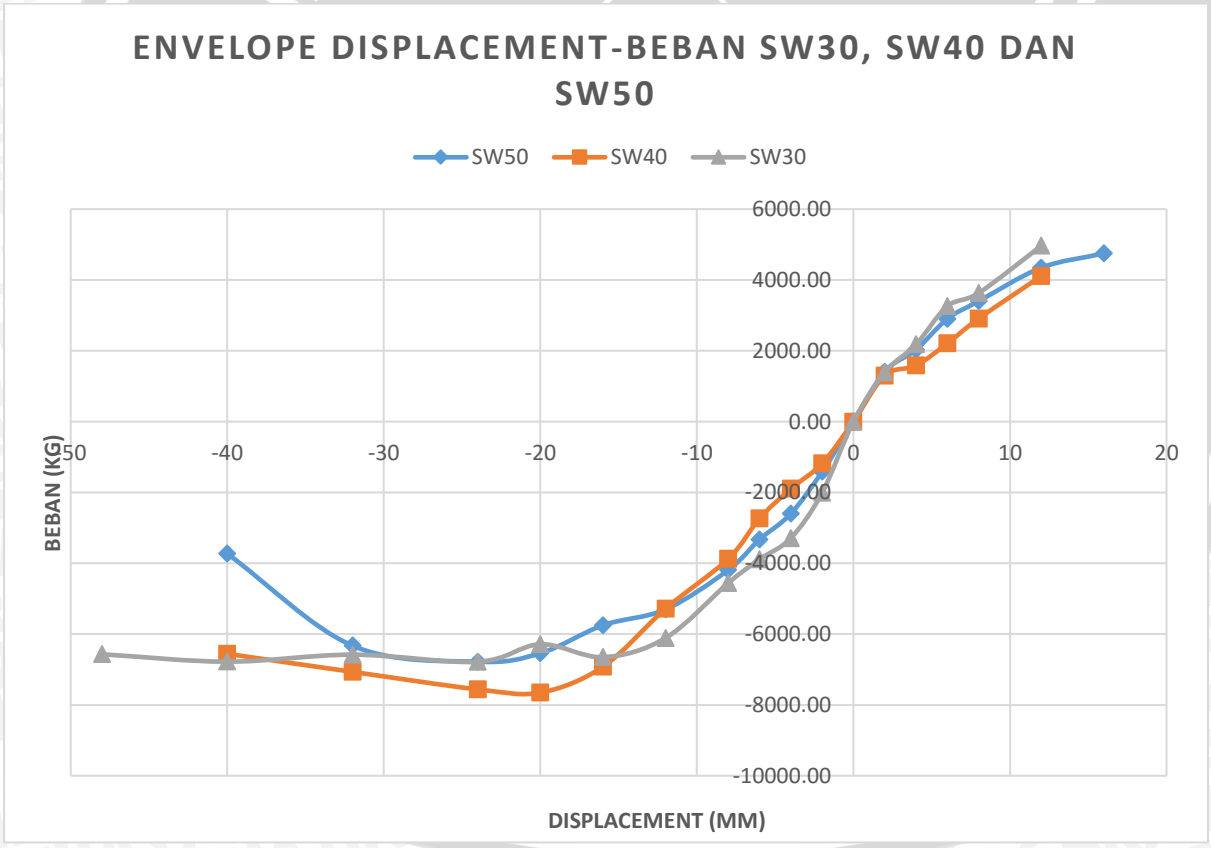
Visualisasi Eksperimental SW-30:

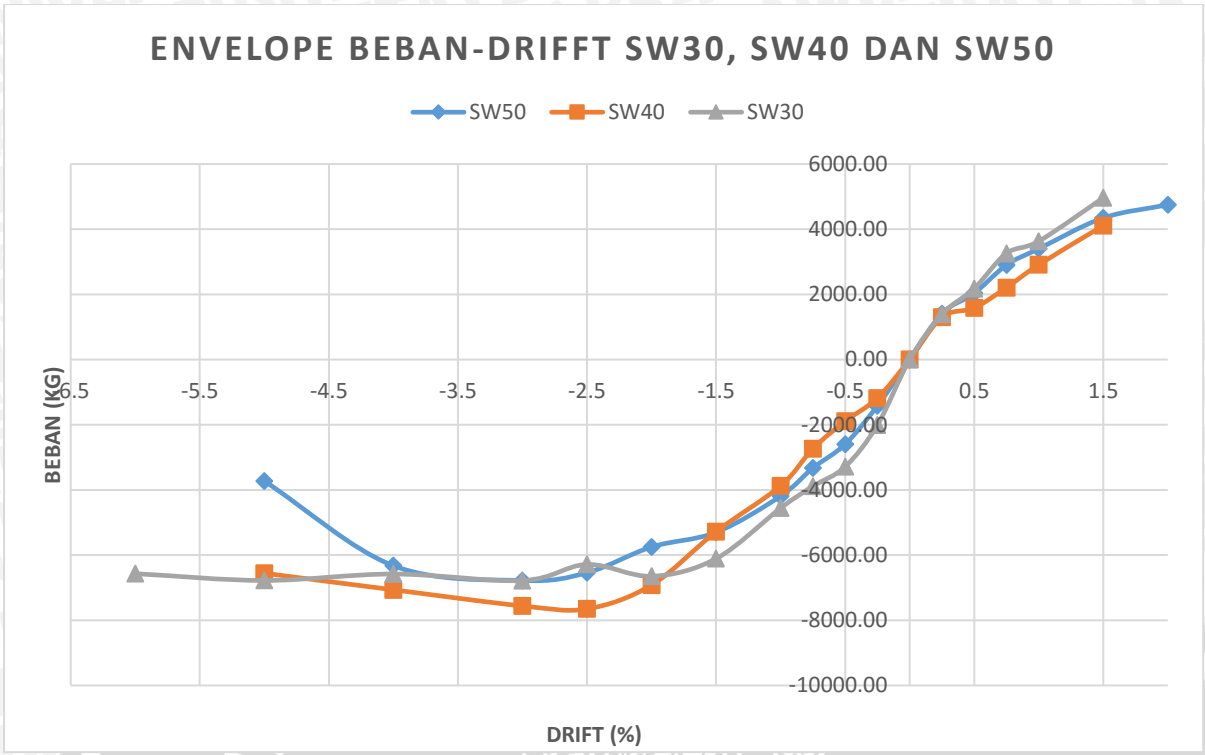
Drift 0,25% 	Drift 0,5% 	Drift 0,75% 
Drift 1% 	Drift 1,5% 	Drift 2% 
Drift 3% 	Drift 4% 	Drift 5% 

Drift 6%



Grafik envelope gabungan SW30, SW40 dan SW50 :




ENVELOPE BEBAN-DRIFFT SW30, SW40 DAN SW50
SW50
SW40
SW30
6000.00
4000.00
2000.00
0.00
-2000.00
-4000.00
-6000.00
-8000.00
-10000.00
-6.5
-5.5
-4.5
-3.5
-2.5
-1.5
-0.5
0.5
1.5
BEBAN (KG)
DRIFT (%)

3.6 PERHITUNGAN DAKTILITAS

Jenis daktilitas yang akan ditinjau dalam penelitian ini adalah *displacement ductility*. *Displacement ductility* akan diperoleh dari grafik beban lateral-*displacement. Displacement ductility* akan ditentukan dengan asumsi leleh, yaitu leleh pertama dari asumsi 75% x nilai Pmax dan *displacement* ultimit dicapai di 80% Pmax.

$$\mu_\delta = \Delta_u / \Delta_y$$

Cara menentukan nilai *displacement ductility* adalah sebagai berikut :

1. Tentukan besarnya $P_{peak\ load}$ dari grafik beban lateral-*displacement* yang ada.
2. Tentukan $\Delta_{peak\ load}$ dari beban $P_{peak\ load}$ dari grafik dengan menarik garis keatas pada saat grafik beban maksimum.
3. Hitung besarnya 0,75 x Pmax untuk menentukan kondisi beban di saat leleh.
4. Plotkan titik pada point 2 dalam grafik beban lateral-*displacement,* kemudian tarik garis horizontal sampai menyinggung grafik naik (garis sebelum puncak).
5. Tarik garis linier yang menghubungkan titik koordinat (0,0) menyinggung titik (yang dibuat pada point 3 sampai sejajar dengan ketinggian Pmax.
6. Tarik garis vertical keatas, kemudian baca besarnya nilai Δ_y.
7. Tentukan titik ketika beban maksimum pada drift maksimum pengujian.
8. Kemudian tarik garis horizontal sampai menyinggung grafik turun (garis setelah puncak) pada grafik beban lateral-*displacement,* plotkan titiknya.
9. Tarik garis vertikal kebawah dari titik yang diplot pada point 7, kemudian baca besarnya nilai $\Delta_{simpangan\ max}$.

Sehingga diperoleh nilai $\mu_{peak} = \Delta_{peak\ load} / \Delta_y$ dan $\mu_{max} = \Delta_{simpangan\ max} / \Delta_y$. Nilai displacement ductility untuk masing-masing benda uji dinding geser adalah :

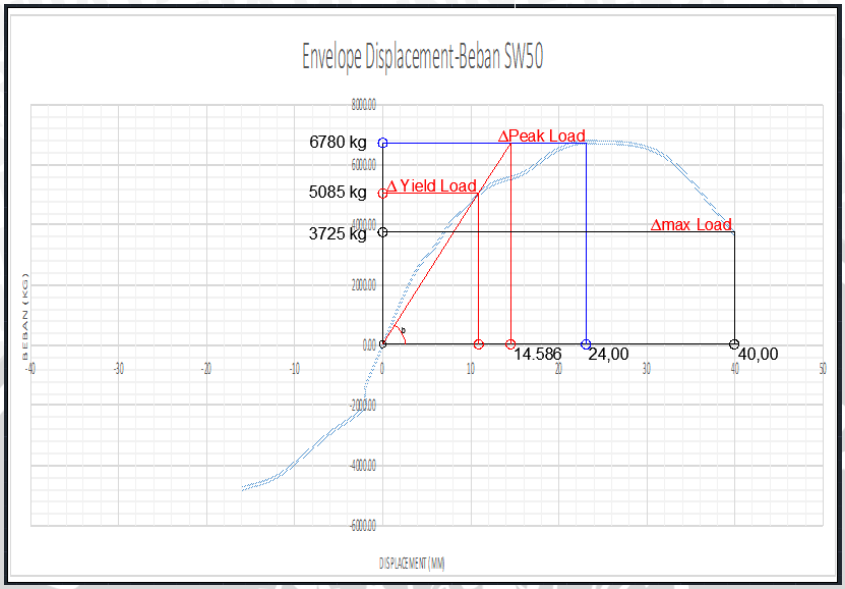
	SW-50	SW-40	SW-30
$P_{peak\ load}$ (ton)	6780 kg	7650 kg	6782 kg
$\Delta_{peak\ load}$ (mm)	24 mm	20 mm	24 mm
Δy (mm)	14,586 mm	17,587 mm	12,249 mm
$\Delta_{simpangan\ max}$ (mm)	40 mm	40 mm	48 mm
$\mu_{peak\ load}$	1,645	1,137	1,959
$\mu_{max\ load}$	2,742	2,274	3,919

I. SW 50

$P_{peak\ load}$ = 6780 kg

0,75 x $P_{peak\ load}$ = 5085 kg (*yield condition*)

$P_{max\ load}$ = 3725 kg (keruntuhan setelah drift 5%)

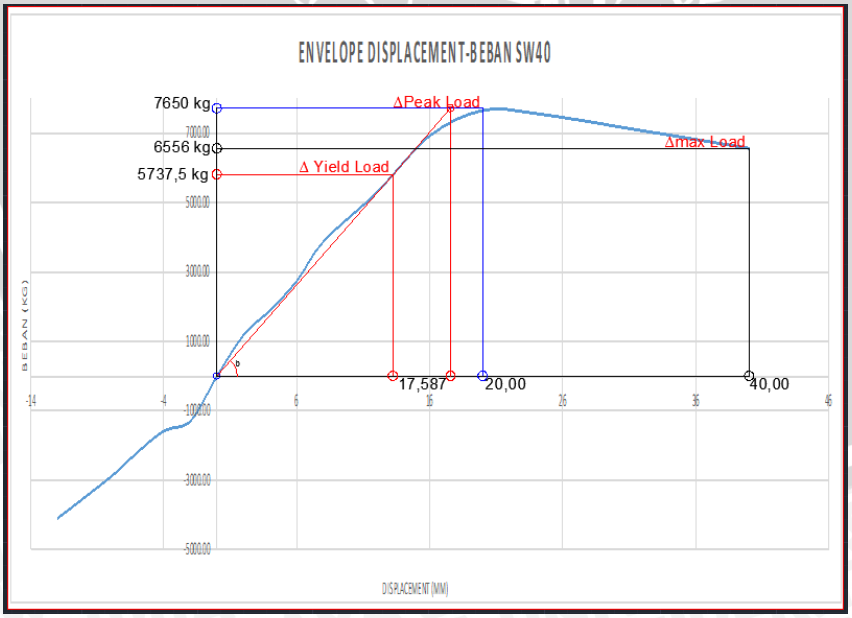


II. SW 40

$P_{peak\ load}$ = 7650 kg

0,75 x $P_{peak\ load}$ = 5737,5 kg (*yield condition*)

$P_{max\ load}$ = 6556 kg (keruntuhan setelah drift 5%)

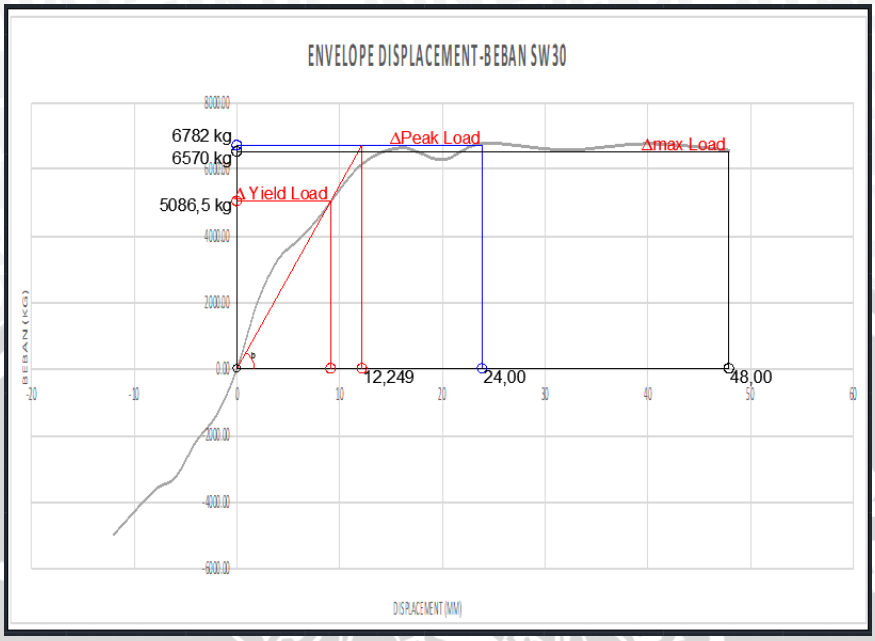


III. SW 30

$P_{peak\ load}$ = 6782 kg

0,75 x $P_{peak\ load}$ = 5086,5 kg (*yield condition*)

$P_{max\ load}$ = 6570 kg (keruntuhan setelah drift 6%)



3.6 PERHITUNGAN KEKAKUAN

Kekakuan didefinisikan sebagai gaya yang dibutuhkan suatu elemen untuk menghasilkan suatu lendutan atau merupakan rasio antara beban dengan perpendekan kolom. Rumus umum kekakuan adalah :

$$k = \frac{P}{x}$$

P = Beban yang terjadi (kg)

x = Deformasi searah beban (m)

k = Kekakuan struktur (kg/m)

Cara menentukan nilai kekakuan adalah sebagai berikut :

I. Tangential Stiffness

a. Buatlah garis yang menyentuh titik pada saat beban max pada sumbu x dan sumbu y.
b. Tarik garis dari (0,0) mengikuti bentuk garis diagram yang lurus dan tanpa ada pola garis diagram yang tidak sejajar dengan garis mula-mula kemudian teruskan garis sampai bersinggungan dengan garis pada point I.
c. Tarik garis kearah bawah hingga bersinggungan untuk menentukan Δ (perpindahan) kemudian baca nilai Δ (perpindahan).
d. *Tangential stiffness* adalah perbandingan antara beban max dan perpindahan.

II. Secant Stiffness

a. Buatlah garis yang menyentuh titik pada saat beban max pada sumbu x dan sumbu y.
b. Buatlah garis yang menyentuh titik pada saat beban penetrasi leleh pada sumbu x dan sumbu y
c. Tarik garis dari (0,0) hingga berisinggungan dengan point II kemudian terus garis hingga bersinggungan dengan pint I
d. Tarik garis kearah bawah hingga bersinggungan untuk menentukan Δ (perpindahan) kemudian baca nilai Δ (perpindahan).
e. *Secant stiffness* adalah perbandingan antara garis miring dari proses diatas dan perpindahan.

1. Kekakuan SW-50

Tangential Stiffness :

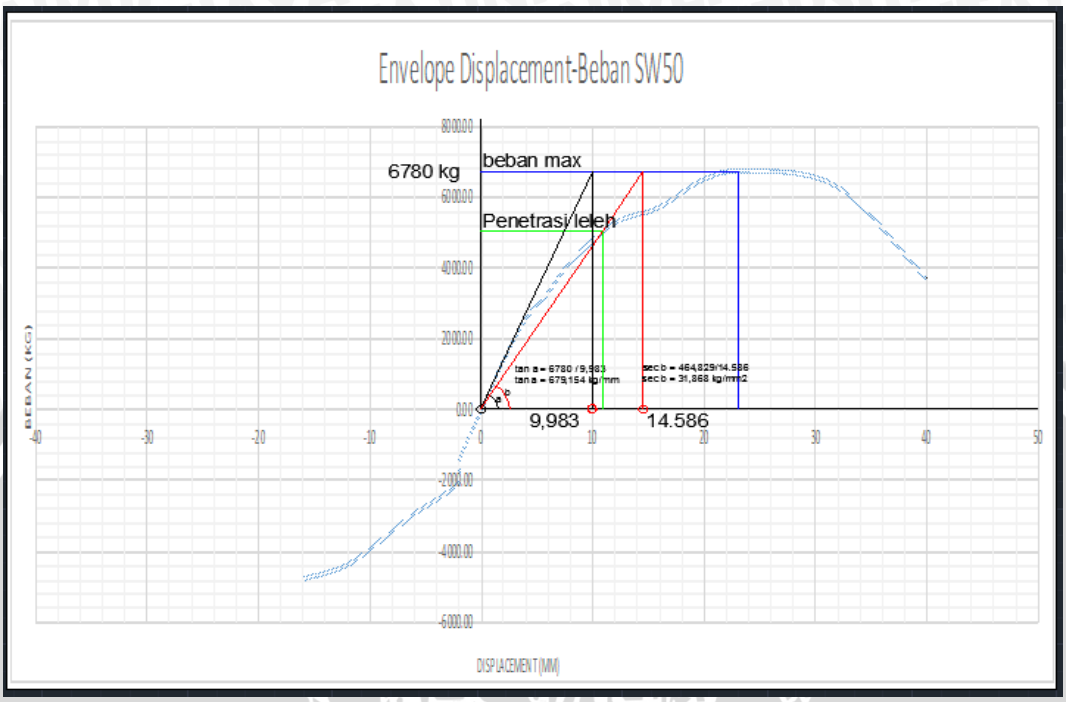
Tan a = 6780 kg/ 9,983 mm

Tan a = 679,154 kg/mm

Secant Stiffness :

Sec a = 6780 kg / 14,586 mm

Sec a = 464,829 kg/mm



2. Kekakuan SW-40

Tangential Stiffness :

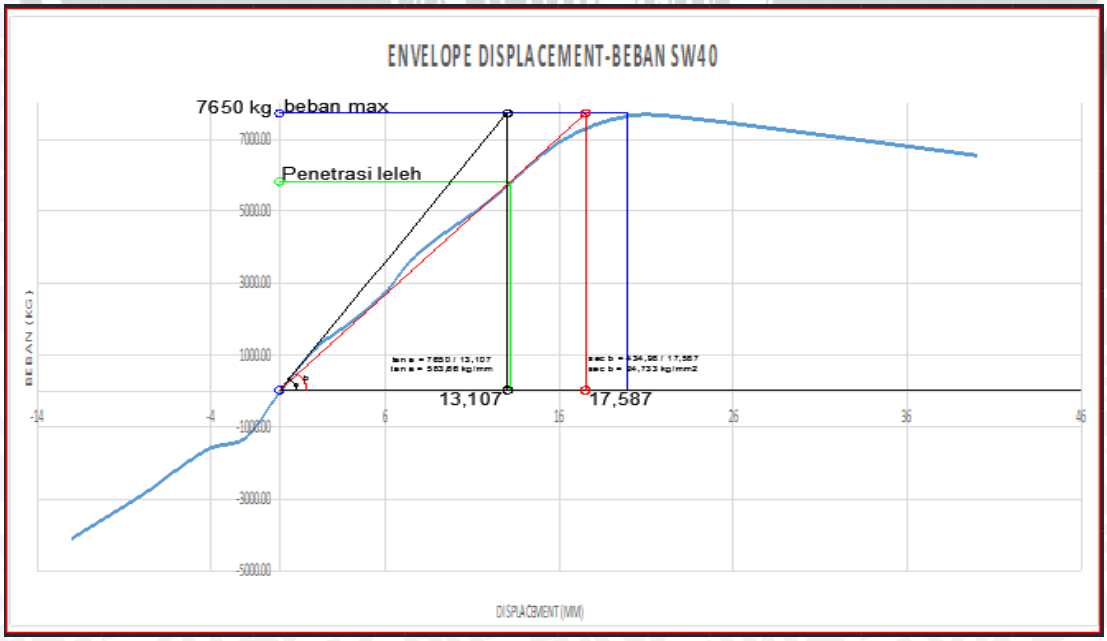
Tan a = 7650 kg/ 13,107 mm

Tan a = 583,658 kg/mm

Secant Stiffness :

Sec a = 7650 kg / 17,587 mm

Sec a = 434,98 kg/mm



3. Kekakuan SW-30

Tangential Stiffness :

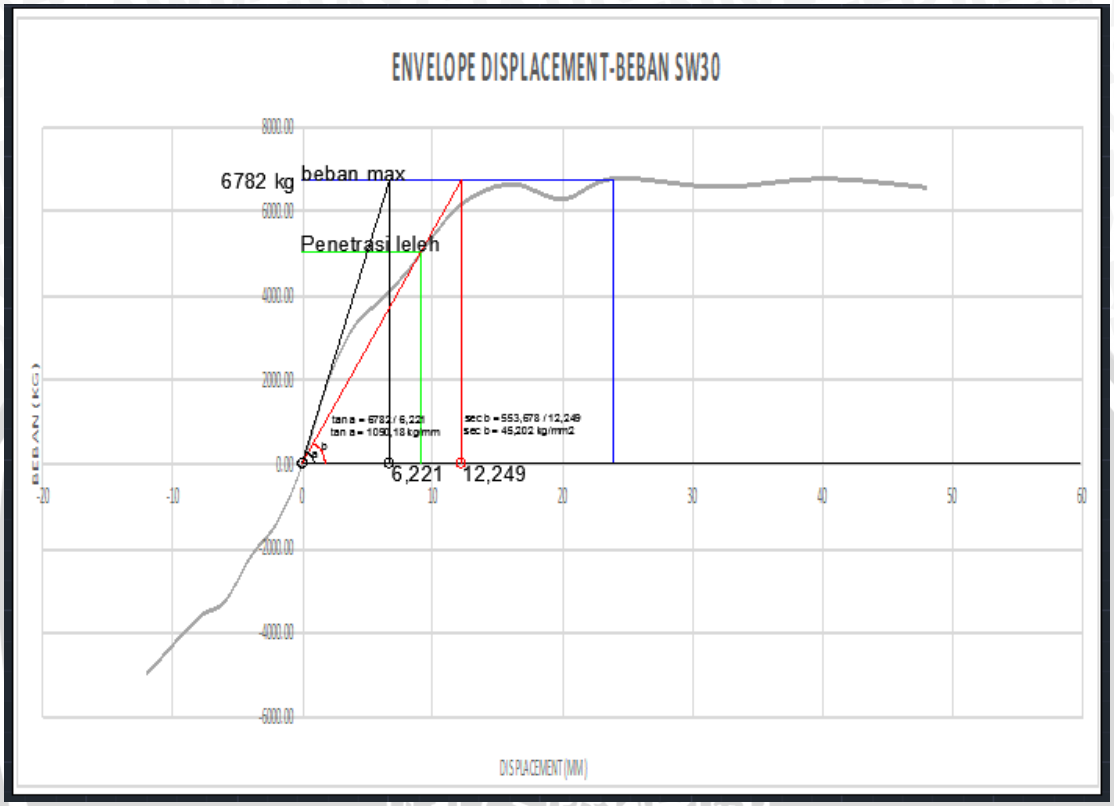
Tan a = 6782 kg/ 6,221 mm

Tan a = 1090,178 kg/mm

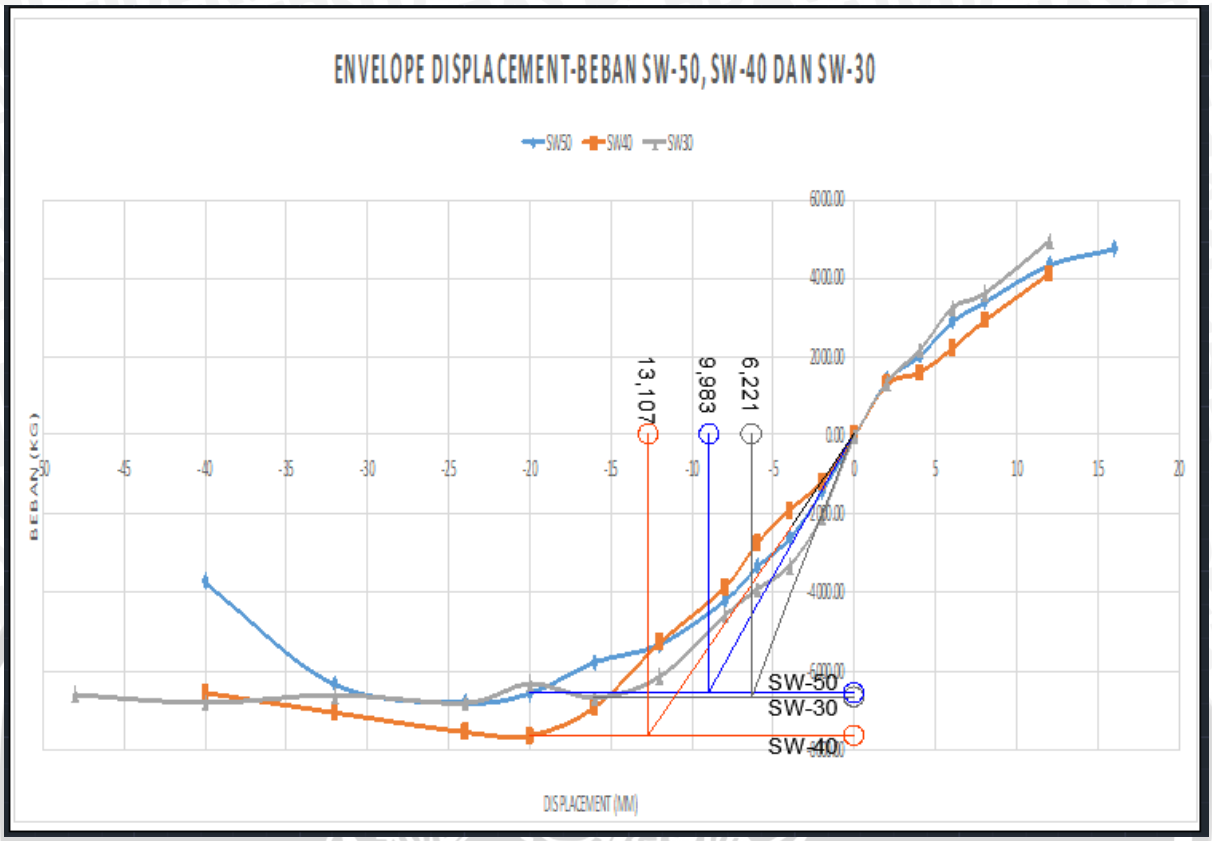
Secant Stiffness :

Sec a = 6782 kg/mm / 12.249 mm

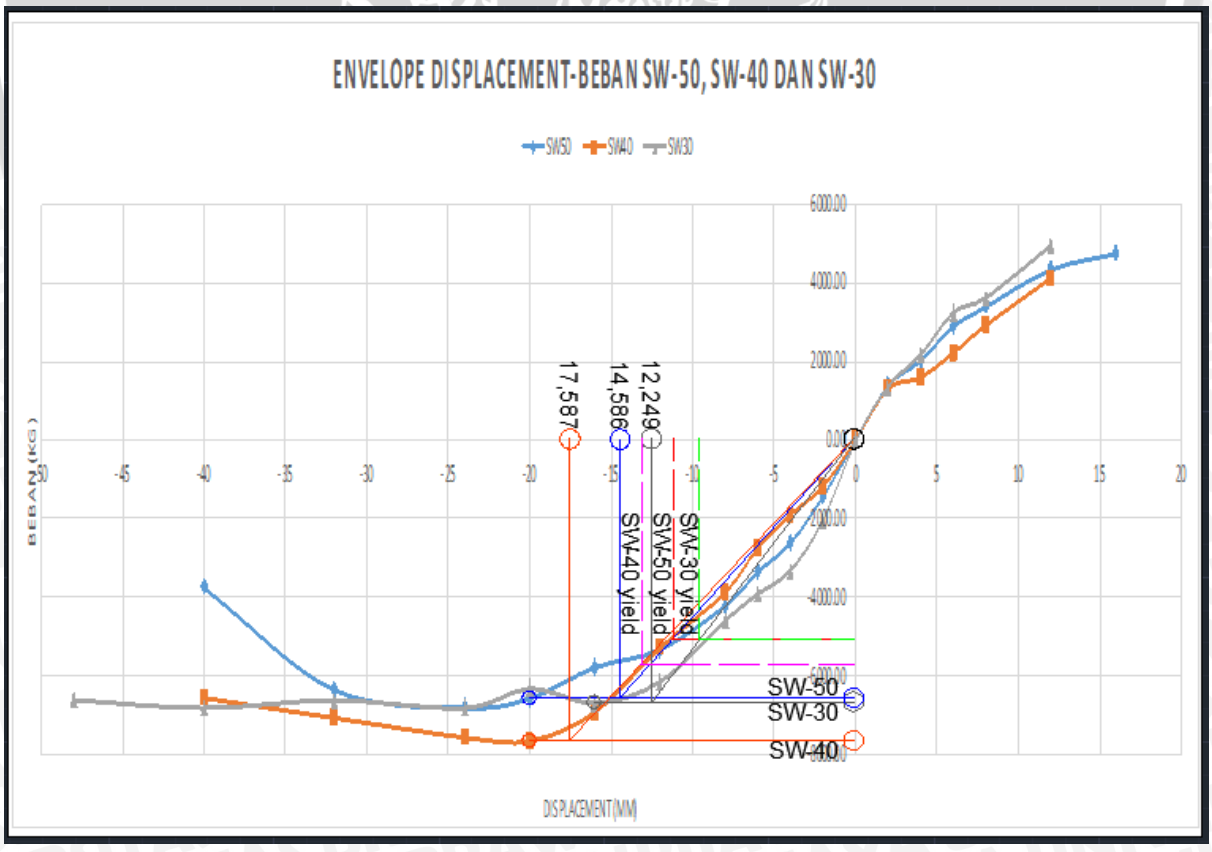
Sec a = 553,678 kg/mm^2



Perbandingan tangential stiffness pada SW-50, SW-40 dan SW-30:



Perbandingan secant stiffness pada SW-50, SW-40 dan SW-30:



LAMPIRAN 5

DOKUMENTASI PENELITIAN

5.1 Gambar Alat dan Bahan

	
Waterpass dan Meteran	**Palu**
	
Sekop	**Cetokan**
	
Bor Listrik	**Kunci inggris, mur, obeng, pemotong besi dan baut**

Tali

Vibrator

Pembuat *Caping* Beton

Hydraulic Forklift

Baja Pengekang

Baja WF

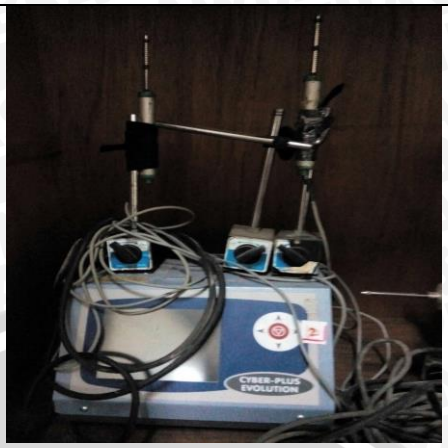
Analog Dial Gauge

Molen

Timbangan Eletrik

Hydraulic Jack

***Load Cell* dan Pembacanya**

LVDT

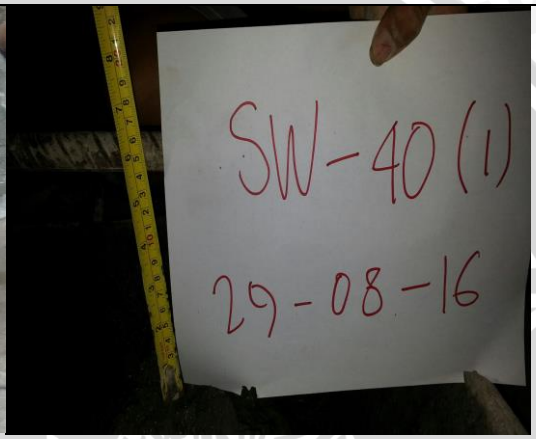
5.2 Pembuatan Benda Uji Dinding Geser


Setting Up Frame



Penimbangan Bahan Penyusun Dinding Geser


Pembuatan Tahu Beton

Pengujian Slump

Pembuatan Silinder Beton

Pengecoran Spesimen Dinding Geser

5.3 Pengujian Bahan Penyusun Dinding Geser

Uji Tekan Silinder Beton

Uji Tarik Baja

5.4 Pengujian Siklik

Pengujian Beban Siklik Benda Uji Dinding Geser