BAB VI

KESIMPULAN DAN SARAN

6.1 Kesimpulan

Berdasarkan hasil penelitian dan pembahasan yang telah diuraikan sebelumnya, maka diperoleh beberapa kesimpulan sebagai berikut.

1. Berat jenis beton daur ulang rerata yang didapatkan dari masing-masing benda uji umur 28 hari yaitu NM 0,3 sebesar 2215,471 kg/m^3, NM 0,4 sebesar 2271,155 kg/m^3, TM 0,3 sebesar 2210,814 kg/m^3, dan TM 0,4 sebesar 2243,253 kg/m^3. Dari hasil yang didapat maka dapat disimpulkan bahwa berat jenis dari RCA masih tergolong dalam kategori beton normal. Syarat berat jenis beton normal yaitu 2200 kg/m^3 – 2500 kg/m^3 (SNI 03-2834-2000).
2. Hasil pengujian kuat tekan didapat kuat tekan beton daur ulang variasi NM 0,3, NM 0,4 , TM 0,3, TM 0,4 masing-masing sebesar 29,95, 24,62, 31,03, dan 30,06 MPa. Dari hasil yang didapat maka dapat disimpulkan bahwa kuat tekan tertinggi terdapat pada TM 0,3 dan yang terendah terdapat pada NM 0,4.
3. Metode *triple method* berhasil meningkatkan kuat tekan dan kuat tarik pada beton agregat daur ulang walaupun tidak secara signifikan. *Slag* yang digunakan sebagai pelapis permukaan agregat daur ulang berhasil mengurangi porositas dan menaikkan kekuatan tekan beton.

4. Pada pengujian kuat tekan diketahui bahwa faktor air semen dan *triple method* memiliki pengaruh dan meningkatkan hasil kuat tekan beton daur ulang
5. Pada pengujian porositas diketahui bahwa faktor air semen dan *slag* yang digunakan pada *triple method* sebagai pelapis permukaan agregat kasar daur ulang memiliki pengaruh terhadap porositas.

6.2 Saran

Dari hasil penelitian yang telah dilaksanakan, penulis memberikan beberapa saran berikut ini.

1. Pada penelitian lebih lanjut bahan agregat daur ulang dapat dipilih dari kuat tekan / jenis beton yang sama.
2. Untuk meningkatkan *workability* beton dapat dilakukan dengan beberapa cara seperti menambah bahan tambah pada adukan beton.
3. Pada penelitian selanjutnya, dapat menambahkan variasi pembanding menggunakan agregat alam.
4. Untuk penelitian selanjutnya sebaiknya melakukan pengujian *Scanning Electron Microscope* (SEM) untuk mengetahui kondisi pada bagian dalam dan kepadatan beton secara detail beton yang menggunakan *triple method.* Dapat juga menambahkan pengujian permeabilitas untuk lebih mengetahui pengaruh faktor air semen terhadap beton daur ulang

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LAMPIRAN

A. PENGUJIAN BAHAN

A.1 PENGUJIAN BERAT JENIS DAN PENYERAPAN AGREGAT KASAR DAUR ULANG

Waktu Pemeriksaan : 30 Oktober 2018

Bahan : Limbah Beton

Asal : Tempat Pembuangan Limbah Beton Laboratorium Struktur dan Bahan Bangunan (LSBB)

Lokasi Pengujian : Laboratorium Struktur dan Bahan Bangunan (LSBB), Jurusan Teknik Sipil, Universitas Atma Jaya Yogyakarta

Hasil Pengujian :

	Nomor Pemeriksaan	I
A	Berat Contoh Kering	1106.3 gr
B	Berat Contoh Jenuh Kering Permukaan (SSD)	1205.14 gr
C	Berat Contoh Dalam Air	691.24 gr
D	Berat Jenis Bulk $= \frac{A}{(B-C)}$	2.1528 gr/cm^3
E	Berat Jenis Kering Permukaan (SSD) $= \frac{A}{(A-C)}$	2.3451 gr/cm^3
F	Berat Jenis Semu (Apparent) $= \frac{B}{(B-C)}$	2.1528 gr/cm^3
G	Penyerapan $= \frac{(B-A)}{A} \times 100$	9%

A.2 PEMERIKSAAN KEAUSAN AGREGAT KASAR DENGAN MESIN *LOS ANGELES ABRATION*

Waktu Pemeriksaan : 31 Oktober 2018

Bahan : Limbah Beton

Asal : Tempat Pembuangan Limbah Beton Laboratorium Struktur dan Bahan Bangunan (LSBB)

Lokasi Pengujian : Laboratorium Transportasi, Jurusan Teknik Sipil, Universitas Atma Jaya Yogyakarta

Hasil Pengujian :

Gradasi Saringan		**Nomor Contoh**
		I
Lolos	***Tertahan***	***Berat Masing-masing Agregat***
$^3/_4$"	$^1/_2$"	2500 gram
$^1/_2$"	$^3/_8$"	2500 gram

Nomor Contoh	**I**
Berat sebelumnya (A)	5000
Berat sesudah diayak saringan No.12 (B)	2784
Berat sesudah (A) - (B)	2216
Keausan = $\frac{(A-B)}{A} \times 100$	44.32 %
Keausan Rata-rata	44.32 %

A.3 PENGUJIAN BERAT JENIS DAN PENYERAPAN AGREGAT HALUS

Waktu Pemeriksaan : 28 Oktober 2018

Bahan : Pasir

Asal : Kali Progo

Lokasi Pengujian : Laboratorium Struktur dan Bahan Bangunan (LSBB), Jurusan Teknik Sipil, Universitas Atma Jaya Yogyakarta

Hasil Pengujian :

	Nomor Pemeriksaan	I
A	Berat Contoh Jenuh Kering Permukaan (SSD)	500.07 gr
B	Berat Kering Oven	489.19 gr
C	Jumlah Air (V-W)	188.07 gr
D	Berat Jenis Bulk $= \frac{B}{C}$	2.60
E	Berat Jenis Kering Permukaan (SSD) $= \frac{A}{C}$	2.66
F	Berat Jenis Semu (Apparent) $= \frac{B}{C-(A-B)}$	2.76
G	Penyerapan $= \frac{(A-B)}{B} \times 100$	2.22%

A.4 PENGUJIAN KANDUNGAN LUMPUR AGREGAT HALUS

I. Waktu Pemeriksaan : 3 November 2018

II. Bahan

a. Pasir kering tungku, asal : Kali Progo

b. Air jernih asal : LSBB Prodi TS FT- UAJY

III. Alat

a. Gelas ukur, ukuran : 250 cc

b. Timbangan

c. Tungku (oven), suhu antar 105-110^{o}C

IV. Pasir + piring masuk tungku

V. Hasil

Pasir + piring keluar tungku

a. Berat pasir mula-mula = 103,30 gram

b. Berat piring + pasir = 190,83 gram

c. Berat piring kosong = 89,38 gram

d. Berat pasir = 101,45 gram

Kandungan Lumpur = $\frac{103,30-101,45}{103,30} \times 100\%$

= 1,79 %

Kesimpulan : Kandungan Lumpur 1,79 % < 5 %, maka agregat halus memenuhi persyaratan dan tidak perlu dicuci terlebih dahulu sebelum digunakan.

A.5 PENGUJIAN ZAT ORGANIK AGREGAT HALUS

I. Waktu Pemeriksaan : 3 November 2018

II. Bahan

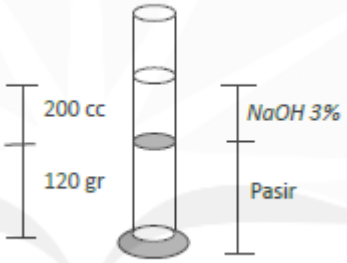
a. Pasir kering tungku, asal : Kali Progo

b. Larutan NaOH 3%

III. Alat

a. Gelas ukur, ukuran : 250 cc

IV. Sketsa



V. Hasil

Setelah didiamkan selama 24 jam, warna larutan di atas pasir sesuai dengan warna *Gardner Standard Color* No. 8

Kesimpulan : Warna *Gardner Standard Colour* No. 8, maka dapat disimpulkan pasir tersebut baik digunakan.

A.6 PENGUJIAN BERAT SATUAN VOLUME AGREGAT HALUS

Waktu Pemeriksaan : 29 Oktober 2018

Bahan : Pasir

Asal : Kali Progo

Hasil Pengujian :

	Nomor Pemeriksaan	I
A	Berat Wadah	3500 gram
B	Tinggi Wadah	16 cm
C	Diameter Wadah	15 cm
D	Volume Wadah	2800 cm^3
E	Berat Agregat dan Wadah	8180 gram
F	Berat Satuan Volume Agregat = $\frac{(E-A)}{D}$	1,671 gr/cm^3

A.7 PENGUJIAN *SLAG* (TERAK LOGAM)

INSTITUT PERTANIAN STIPER
INSTIPER
YOGYAKARTA

UPT LABORATORIUM

HASIL ANALISIS

NOMOR KODE LAB : LS.21.11.18/ 294

NAMA PEMOHON : Gabriel Selo

JENIS ANALISIS : Kadar air, Al2O3, MgO, SO3, K2O, Na2O, LOI

JUMLAH SAMPEL : 4

TANGGAL MASUK : 21 November 2018

TANGGAL PENGUJIAN : 26 November - 18 Desember 2018

NO	Kode Sampel	Kadar Air	LOI	Al2O3	MgO	SO3	K2O	Na2O
				Ekstrak HNO3 + HClO4				
		%	%	%				
1	Kalatis	0,88	1,31					
2	Fly Ash	0,82	1,69	0,98	0,75	0,11	0,75	0,98
3	Terak Logam	1,46	2,38	0,87	0,98	0,09	0,56	0,87
4	Sekam Padi	1,60	2,25	0,67	0,32	0,14	2,21	1,56

Yogyakarta, 18 Desember 2018

Ka.UPT.Laboratorium&Perpustakaan — Ka Bag UPT Lab

Dr.Ir. Candra Ginting, MP. — Roostriyanti

Jl. Nangka II, Maguwoharjo (Ringroad Utara), Sleman, Yogyakarta 55282. Telp. (0274) 885478, 885479, 885580; Fax. (0274) 885479
www.instiperjogja.ac.id | email: instiper@instiperjogja.ac.id

A.7 PENGUJIAN *SLAG* (TERAK LOGAM)

KEMENTERIAN KESEHATAN REPUBLIK INDONESIA
DIREKTORAT JENDERAL
PENCEGAHAN DAN PENGENDALIAN PENYAKIT
BALAI BESAR TEKNIK KESEHATAN LINGKUNGAN
DAN PENGENDALIAN PENYAKIT YOGYAKARTA
Jalan Wiyoro Lor No. 21 Baturetno, Banguntapan, Bantul, DIY. 55197
Telepon (0274) 371588, 443283 Faksimile (0274) 443284
Laman : www.btkljogja.or.id Surat Elektronik info@btkljogja.or.id

GERMAS

FR/VIII.3/12-P/Rev.7

LAPORAN HASIL UJI
P/ /2018

hal 1 dari 1 hal

Pengujian Laboratorium Fisika Kimia Padatan dan B3

Nomor contoh uji : **22.690 P**
Jenis contoh uji : Padatan.
Asal contoh uji : Clara Monica P, Mhs.Fak.Teknik Sipil Universitas Atmajaya, Yogyakarta.
.Pengambil contoh uji : Clara Monica P (Pelanggan)
Tgl diambil/diterima : 30-10-2018 / 30-10-2018
Tgl pengujian : 30-10-2018 s.d 12 -11 -2018
Uraian :

22.690 P: Contoh uji iron slag.

No	Parameter	Satuan	Hasil Uji	Metode Uji
			22.690 P	
1	Silikat total (Sio_2)	%	21,54	AOAC International 17th Edition
2	Besi (Fe_2O_3)	%	80,51	USEPA 3051,SW 846-7000B.2007
3	Kalsium (CaO_2)	%	0,16	USEPA 3051,SW 846-7000B.2007
4	Kalsium ($Ca(OH_2)$)	%	0,02	USEPA 3051,SW 846-7000B.2007
5	Magnesium (Mg)	%	0,02	USEPA 3051,SW 846-7000B.2007
6	Kalium (K_2O)	%	0,05	USEPA , APHA 2012 Section 3500
7	Natrium (Na_2O_2)	%	0,36	USEPA , APHA 2012 Section 3500
8	Kadar Lengas	%	0,31	SNI 13-4719-1998

Yogyakarta, 13 November 2018

Catatan : 1. Hasil uji hanya berlaku untuk contoh yang diuji
2. Laporan Hasil Uji ini tidak boleh digandakan tanpa ijin Manajer Puncak Laboratorium Penguji dan Kalibrasi BBTKL PP Yogyakarta, kecuali secara lengkap
3. Hasil uji dihitung dalam berat kering

Deputi Manajer Teknik
Fisika Kimia Padatan dan B3

Rinisih Winarti, SKM
NIP 196310271983032001

B. RENCANA ADUKAN BETON (*MIX DESIGN*)

B.1 Data bahan

a. Agregat kasar : Limbah beton LSBB Prodi TS, FT – UAJY

b. Semen : Gresik

c. Air : LSBB Prodi TS, FT – UAJY

d. Ukuran agregat kasar : maks. 19 mm

e. Faktor air semen (fas) : 0,3 dan 0,4

f. *Slag* : 20% dari berat semen

g. Berat jenis agregat kasar : 2345 kg/m^3

h. Berat jenis semen : 3150 kg/m^3

i. Tinggi silinder, t_1 : 15 cm

j. Diameter silinder, d_1 : 30 cm

k. Volume silinder, V_1 : 5301,44 cm^3

: 0,00530144 m^3

l. Tinggi silinder, t_2 : 10 cm

m. Diameter silinder, d_2 : 20 cm

n. Volume silinder, V_2 : 1570,80 cm^3

: 0,00157080 m^3

B.2 Perhitungan Adukan Beton (*Mix Design*)

a. Rencana Adukan (Contoh Perhitungan) untuk 1 Silinder diameter 15cm tinggi 30 cm (Fas 0,3 ; *triple method*)

Perbandingan semen : pasir : kerikil = 1,5 : 1,6 : 2,4

Slag = 20% dari semen

Berat agregat kasar daur ulang $= \frac{2,4}{(1,5+1,6+2,4)} \times 0,00530144 \times 2345$

$= 5,425$ kg

Berat agregat halus $= \frac{1,6}{(1,5+1,6+2,4)} \times 0,00530144 \times 2660$

$= 3,617$ kg

Berat semen $= \frac{1,5}{(1,5+1,6+2,4)} \times 0,00530144 \times 3150$

$= 4,5544$ kg

Berat *slag* $= \frac{20}{100} \times 4,5544$

$= 0,911$ kg

Berat semen setelah substitusi*slag* = 4,5544 – 0,911 = 3,644 kg

Berat air fas 0,3 = 0,3 x 4,5544

= 1,366 kg

Dengan *Safety Factor* = 10%, maka diperoleh kebutuhan untuk 1 benda uji silinder beton sebagai berikut.

Agregat daur ulang $= 5,425 + (\frac{10}{100} \times 5,425)$ = 5,967 kg

Agregat halus $= 3,617 + (\frac{10}{100} \times 3,617)$ = 3,978 kg

Semen $= 3,644 + (\frac{10}{100} \times 3,644)$ = 4,008 kg

Slag = 0,911 + ($\frac{10}{100} \times 0{,}911$) = 1,002 kg

Air = 1,366 + ($\frac{10}{100} \times 1{,}366$) = 1,503 kg

b. Rencana Adukan (Contoh Perhitungan) untuk 1 Silinder diameter 10cm tinggi 20 cm (Fas 0,4 ; *normal method*)

Perbandingan semen : pasir : kerikil = 1,5 : 1,6 : 2,4

Berat agregat kasar daur ulang = $\frac{2{,}4}{(1{,}5+1{,}6+2{,}4)} \times 0{,}00157080 \times 2345$

= 1,607 kg

Berat agregat halus = $\frac{1{,}6}{(1{,}5+1{,}6+2{,}4)} \times 0{,}00157080 \times 2660$

= 1,0716 kg

Berat semen = $\frac{1{,}5}{(1{,}5+1{,}6+2{,}4)} \times 0{,}00157080 \times 3150$

= 1,3495 kg

Berat air fas 0,4 = 0,4 x 1,3495

= 0,5398 kg

Dengan *Safety Factor* = 10%, maka diperoleh kebutuhan untuk 1 benda uji silinder beton sebagai berikut.

Agregat daur ulang = 1,607 + ($\frac{10}{100} \times 1{,}607$) = 5,967 kg

Agregat halus = 1,0716 + ($\frac{10}{100} \times 1{,}0716$) = 3,978 kg

Semen = 1,3495+ ($\frac{10}{100} \times 1{,}3495$) = 1,0796 kg

Air = 0,5398 + ($\frac{10}{100} \times 0{,}5398$) = 0,594 kg

Kebutuhan Adukan 1 Benda Uji Kuat Tekan, Kuat Tarik, Dan Modulus Elastisitas

Kode	RAC	Berat Pasir	Berat Semen	Slag	Air
NM 0,3	5,967	3,978	5,010	-	1,503
NM 0,4	5,967	3,978	5,010	-	2,004
TM 0,3	5,967	3,978	4,008	1,002	1,503
TM 0,4	5,967	3,978	4,008	1,002	2,004

Kebutuhan Adukan 1 Benda Uji Porositas

Kode	RAC	Berat Pasir	Berat Semen	Slag	Air
NM 0,3	1,768	1,179	1,484	-	0,445
NM 0,4	1,768	1,179	1,484	-	0,594
TM 0,3	1,768	1,179	1,188	0,297	0,445
TM 0,4	1,768	1,179	1,188	0,297	0,594

C. HASIL PENGUJIAN BENDA UJI

C.1 PEMERIKSAAN BERAT JENIS BETON

No	Kode	Tinggi (mm)	Diameter (mm)	Volume (m^3)	Berat (kg)	Berat Jenis (kg/m^3)	Berat Jenis (kg/m^3)
1	NM 0,3	309,50	152,43	0,0056	12,2	2157,177	2215,5
2		306,87	154,10	0,0057	12,0	2090,428	
3		306,67	151,37	0,0055	12,1	2200,649	
4		306,27	151,03	0,0055	12,2	2220,552	
5		307,63	150,30	0,0055	12,1	2224,982	
6		307,03	150,73	0,0055	13,1	2399,111	
1	NM 0,4	301,93	150,93	0,0054	12,2	2262,814	2271,2
2		303,77	150,53	0,0054	12,3	2268,528	
3		304,83	151,07	0,0055	12,3	2257,472	
4		303,27	149,67	0,0053	12,3	2306,159	
5		302,47	150,83	0,0054	12,2	2254,417	
6		301,43	151,00	0,0054	12,3	2277,539	
1	TM 0,3	304,67	154,23	0,0057	12,6	2217,875	2210,8
2		305,20	154,57	0,0057	12,6	2207,954	
3		305,93	155,33	0,0058	12,7	2187,873	
4		304,33	150,00	0,0054	12,0	2235,793	
5		302,47	154,50	0,0057	12,6	2219,245	
6		304,73	151,50	0,0055	12,1	2196,146	
1	TM 0,4	305,23	154,23	0,0057	12,8	2241,824	2243,3
2		302,60	154,57	0,0057	12,8	2246,305	
3		303,10	155,33	0,0057	12,9	2244,899	
4		302,40	150,00	0,0053	12,2	2276,294	
5		300,10	154,50	0,0056	12,6	2247,415	
6		301,80	151,50	0,0054	12,0	2202,781	

C.2 PENGUJIAN KUAT TEKAN SILINDER BETON

Umur	No	Kode	Beban Tekan (kN)	Kuat Tekan (MPa)	Kuat Tekan Rerata (MPa)
28 hari	1	NM 0,3	550	30,14	29,95
	2	NM 0,3	555	29,76	
	3	NM 0,3*	400	22,23	
	4	NM 0,4	495	27,67	24,62
	5	NM 0,4	435	24,44	
	6	NM 0,4	390	21,76	
	7	TM 0,3	570	30,51	31,03
	8	TM 0,3	600	31,98	
	9	TM 0,3	575	30,34	
	10	TM 0,4	575	30,78	30,06
	11	TM 0,4	550	29,31	
	12	TM 0,4	570	30,08	

C.3 PENGUJIAN KUAT TARIK SILINDER BETON

Umur	No	Kode	Beban Tarik (kN)	Kuat Tarik (MPa)	Kuat Tarik Rerata (MPa)
28 hari	1	NM 0,3	150	2,06	1,95
	2	NM 0,3	125	1,74	
	3	NM 0,3	150	2,05	
	4	NM 0,4	125	1,75	1,82
	5	NM 0,4	125	1,74	
	6	NM 0,4	140	1,95	
	7	TM 0,3	190	2,66	2,73
	8	TM 0,3	220	2,98	
	9	TM 0,3	185	2,55	
	10	TM 0,4	160	2,25	2,18
	11	TM 0,4	150	2,05	
	12	TM 0,4	160	2,23	

C.4 PENGUJIAN MODULUS ELASTISITAS SILINDER BETON

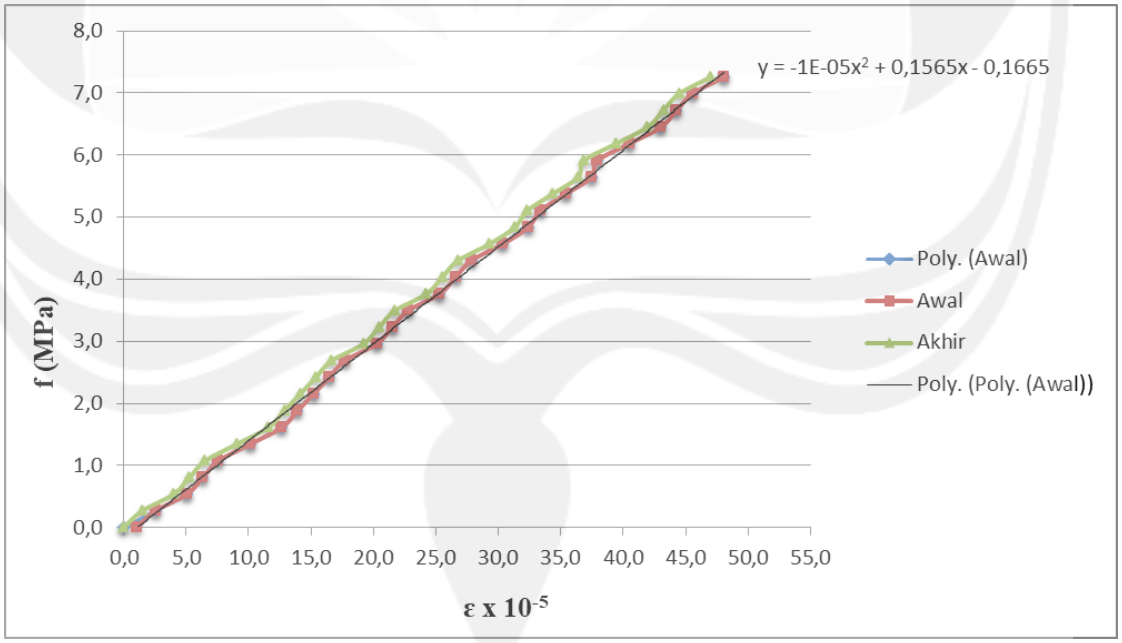
Kode Beton = NM 0,3 - 1 Ao = 18249,45 mm^2

Diameter baut = 7,60 mm Beban Max = 13500 kgf

Po = 197,58 mm E = 15434,43 Mpa

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
0	0	0,0	0,000	0,000	1,064	0,000	0,000
500	4905	10,0	5,000	0,269	2,531	1,467	2,531
1000	9810	20,0	10,000	0,538	5,061	3,997	5,061
1500	14715	25,0	12,500	0,806	6,327	5,263	6,327
2000	19620	30,0	15,000	1,075	7,592	6,528	7,592
2500	24525	40,0	20,000	1,344	10,122	9,059	10,122
3000	29430	50,0	25,000	1,613	12,653	11,589	12,653
3500	34335	55,0	27,500	1,881	13,918	12,854	13,918
4000	39240	60,0	30,000	2,150	15,184	14,120	15,184
4500	44145	65,0	32,500	2,419	16,449	15,385	16,449
5000	49050	70,0	35,000	2,688	17,714	16,650	17,714
5500	53955	80,0	40,000	2,957	20,245	19,181	20,245
6000	58860	85,0	42,500	3,225	21,510	20,446	21,510
6500	63765	90,0	45,000	3,494	22,776	21,712	22,776
7000	68670	100,0	50,000	3,763	25,306	24,242	25,306
7500	73575	105,0	52,500	4,032	26,572	25,508	26,572
8000	78480	110,0	55,000	4,300	27,837	26,773	27,837
8500	83385	120,0	60,000	4,569	30,367	29,303	30,367
9000	88290	128,0	64,000	4,838	32,392	31,328	32,392
9500	93195	132,0	66,000	5,107	33,404	32,340	33,404

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
10000	98100	140,0	70,000	5,376	35,429	34,365	35,429
10500	103005	148,0	74,000	5,644	37,453	36,389	37,453
11000	107910	150,0	75,000	5,913	37,959	36,895	37,959
11500	112815	160,0	80,000	6,182	40,490	39,426	40,490
12000	117720	170,0	85,000	6,451	43,021	41,957	43,021
12500	122625	175,0	87,500	6,719	44,286	43,222	44,286
13000	127530	180,0	90,000	6,988	45,551	44,487	45,551
13500	132435	190,0	95,000	7,257	48,082	47,018	48,082



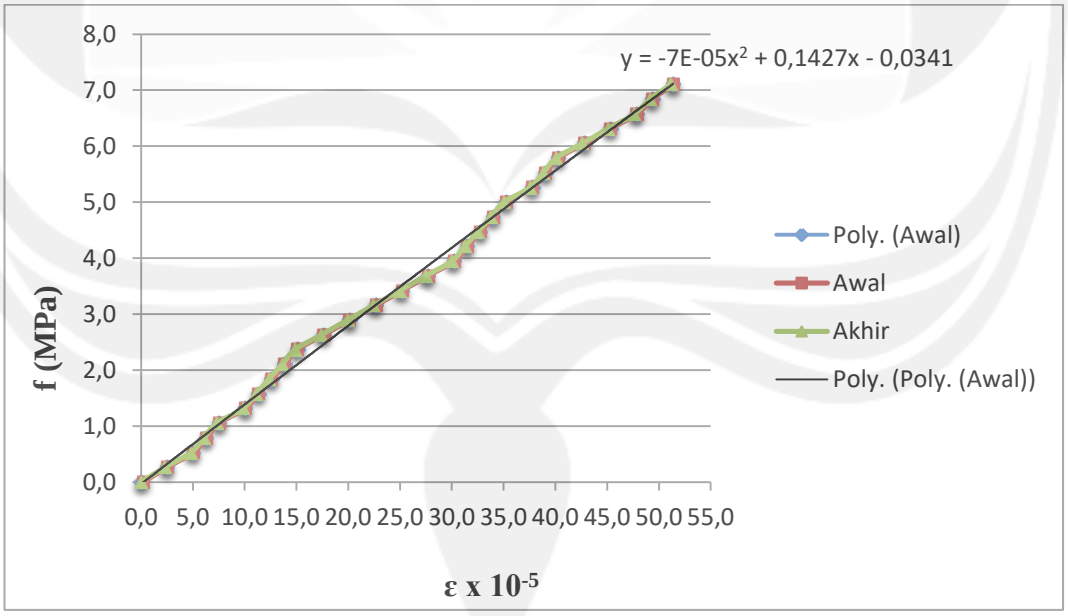
Kode Beton = NM 0,3 - 2 Ao = 18650,70096 mm^2

Diameter baut = 7,60 mm Beban Max = 13500 kgf

Po = 198,50 mm E = 13883,29 Mpa

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
0	0	0,0	0,000	0,000	0,239	0,000	0,000
500	4905	10,0	5,000	0,263	2,519	2,280	2,519
1000	9810	20,0	10,000	0,526	5,038	4,799	5,038
1500	14715	25,0	12,500	0,789	6,297	6,058	6,297
2000	19620	30,0	15,000	1,052	7,557	7,318	7,557
2500	24525	40,0	20,000	1,315	10,076	9,837	10,076
3000	29430	45,0	22,500	1,578	11,335	11,096	11,335
3500	34335	50,0	25,000	1,841	12,594	12,355	12,594
4000	39240	55,0	27,500	2,104	13,854	13,615	13,854
4500	44145	60,0	30,000	2,367	15,113	14,874	15,113
5000	49050	70,0	35,000	2,630	17,632	17,393	17,632
5500	53955	80,0	40,000	2,893	20,151	19,912	20,151
6000	58860	90,0	45,000	3,156	22,670	22,431	22,670
6500	63765	100,0	50,000	3,419	25,189	24,950	25,189
7000	68670	110,0	55,000	3,682	27,708	27,469	27,708
7500	73575	120,0	60,000	3,945	30,227	29,988	30,227
8000	78480	125,0	62,500	4,208	31,486	31,247	31,486
8500	83385	130,0	65,000	4,471	32,746	32,507	32,746
9000	88290	135,0	67,500	4,734	34,005	33,766	34,005
9500	93195	140,0	70,000	4,997	35,264	35,025	35,264
10000	98100	150,0	75,000	5,260	37,783	37,544	37,783

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
10500	103005	155,0	77,500	5,523	39,043	38,804	39,043
11000	107910	160,0	80,000	5,786	40,302	40,063	40,302
11500	112815	170,0	85,000	6,049	42,821	42,582	42,821
12000	117720	180,0	90,000	6,312	45,340	45,101	45,340
12500	122625	190,0	95,000	6,575	47,859	47,620	47,859
13000	127530	196,0	98,000	6,838	49,370	49,131	49,370
13500	132435	204,0	102,000	7,101	51,385	51,146	51,385



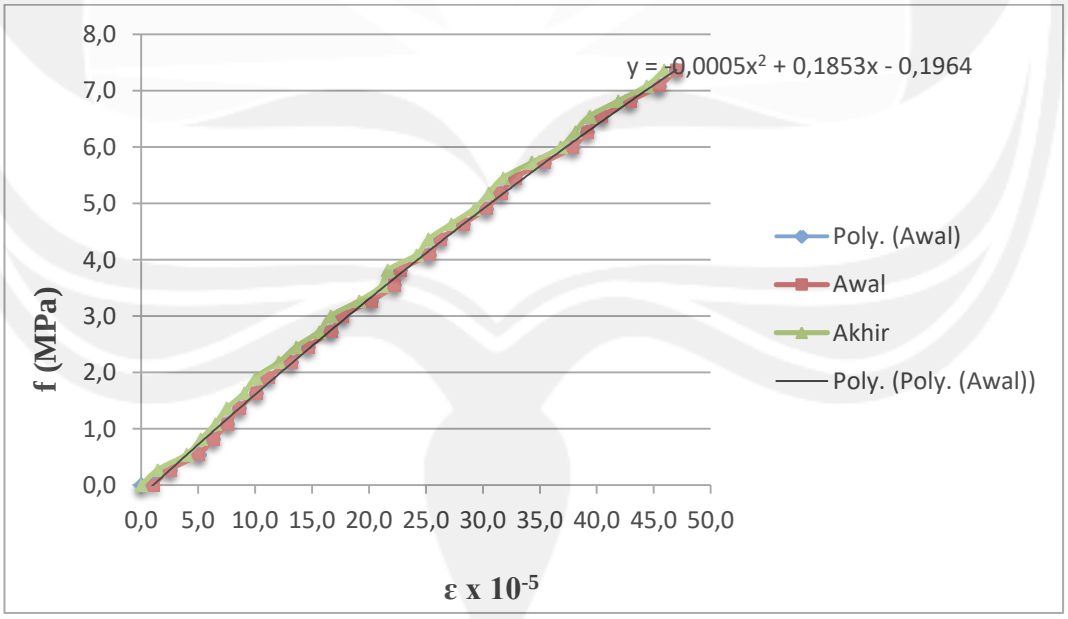
Kode Beton = NM 0,3 - 3 Ao = 17994,93887 mm^2

Diameter baut = 7,60 mm Beban Max = 13500 kgf

Po = 198,00 mm E = 16031,56 MPa

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
0	0	0,0	0,000	0,000	1,063	0,000	0,000
500	4905	10,0	5,000	0,273	2,525	1,462	2,525
1000	9810	20,0	10,000	0,545	5,051	3,988	5,051
1500	14715	25,0	12,500	0,818	6,313	5,250	6,313
2000	19620	30,0	15,000	1,090	7,576	6,513	7,576
2500	24525	34,0	17,000	1,363	8,586	7,523	8,586
3000	29430	40,0	20,000	1,635	10,101	9,038	10,101
3500	34335	44,0	22,000	1,908	11,111	10,048	11,111
4000	39240	52,0	26,000	2,181	13,131	12,068	13,131
4500	44145	58,0	29,000	2,453	14,646	13,584	14,646
5000	49050	66,0	33,000	2,726	16,667	15,604	16,667
5500	53955	70,0	35,000	2,998	17,677	16,614	17,677
6000	58860	80,0	40,000	3,271	20,202	19,139	20,202
6500	63765	88,0	44,000	3,543	22,222	21,159	22,222
7000	68670	90,0	45,000	3,816	22,727	21,664	22,727
7500	73575	100,0	50,000	4,089	25,253	24,190	25,253
8000	78480	104,0	52,000	4,361	26,263	25,200	26,263
8500	83385	112,0	56,000	4,634	28,283	27,220	28,283
9000	88290	120,0	60,000	4,906	30,303	29,240	30,303
9500	93195	125,0	62,500	5,179	31,566	30,503	31,566
10000	98100	130,0	65,000	5,452	32,828	31,765	32,828

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
10500	103005	140,0	70,000	5,724	35,354	34,291	35,354
11000	107910	150,0	75,000	5,997	37,879	36,816	37,879
11500	112815	155,0	77,500	6,269	39,141	38,078	39,141
12000	117720	160,0	80,000	6,542	40,404	39,341	40,404
12500	122625	170,0	85,000	6,814	42,929	41,866	42,929
13000	127530	180,0	90,000	7,087	45,455	44,392	45,455
13500	132435	186,0	93,000	7,360	46,970	45,907	46,970



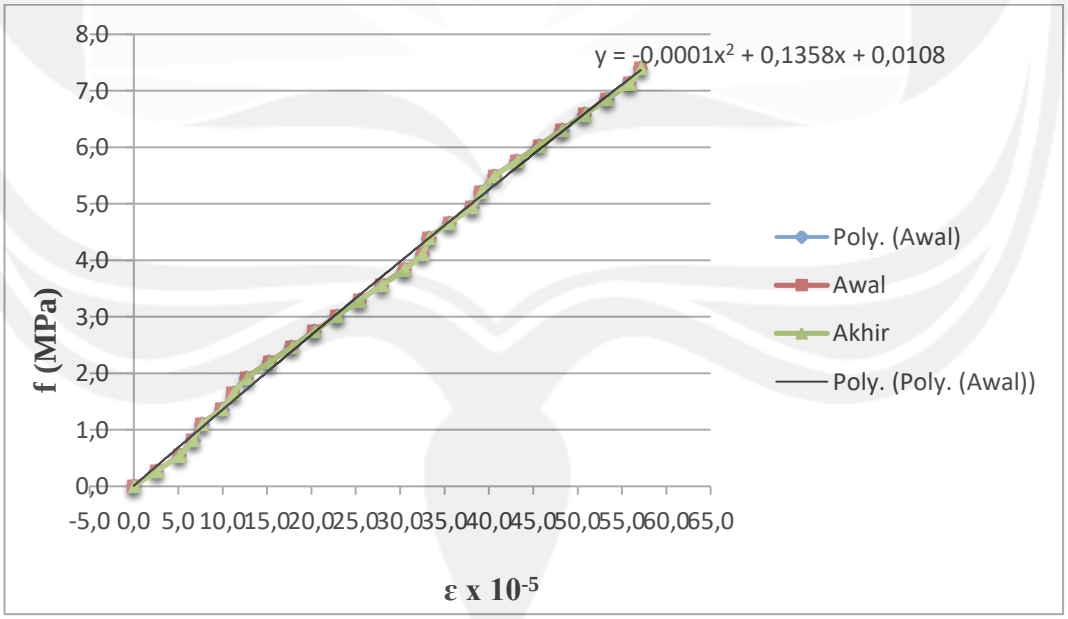
Kode Beton = NM 0,4 - 1 Ao = 17892,05 mm^2

Diameter baut = 7,60 mm Beban Max = 13500 kgf

Po = 197,10 mm E = 12950,07 MPa

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
0	0	0,0	0,000	0,000	-0,080	0,000	0,000
500	4905	10,0	5,000	0,274	2,537	2,616	2,537
1000	9810	20,0	10,000	0,548	5,074	5,153	5,074
1500	14715	26,0	13,000	0,822	6,596	6,675	6,596
2000	19620	30,0	15,000	1,097	7,610	7,690	7,610
2500	24525	39,0	19,500	1,371	9,893	9,973	9,893
3000	29430	44,0	22,000	1,645	11,162	11,241	11,162
3500	34335	50,0	25,000	1,919	12,684	12,763	12,684
4000	39240	60,0	30,000	2,193	15,221	15,300	15,221
4500	44145	70,0	35,000	2,467	17,757	17,837	17,757
5000	49050	80,0	40,000	2,741	20,294	20,374	20,294
5500	53955	90,0	45,000	3,016	22,831	22,911	22,831
6000	58860	100,0	50,000	3,290	25,368	25,447	25,368
6500	63765	110,0	55,000	3,564	27,905	27,984	27,905
7000	68670	120,0	60,000	3,838	30,441	30,521	30,441
7500	73575	128,0	64,000	4,112	32,471	32,550	32,471
8000	78480	131,0	65,500	4,386	33,232	33,311	33,232
8500	83385	140,0	70,000	4,660	35,515	35,594	35,515
9000	88290	150,0	75,000	4,935	38,052	38,131	38,052
9500	93195	154,0	77,000	5,209	39,066	39,146	39,066
10000	98100	160,0	80,000	5,483	40,589	40,668	40,589

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
10500	103005	170,0	85,000	5,757	43,125	43,205	43,125
11000	107910	180,0	90,000	6,031	45,662	45,742	45,662
11500	112815	190,0	95,000	6,305	48,199	48,278	48,199
12000	117720	200,0	100,000	6,579	50,736	50,815	50,736
12500	122625	210,0	105,000	6,854	53,272	53,352	53,272
13000	127530	220,0	110,000	7,128	55,809	55,889	55,809
13500	132435	225,0	112,500	7,402	57,078	57,157	57,078



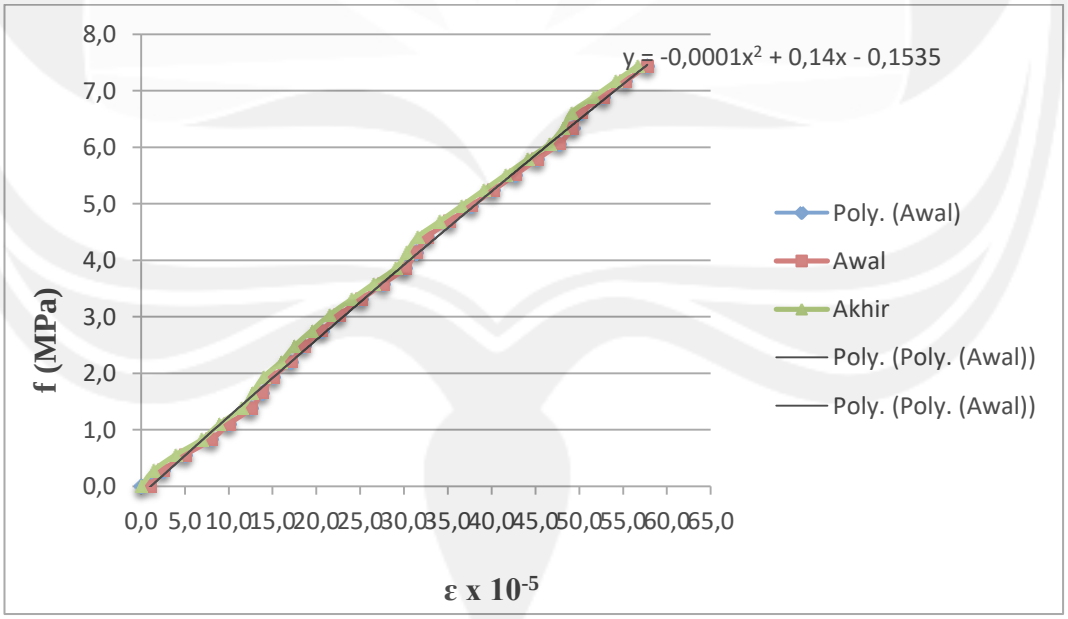
Kode Beton = NM 0,4 - 2 Ao = 17797,35 mm^2

Diameter baut = 7,60 mm Beban Max = 13500 kgf

Po = 199,10 mm E = 13132,60 MPa

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
0	0	0,0	0,000	0,000	1,097	0,000	0,000
500	4905	10,0	5,000	0,276	2,511	1,414	2,511
1000	9810	20,0	10,000	0,551	5,023	3,925	5,023
1500	14715	32,0	16,000	0,827	8,036	6,939	8,036
2000	19620	40,0	20,000	1,102	10,045	8,948	10,045
2500	24525	50,0	25,000	1,378	12,557	11,459	12,557
3000	29430	55,0	27,500	1,654	13,812	12,715	13,812
3500	34335	60,0	30,000	1,929	15,068	13,971	15,068
4000	39240	68,0	34,000	2,205	17,077	15,980	17,077
4500	44145	74,0	37,000	2,480	18,584	17,486	18,584
5000	49050	82,0	41,000	2,756	20,593	19,495	20,593
5500	53955	90,0	45,000	3,032	22,602	21,504	22,602
6000	58860	100,0	50,000	3,307	25,113	24,016	25,113
6500	63765	110,0	55,000	3,583	27,624	26,527	27,624
7000	68670	120,0	60,000	3,858	30,136	29,038	30,136
7500	73575	125,0	62,500	4,134	31,391	30,294	31,391
8000	78480	130,0	65,000	4,410	32,647	31,550	32,647
8500	83385	140,0	70,000	4,685	35,158	34,061	35,158
9000	88290	150,0	75,000	4,961	37,670	36,572	37,670
9500	93195	160,0	80,000	5,236	40,181	39,084	40,181
10000	98100	170,0	85,000	5,512	42,692	41,595	42,692

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
10500	103005	180,0	90,000	5,788	45,203	44,106	45,203
11000	107910	190,0	95,000	6,063	47,715	46,617	47,715
11500	112815	196,0	98,000	6,339	49,221	48,124	49,221
12000	117720	200,0	100,000	6,614	50,226	49,129	50,226
12500	122625	210,0	105,000	6,890	52,737	51,640	52,737
13000	127530	220,0	110,000	7,166	55,249	54,151	55,249
13500	132435	230,0	115,000	7,441	57,760	56,663	57,760



Kode Beton = NM 0,4 - 3

Ao = 17923,68 mm^2

Diameter baut = 7,60 mm

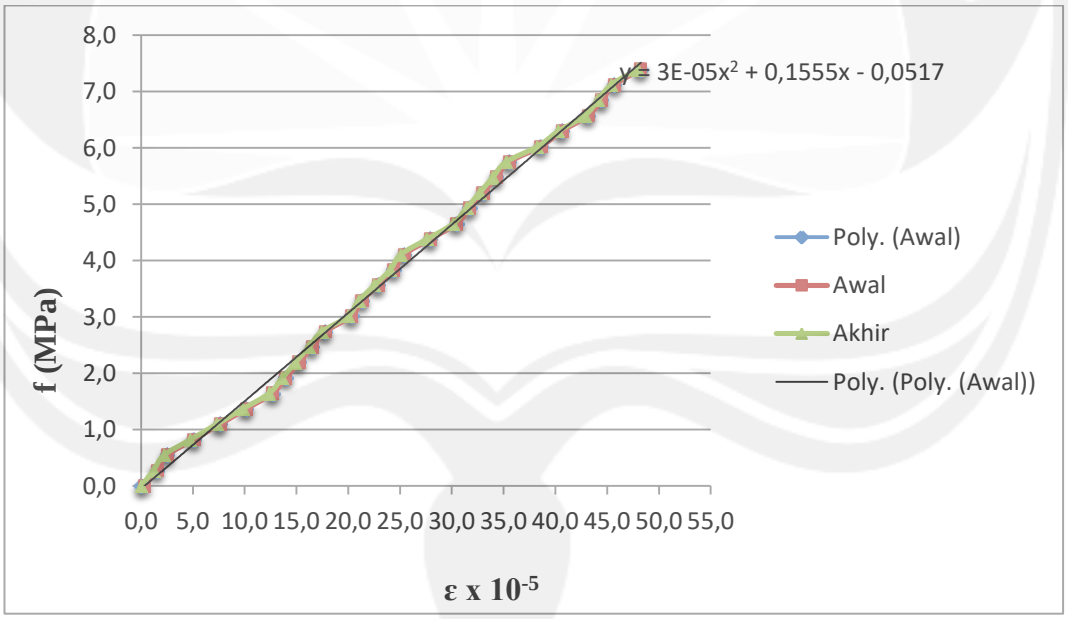
Beban Max = 13500 kgf

Po = 196,90 mm

E = 15420,59 MPa

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
0	0	0,0	0,000	0,000	0,332	0,000	0,000
500	4905	6,0	3,000	0,274	1,524	1,191	1,524
1000	9810	10,0	5,000	0,547	2,539	2,207	2,539
1500	14715	20,0	10,000	0,821	5,079	4,746	5,079
2000	19620	30,0	15,000	1,095	7,618	7,286	7,618
2500	24525	40,0	20,000	1,368	10,157	9,825	10,157
3000	29430	50,0	25,000	1,642	12,697	12,364	12,697
3500	34335	55,0	27,500	1,916	13,966	13,634	13,966
4000	39240	60,0	30,000	2,189	15,236	14,904	15,236
4500	44145	65,0	32,500	2,463	16,506	16,173	16,506
5000	49050	70,0	35,000	2,737	17,776	17,443	17,776
5500	53955	80,0	40,000	3,010	20,315	19,982	20,315
6000	58860	84,0	42,000	3,284	21,331	20,998	21,331
6500	63765	90,0	45,000	3,558	22,854	22,522	22,854
7000	68670	96,0	48,000	3,831	24,378	24,045	24,378
7500	73575	100,0	50,000	4,105	25,394	25,061	25,394
8000	78480	110,0	55,000	4,379	27,933	27,600	27,933
8500	83385	120,0	60,000	4,652	30,472	30,140	30,472
9000	88290	125,0	62,500	4,926	31,742	31,410	31,742
9500	93195	130,0	65,000	5,200	33,012	32,679	33,012
10000	98100	135,0	67,500	5,473	34,281	33,949	34,281

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
10500	103005	140,0	70,000	5,747	35,551	35,219	35,551
11000	107910	152,0	76,000	6,021	38,598	38,266	38,598
11500	112815	160,0	80,000	6,294	40,630	40,297	40,630
12000	117720	170,0	85,000	6,568	43,169	42,837	43,169
12500	122625	175,0	87,500	6,842	44,439	44,106	44,439
13000	127530	180,0	90,000	7,115	45,708	45,376	45,708
13500	132435	190,0	95,000	7,389	48,248	47,915	48,248



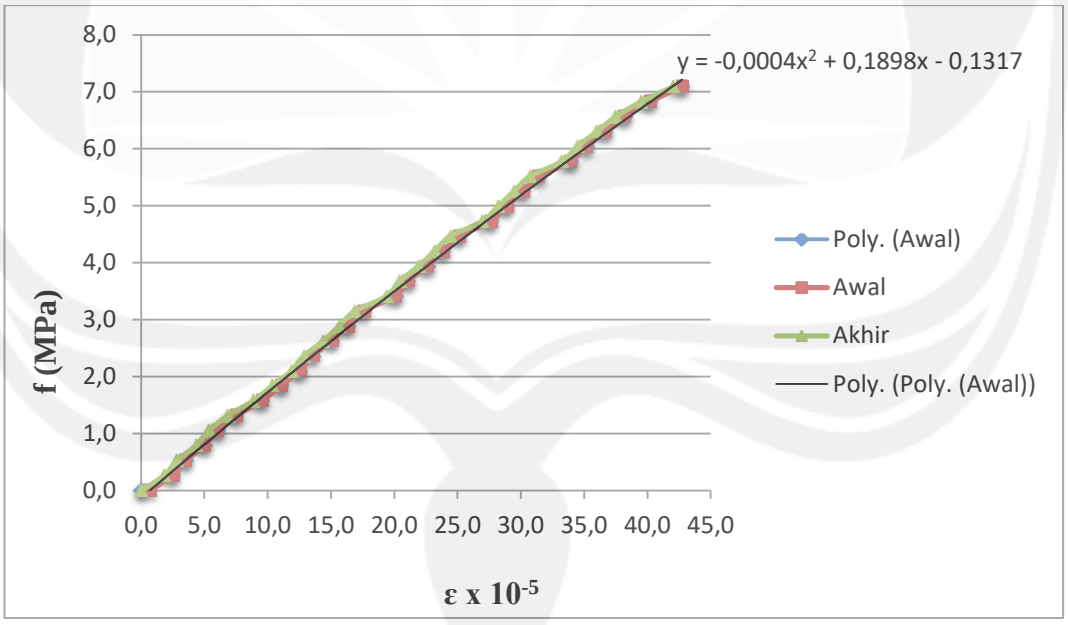
Kode Beton = TM 0,3 - 1 Ao = 18682,99 mm^2

Diameter baut = 7,60 mm Beban Max = 13500 kgf

Po = 198,98 mm E = 16868,24 Mpa

Beban		Compressometer (ΔP)		Tegangan	Reganga n awal	Reganga n koreksi	Reganga n (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
0	0	0,0	0,000	0,000	0,695	0,000	0,000
500	4905	10,0	5,000	0,263	2,513	1,818	2,513
1000	9810	14,0	7,000	0,525	3,518	2,823	3,518
1500	14715	20,0	10,000	0,788	5,026	4,331	5,026
2000	19620	24,0	12,000	1,050	6,031	5,336	6,031
2500	24525	30,0	15,000	1,313	7,538	6,844	7,538
3000	29430	38,0	19,000	1,575	9,549	8,854	9,549
3500	34335	44,0	22,000	1,838	11,056	10,361	11,056
4000	39240	50,0	25,000	2,100	12,564	11,869	12,564
4500	44145	54,0	27,000	2,363	13,569	12,874	13,569
5000	49050	60,0	30,000	2,625	15,077	14,382	15,077
5500	53955	65,0	32,500	2,888	16,333	15,638	16,333
6000	58860	70,0	35,000	3,150	17,590	16,895	17,590
6500	63765	80,0	40,000	3,413	20,103	19,408	20,103
7000	68670	84,0	42,000	3,676	21,108	20,413	21,108
7500	73575	90,0	45,000	3,938	22,615	21,920	22,615
8000	78480	95,0	47,500	4,201	23,872	23,177	23,872
8500	83385	100,0	50,000	4,463	25,128	24,433	25,128
9000	88290	110,0	55,000	4,726	27,641	26,946	27,641
9500	93195	115,0	57,500	4,988	28,897	28,202	28,897
10000	98100	120,0	60,000	5,251	30,154	29,459	30,154

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
10500	103005	125,0	62,500	5,513	31,410	30,715	31,410
11000	107910	135,0	67,500	5,776	33,923	33,228	33,923
11500	112815	140,0	70,000	6,038	35,179	34,485	35,179
12000	117720	146,0	73,000	6,301	36,687	35,992	36,687
12500	122625	152,0	76,000	6,563	38,195	37,500	38,195
13000	127530	160,0	80,000	6,826	40,205	39,510	40,205
13500	132435	170,0	85,000	7,089	42,718	42,023	42,718



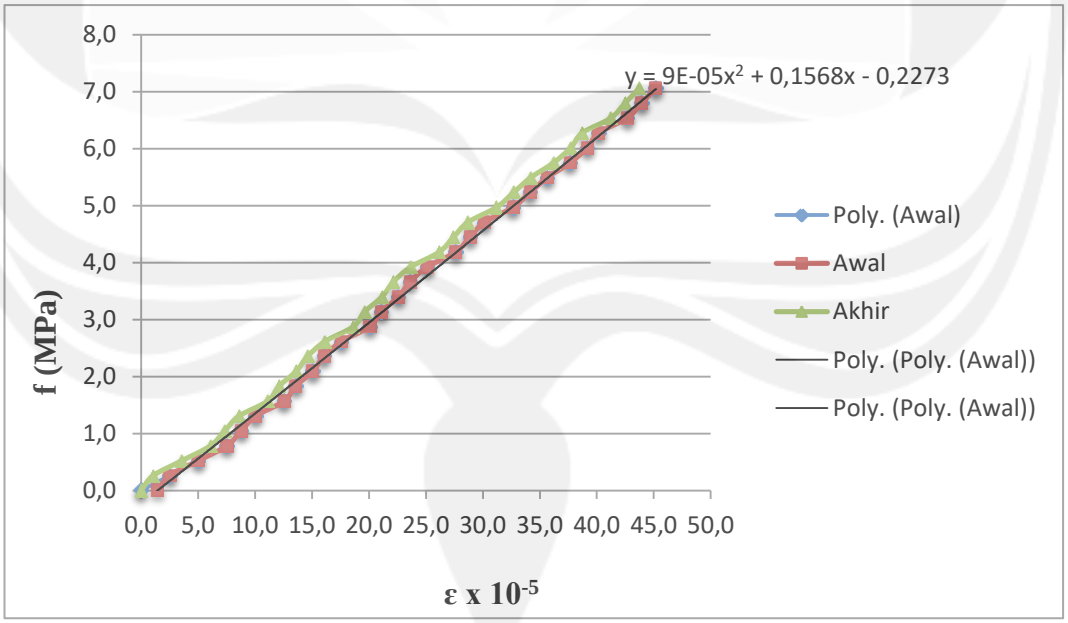
Kode Beton = TM 0,3 - 2 Ao = 18763,83 mm^2

Diameter baut = 7,60 mm Beban Max = 13500 kgf

Po = 199,20 mm E = 16139,08 MPa

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
0	0	0,0	0,000	0,000	1,448	0,000	0,000
500	4905	10,0	5,000	0,261	2,510	1,062	2,510
1000	9810	20,0	10,000	0,523	5,020	3,572	5,020
1500	14715	30,0	15,000	0,784	7,530	6,082	7,530
2000	19620	35,0	17,500	1,046	8,785	7,337	8,785
2500	24525	40,0	20,000	1,307	10,040	8,592	10,040
3000	29430	50,0	25,000	1,568	12,550	11,102	12,550
3500	34335	54,0	27,000	1,830	13,554	12,106	13,554
4000	39240	60,0	30,000	2,091	15,060	13,612	15,060
4500	44145	64,0	32,000	2,353	16,064	14,616	16,064
5000	49050	70,0	35,000	2,614	17,570	16,122	17,570
5500	53955	80,0	40,000	2,875	20,080	18,632	20,080
6000	58860	84,0	42,000	3,137	21,084	19,636	21,084
6500	63765	90,0	45,000	3,398	22,590	21,142	22,590
7000	68670	94,0	47,000	3,660	23,594	22,146	23,594
7500	73575	100,0	50,000	3,921	25,100	23,652	25,100
8000	78480	110,0	55,000	4,183	27,610	26,162	27,610
8500	83385	115,0	57,500	4,444	28,865	27,417	28,865
9000	88290	120,0	60,000	4,705	30,120	28,672	30,120
9500	93195	130,0	65,000	4,967	32,631	31,182	32,631
10000	98100	136,0	68,000	5,228	34,137	32,688	34,137

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
10500	103005	142,0	71,000	5,490	35,643	34,194	35,643
11000	107910	150,0	75,000	5,751	37,651	36,202	37,651
11500	112815	156,0	78,000	6,012	39,157	37,708	39,157
12000	117720	160,0	80,000	6,274	40,161	38,712	40,161
12500	122625	170,0	85,000	6,535	42,671	41,222	42,671
13000	127530	175,0	87,500	6,797	43,926	42,477	43,926
13500	132435	180,0	90,000	7,058	45,181	43,732	45,181



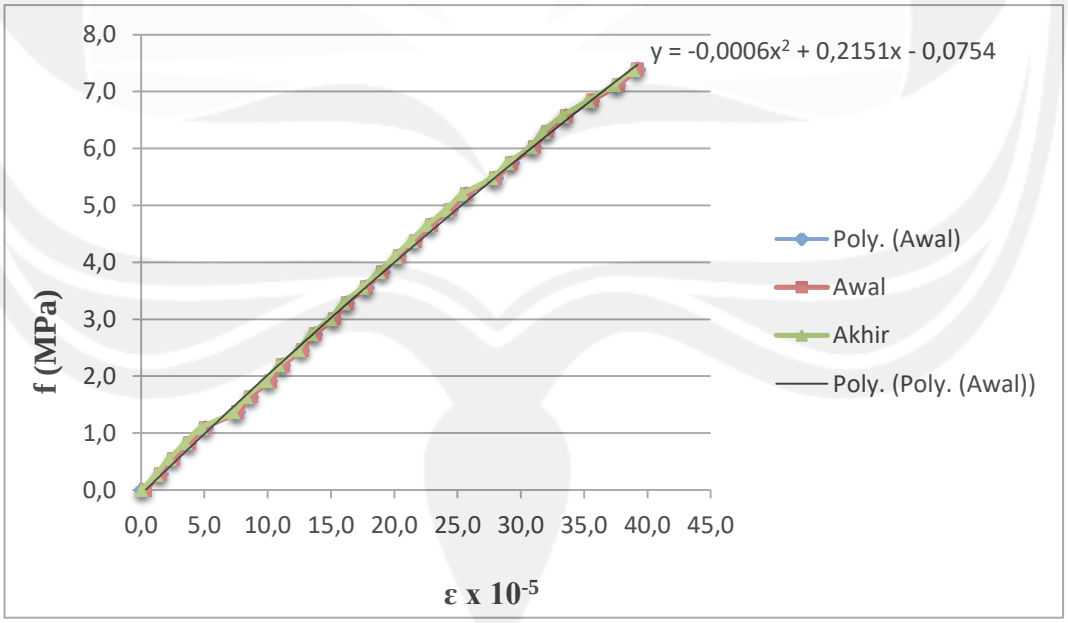
Kode Beton = TM 0,3 - 3 Ao = 17923,68mm^2

Diameter baut = 7,60 mm Beban Max = 13500 kgf

Po = 196,40 mm E = 19016,50 MPa

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	1x10^{-3}	$\frac{(1x10^{-3})}{2}$	MPa	x10^{-5}	x10^{-5}	x10^{-5}
0	0	0,0	0,000	0,000	0,351	0,000	0,000
500	4905	6,0	3,000	0,274	1,527	1,177	1,527
1000	9810	10,0	5,000	0,547	2,546	2,195	2,546
1500	14715	15,0	7,500	0,821	3,819	3,468	3,819
2000	19620	20,0	10,000	1,095	5,092	4,741	5,092
2500	24525	30,0	15,000	1,368	7,637	7,287	7,637
3000	29430	34,0	17,000	1,642	8,656	8,305	8,656
3500	34335	40,0	20,000	1,916	10,183	9,832	10,183
4000	39240	44,0	22,000	2,189	11,202	10,851	11,202
4500	44145	50,0	25,000	2,463	12,729	12,378	12,729
5000	49050	54,0	27,000	2,737	13,747	13,397	13,747
5500	53955	60,0	30,000	3,010	15,275	14,924	15,275
6000	58860	64,0	32,000	3,284	16,293	15,942	16,293
6500	63765	70,0	35,000	3,558	17,821	17,470	17,821
7000	68670	75,0	37,500	3,831	19,094	18,743	19,094
7500	73575	80,0	40,000	4,105	20,367	20,016	20,367
8000	78480	85,0	42,500	4,379	21,640	21,289	21,640
8500	83385	90,0	45,000	4,652	22,912	22,562	22,912
9000	88290	96,0	48,000	4,926	24,440	24,089	24,440
9500	93195	101,0	50,500	5,200	25,713	25,362	25,713
10000	98100	110,0	55,000	5,473	28,004	27,653	28,004

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
10500	103005	115,0	57,500	5,747	29,277	28,926	29,277
11000	107910	122,0	61,000	6,021	31,059	30,708	31,059
11500	112815	126,0	63,000	6,294	32,077	31,727	32,077
12000	117720	132,0	66,000	6,568	33,605	33,254	33,605
12500	122625	140,0	70,000	6,842	35,642	35,291	35,642
13000	127530	148,0	74,000	7,115	37,678	37,327	37,678
13500	132435	154,0	77,000	7,389	39,206	38,855	39,206



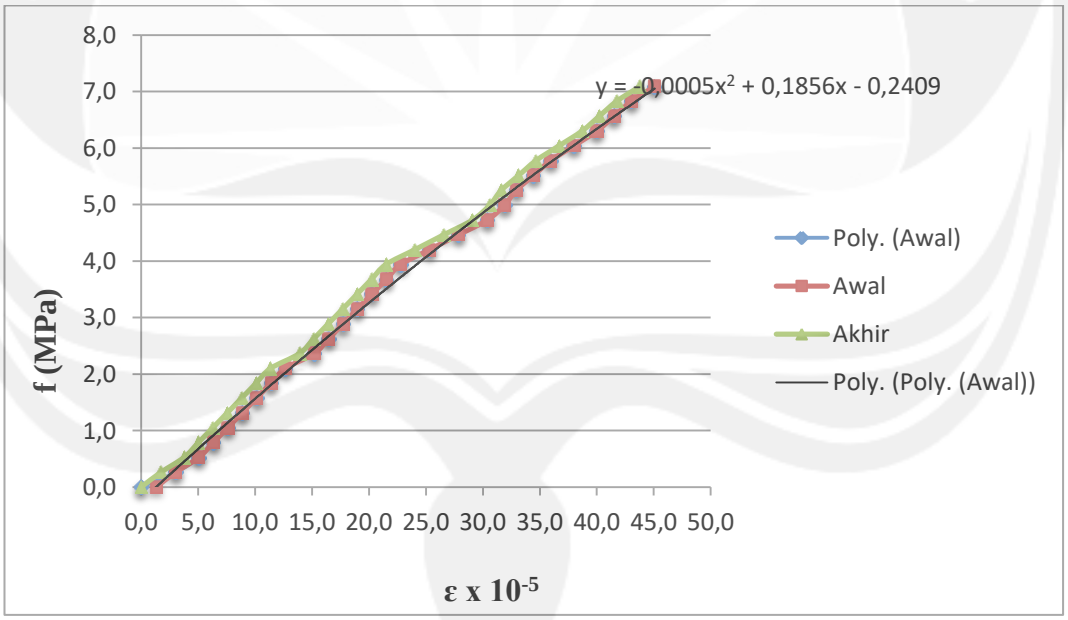
Kode Beton = TM 0,4 - 1 Ao = 18682,99 mm^2

Diameter baut = 7,60 mm Beban Max = 13500 kgf

Po = 197,50 mm E = 16198,38 Mpa

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
0	0	0,0	0,000	0,000	1,303	0,000	0,000
500	4905	12,0	6,000	0,263	3,038	1,735	3,038
1000	9810	20,0	10,000	0,525	5,063	3,761	5,063
1500	14715	25,0	12,500	0,788	6,329	5,027	6,329
2000	19620	30,0	15,000	1,050	7,595	6,292	7,595
2500	24525	35,0	17,500	1,313	8,861	7,558	8,861
3000	29430	40,0	20,000	1,575	10,127	8,824	10,127
3500	34335	45,0	22,500	1,838	11,392	10,090	11,392
4000	39240	50,0	25,000	2,100	12,658	11,356	12,658
4500	44145	60,0	30,000	2,363	15,190	13,887	15,190
5000	49050	65,0	32,500	2,625	16,456	15,153	16,456
5500	53955	70,0	35,000	2,888	17,722	16,419	17,722
6000	58860	75,0	37,500	3,150	18,987	17,685	18,987
6500	63765	80,0	40,000	3,413	20,253	18,951	20,253
7000	68670	85,0	42,500	3,676	21,519	20,216	21,519
7500	73575	90,0	45,000	3,938	22,785	21,482	22,785
8000	78480	100,0	50,000	4,201	25,316	24,014	25,316
8500	83385	110,0	55,000	4,463	27,848	26,546	27,848
9000	88290	120,0	60,000	4,726	30,380	29,077	30,380
9500	93195	126,0	63,000	4,988	31,899	30,596	31,899
10000	98100	130,0	65,000	5,251	32,911	31,609	32,911

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
10500	103005	136,0	68,000	5,513	34,430	33,128	34,430
11000	107910	142,0	71,000	5,776	35,949	34,647	35,949
11500	112815	150,0	75,000	6,038	37,975	36,672	37,975
12000	117720	158,0	79,000	6,301	40,000	38,697	40,000
12500	122625	164,0	82,000	6,563	41,519	40,216	41,519
13000	127530	170,0	85,000	6,826	43,038	41,735	43,038
13500	132435	178,0	89,000	7,089	45,063	43,761	45,063



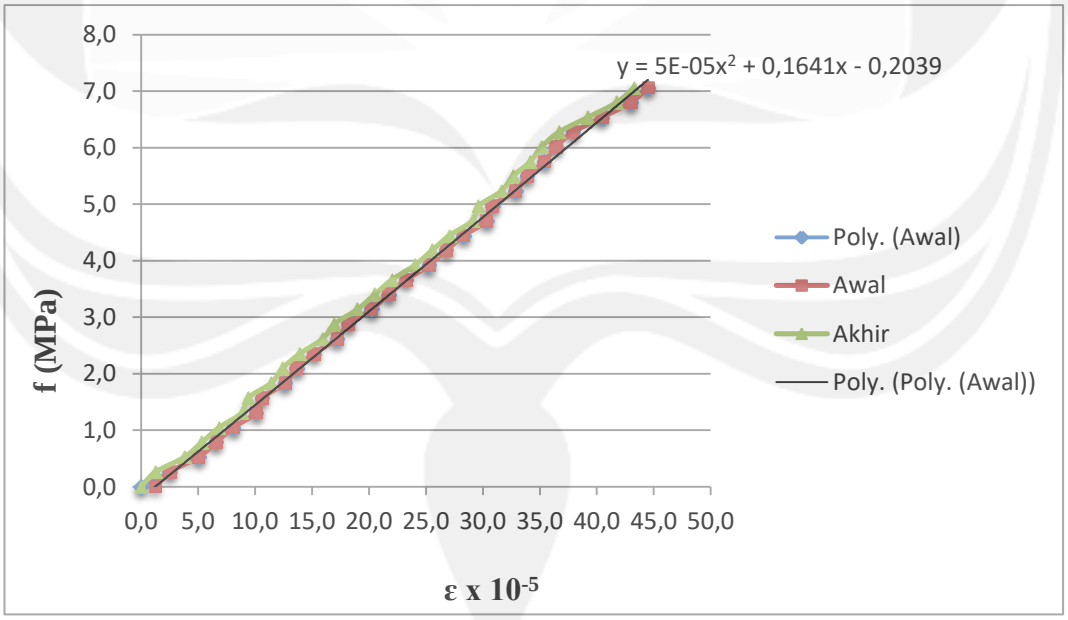
Kode Beton = TM 0,4 - 2 Ao = 18763,83 mm^2

Diameter baut = 7,60 mm Beban Max = 13500 kgf

Po = 197,80 mm E = 16320,43 MPa

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
0	0	0,0	0,000	0,000	1,243	0,000	0,000
500	4905	10,0	5,000	0,261	2,528	1,285	2,528
1000	9810	20,0	10,000	0,523	5,056	3,813	5,056
1500	14715	26,0	13,000	0,784	6,572	5,329	6,572
2000	19620	32,0	16,000	1,046	8,089	6,846	8,089
2500	24525	40,0	20,000	1,307	10,111	8,868	10,111
3000	29430	42,0	21,000	1,568	10,617	9,374	10,617
3500	34335	50,0	25,000	1,830	12,639	11,396	12,639
4000	39240	54,0	27,000	2,091	13,650	12,407	13,650
4500	44145	60,0	30,000	2,353	15,167	13,924	15,167
5000	49050	68,0	34,000	2,614	17,189	15,946	17,189
5500	53955	72,0	36,000	2,875	18,200	16,957	18,200
6000	58860	80,0	40,000	3,137	20,222	18,979	20,222
6500	63765	86,0	43,000	3,398	21,739	20,496	21,739
7000	68670	92,0	46,000	3,660	23,256	22,013	23,256
7500	73575	100,0	50,000	3,921	25,278	24,035	25,278
8000	78480	106,0	53,000	4,183	26,795	25,552	26,795
8500	83385	112,0	56,000	4,444	28,311	27,068	28,311
9000	88290	120,0	60,000	4,705	30,334	29,091	30,334
9500	93195	122,0	61,000	4,967	30,839	29,596	30,839
10000	98100	130,0	65,000	5,228	32,861	31,618	32,861

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
10500	103005	134,0	67,000	5,490	33,873	32,630	33,873
11000	107910	140,0	70,000	5,751	35,389	34,146	35,389
11500	112815	144,0	72,000	6,012	36,400	35,157	36,400
12000	117720	150,0	75,000	6,274	37,917	36,674	37,917
12500	122625	160,0	80,000	6,535	40,445	39,202	40,445
13000	127530	170,0	85,000	6,797	42,973	41,730	42,973
13500	132435	176,0	88,000	7,058	44,489	43,246	44,489



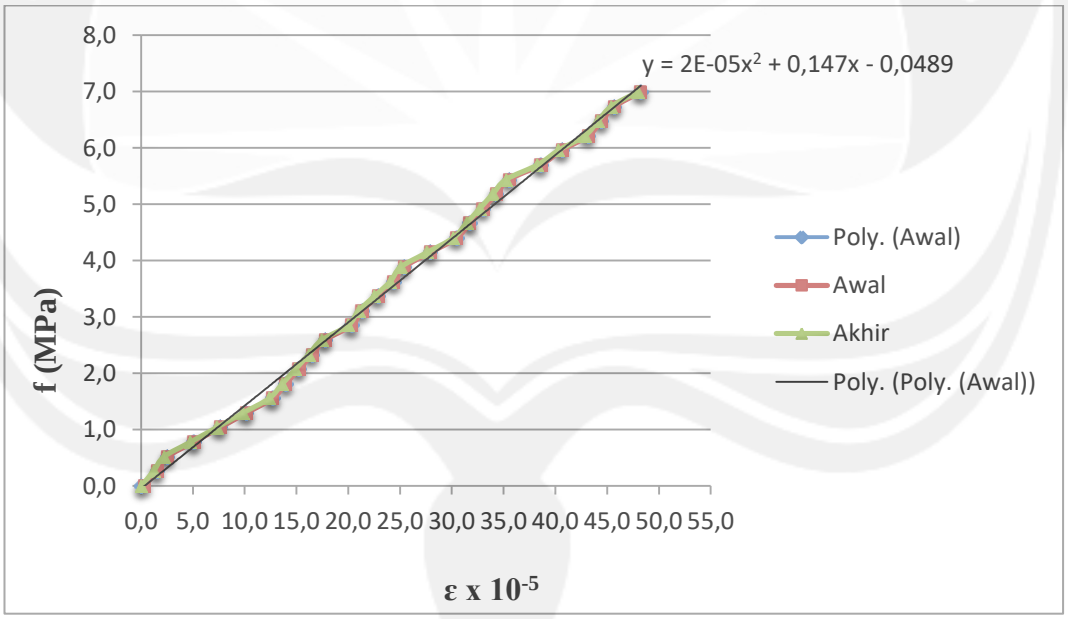
Kode Beton = TM 0,4 - 3 Ao = 18950,44 mm^2

Diameter baut = 7,60 mm Beban Max = 13500 kgf

Po = 196,90 mm E = 14585,13 MPa

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
0	0	0,0	0,000	0,000	0,333	0,000	0,000
500	4905	6,0	3,000	0,259	1,524	1,191	1,524
1000	9810	10,0	5,000	0,518	2,539	2,207	2,539
1500	14715	20,0	10,000	0,776	5,079	4,746	5,079
2000	19620	30,0	15,000	1,035	7,618	7,285	7,618
2500	24525	40,0	20,000	1,294	10,157	9,825	10,157
3000	29430	50,0	25,000	1,553	12,697	12,364	12,697
3500	34335	55,0	27,500	1,812	13,966	13,634	13,966
4000	39240	60,0	30,000	2,071	15,236	14,904	15,236
4500	44145	65,0	32,500	2,329	16,506	16,173	16,506
5000	49050	70,0	35,000	2,588	17,776	17,443	17,776
5500	53955	80,0	40,000	2,847	20,315	19,982	20,315
6000	58860	84,0	42,000	3,106	21,331	20,998	21,331
6500	63765	90,0	45,000	3,365	22,854	22,522	22,854
7000	68670	96,0	48,000	3,624	24,378	24,045	24,378
7500	73575	100,0	50,000	3,882	25,394	25,061	25,394
8000	78480	110,0	55,000	4,141	27,933	27,600	27,933
8500	83385	120,0	60,000	4,400	30,472	30,140	30,472
9000	88290	125,0	62,500	4,659	31,742	31,409	31,742
9500	93195	130,0	65,000	4,918	33,012	32,679	33,012
10000	98100	135,0	67,500	5,177	34,281	33,949	34,281

Beban		Compressometer (ΔP)		Tegangan	Regangan awal	Regangan koreksi	Regangan (x)
Kgf	N	$1x10^{-3}$	$\frac{(1x10^{-3})}{2}$	MPa	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
10500	103005	140,0	70,000	5,435	35,551	35,218	35,551
11000	107910	152,0	76,000	5,694	38,598	38,266	38,598
11500	112815	160,0	80,000	5,953	40,630	40,297	40,630
12000	117720	170,0	85,000	6,212	43,169	42,836	43,169
12500	122625	175,0	87,500	6,471	44,439	44,106	44,439
13000	127530	180,0	90,000	6,730	45,708	45,376	45,708
13500	132435	190,0	95,000	6,988	48,248	47,915	48,248



C.5 PENGUJIAN POROSITAS BETON

No	Kode	Tinggi (mm)		Diameter (mm)		Luas (mm^2)	Volume (m^3)	Berat Kering Oven (kg)	Berat Beton Dalam Air (kg)	Berat SSD (kg)	Porositas	Porositas Rerata (%)
1	NM 0,3	206,2 206,4 206,1	206,23	101,20 101,30 98,00	100,17	7880,18	0,0016	3,26	2,67	3,64	39,09	41,37
2		206,4 206,3 206,2	206,30	100,50 101,00 102,30	101,27	8054,21	0,0017	3,30	2,84	3,66	43,64	
1	NM 0,4	203,5 202,5 203,1	203,03	100,20 100,50 90,90	97,20	7420,32	0,0015	3,20	2,74	3,60	46,30	43,58
2		204,2 206,1 204,4	204,90	100,20 100,20 101,30	100,57	7943,25	0,0016	3,26	2,71	3,64	40,86	

No	Kode	Tinggi (mm)		Diameter (mm)		Luas (mm^2)	Volume (m^3)	Berat (kg)	Berat Jenis (kN/m^3)	Berat Kering Oven (kg)	Berat Beton Dalam Air (kg)	Berat SSD (kg)	Porositas	Porositas Rerata (%)
1	TM 0,3	206,10	206,50	100,50	100,50	7932,72	0,0016	3,69	22,10	3,28	2,59	3,70	37,67	36,69
		206,20		101,10										
		207,20		99,90										
2		204,00	203,80	100,60	100,43	7922,20	0,0016	3,61	21,93	3,22	2,50	3,62	35,71	
		203,90		100,40										
		203,50		100,30										
1	TM 0,4	206,80	206,37	99,80	99,57	7786,06	0,0016	3,68	22,47	3,30	2,66	3,68	37,11	40,66
		206,20		99,30										
		206,10		99,60										
2		204,80	204,90	100,90	100,77	7974,87	0,0016	3,65	21,91	3,24	2,71	3,66	44,21	
		204,80		100,50										
		205,10		100,90										

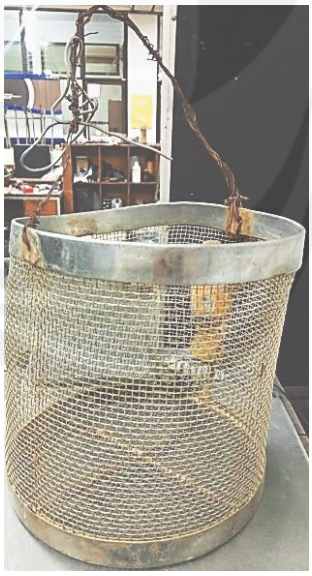
D. DOKUMENTASI PENELITIAN

D.1 DOKUMENTASI ALAT-ALAT PENELITIAN

Oven

Timbangan dengan ketelitian 0,01

Timbangan dengan ketelitian 0,1



Ember Kawat

Stone Crusher

Los Angeles Abrasion Machine

Concrete Mixer

Kaliper

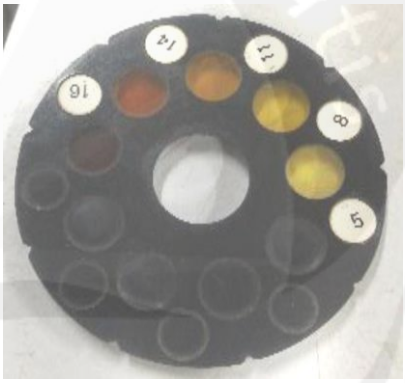
Cetakan ukuran 15 x 30

Cetakan ukuran 10 x 20

Compression Testing Machine (CTM)

Universal Testing Machine (UTM)

Compressometer



Tintometer

Kerucut *Abrams*

D.2 DOKUMENTASI BAHAN – BAHAN PENELITIAN

Agregat Daur Ulang

Semen

Agregat Halus

Slag

D.3 DOKUMENTASI PELAKSANAAN PENELITIAN

Proses penimbangan material untuk beton

Proses pengadukan oleh *mixer*

Pengujian Slump Beton Fas 0,3

Pengujian Slump Beton Fas 0,4

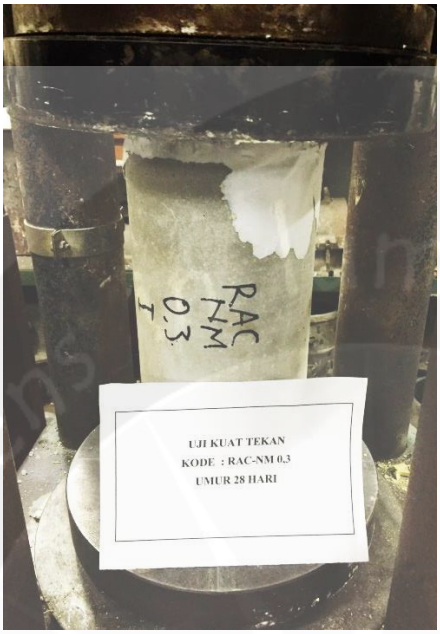
D.4 PENGUJIAN BENDA UJI

Penimbangan beton 28 hari

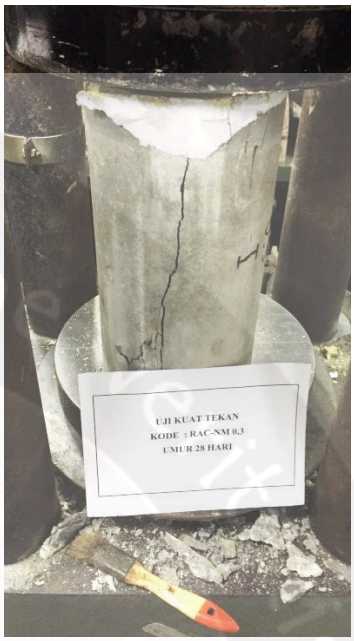

Penimbangan beton porositas 28 hari


Penimbangan beton porositas dalam air

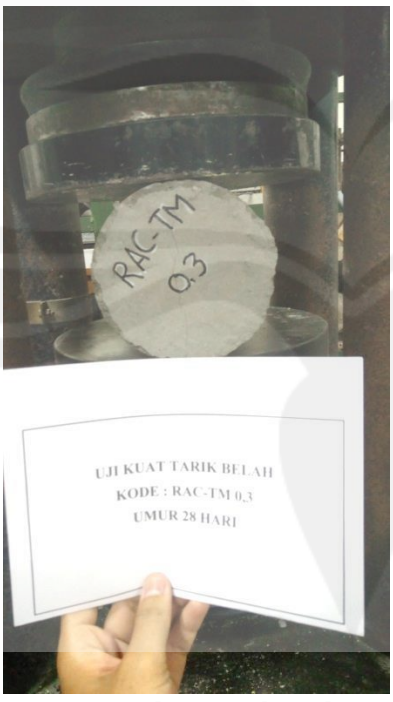
Pengujian modulus elastisitas beton



Pengujian kuat tekan 28 hari



Hasil pengujian kuat tekan 28 hari



Pengujian kuat tarik 28 hari

Hasil pengujian kuat tarik 28 hari