BAB VI

KESIMPULAN DAN SARAN

6.1. Kesimpulan

Berdasarkan hasil penelitian mengenai Pengaruh Variasi Kadar *Fly Ash* terhadap Sifat Mekanik *Self-Compacting Fibre Reinforced Concrete* (SCFRC) ini, dapat ditarik kesimpulan seperti tercantum di bawah ini.

1. Berdasarkan hasil pengujian karakteristik beton segar SCFRC dengan metode *Slump flow,* T_{500} *slump flow, V-funnel,* dan *L-shaped box,* semua variasi sampel menunjukkan bahwa SCFRC memenuhi syarat karakteristik beton segar SCC yaitu *filling ability, passing ability,* dan *viscosity.*
2. Penambahan *fly ash* mempengaruhi tingkat kekentalan adukan beton segar dilihat dari parameter pengujian beton segarnya. Hal ini disebabkan sifat *pozzolan* dari *fly ash,* yaitu dapat bereaksi dengan kapur bebas yang dilepaskan semen saat proses hidrasi dan membentuk senyawa yang bersifat mengikat pada temperatur normal dengan adanya air sehingga banyak menyerap air.
3. Peningkatan kadar *fly ash* yang ditambahkan juga mempengaruhi tingkat kegetasannya. Hal ini disebabkan karena sifat *fly ash* sebagai *filler* yang dapat membuat beton menjadi lebih padat karena ukuran butiran yang sangat kecil dapat mengisi rongga–rongga yang ada pada beton.
4. Nilai kuat tekan SCFRC dengan variasi kadar *fly ash* 0%, 5%, 10%, 15% dan 20 % secara berturut-turut adalah 48,89 MPa, 60,81 MPa, 63,40 MPa,

69,84 MPa dan 62,57 MPa. Hasil tertinggi terdapat pada penambahan *fly ash* dengan kadar 15%, yaitu meningkat 42,867% dibandingkan dengan SCFRC tanpa *fly ash*.

5. Nilai kuat tarik belah SCFRC dengan variasi kadar *fly ash* 0%, 5%, 10%, 15% dan 20 % secara berturut-turut adalah 4,503 MPa, 4,527 MPa, 4,620 MPa, 4,633 MPa dan 4,588. Hasil tertinggi terdapat pada penambahan *fly ash* dengan kadar 15%, yaitu meningkat 2,882% dibandingkan dengan SCFRC tanpa *fly ash*.
6. Nilai modulus elastisitas beton SCFRC dengan variasi kadar *fly ash* 0%, 5%, 10%, 15% dan 20 % secara berturut-turut adalah 30634,73887 MPa, 30814,25579 MPa, 32525,79333 MPa, 35255,21402 MPa, 32507,9916 MPa. Hasil tertinggi terdapat pada penambahan *fly ash* dengan kadar 15% yaitu 35255,21402 MPa.
7. Nilai kuat lentur SCFRC dengan variasi kadar *fly ash* 0%, 5%, 10%, 15% dan 20 % secara berturut-turut adalah 6,103 MPa, 6,528 MPa, 7,196 MPa, 7,240 MPa dan 6,522 MPa. Hasil tertinggi terdapat pada penambahan *fly ash* dengan kadar 15%, yaitu meningkat 18,626% dibandingkan dengan SCFRC tanpa *fly ash*.
8. Variasi kadar *fly ash* yang paling optimal pada penelitian ini adalah dengan penambahan 15% *fly ash* sebagai substitusi semen. Hal ini terbukti dengan terjadi peningkatan terbesar pada pengujian kuat tekan, kuat tarik belah, dan kuat lentur SCFRC.

6.2. Saran

Saran yang dapat penulis berikan setelah melihat hasil penelitian ini adalah seperti tercantum di bawah ini.

1. Perlu dilakukan penelitian lebih lanjut mengenai sifat beton segar SCC terhadap ketahanan segregasi agar parameter beton segar SCFRC ini menjadi lebih lengkap.
2. Dalam proses pencampuran bahan campuran beton yang digunakan sangat membutuhkan ketelitian supaya bahan yang digunakan tidak ada yang terbuang.
3. Pentingnya mengetahui cara penggunaan dan pemeliharaan alat uji beton segar SCC agar selama proses pengambilan data menjadi lebih lancar dan dapat digunakan untuk penelitian–penelitian selanjutnya.
4. Perlu dilakukan percobaan dan penelitian sejenis pada *Self-Compacting Fibre Reinforced Concrete* dengan penambahan *fly ash* sebagai substitusi semen dengan presentase di atas 20% untuk mengetahui pengaruhnya terhadap sifat mekanis *Self-Compacting Fibre Reinforced Concrete* bila menambahkan *High-Volumed Fly Ash*.
5. Perlu dilakukan penelitian dan pengkajian lebih lanjut mengenai pemanfaatan SCFRC ini dalam dunia konstruksi beton.

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Laporan No. : ..... Dikerjakan :.....
Pekerjaan : ..... Diperiksa :.....
..... Tgl. Pemeriksaan :.....

ANALISIS SARINGAN AGREGAT KASAR

BERAT KERING : 1000 gram						
Nomor Saringan	B.Saringan (gram)	Berat Saringan + Tertahan (gram)	B.Tertahan (gram)	∑B.Tertahan (gram)	Persentase	
					B.Tertahan %	Lolos %
3/4" (19,1 mm)	572	572	0	0	0	100
1/2" (12,7 mm)	455	527	72	72	7,2	92,8
3/8" (9,52mm)	460	858	398	470	47	53
No.4(4,75 mm)	532	1042	510	980	98	2
No.8(2,36 mm)	327	335	8	988	98,8	1,2
No.30(0,60mm)	293	296	3	991	99,1	0,9
No.50(0,30mm)	378	380	2	993	99,3	0,7
No.100(0,15mm)	353	355	2	995	99,5	0,5
No.200(0,75mm)	338	340	2	997	99,7	0,3
PAN	374	377	3	1000	100	0

MHB Agregat Kasar = $\frac{6486}{1000}$ = 6,486

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PEMERIKSAAN
BERAT JENIS & PENYERAPAN AGREGAT KASAR

	Nomor Pemeriksaan	I
A	Berat Contoh Kering	970 gram
B	Berat Contoh Jenuh Kering Permukaan (SSD)	998 gram
C	Berat Contoh Dalam Air	616 gram
D	Berat Jenis Bulk $= \frac{(A)}{(B)-(C)}$	2,539
E	BJ.Jenuh Kering Permukaan (SSD) $= \frac{(B)}{(B)-(C)}$	2,62
F	Berat Jenis Semu (*Apparent*) $= \frac{(A)}{(A)-(C)}$	2,74
G	Penyerapan (*Absorption*) $= \frac{(B)-(A)}{(A)} \times 100\ \%$	2,887 %

PERSYARATAN UMUM:

- *Absorption* : 5%
- Berat Jenis :

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Pekerjaan : ……. Diperiksa :
…….
……. Tgl. Pemeriksaan :
…….

PEMERIKSAAN KEAUSAN AGREGAT DENGAN MESIN *LOS ANGELES*

GRADASI SARINGAN		**NOMOR CONTOH**	
		I	II
LOLOS	TERTAHAN	BERAT MASING-MASING AGREGAT	BERAT MASING-MASING AGREGAT
3/8”	1/4”	2500	-
1/4”	No. 4	2500	-

NOMOR CONTOH	**I**
BERAT SEBELUMNYA (A)	5000 gram
BERAT SESUDAH DIAYAK SARINGAN NO.12 (B)	3929 gram
BERAT SESUDAH (A)-(B)	1071 gram
KEAUSAN = $\frac{(A)-(B)}{(A)} \times 100\%$	21.42 %

UKURAN SARINGAN		BERAT AGREGAT			
LOLOS	TERTAHAN	A	B	C	D
1 ½“	1“	1250			
1“	3/4“	1250			
3/4“	1/2“	1250	2500		
1/2“	3/8”	1250	2500		
3/8”	1/4”			2500	
1/4”	No. 4			2500	
B No. 4	No. 8				5000
TOTAL		5000	5000	5000	5000
JUMLAH BOLA BAJA		12	11	8	6

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ANALISIS SARINGAN AGREGAT HALUS

BERAT KERING : 1000 gram						
Nomor Saringan	B.Saringan (gram)	Berat Saringan + Tertahan (gram)	B.Tertahan (gram)	∑B.Tertahan (gram)	Persentase	
					B.Tertahan %	Lolos %
3/4" (19,1 mm)	572	572	0	0	0	100
1/2" (12,7 mm)	452	452	0	0	0	100
3/8" (9,52mm)	457	457	0	0	0	100
No.4(4,75 mm)	531	531	0	0	0	100
No.8(2,36 mm)	330	330	0	0	0	100
No.30(0,60mm)	292	315	23	23	2,3	97,7
No.50(0,30mm)	375	962	587	610	58,7	39
No.100(0,15mm)	351	690	339	949	33,9	5,1
No.200(0,75mm)	269	315	46	995	4,6	0,5
PAN	372	381	5	1000	0,5	0

MHB Agregat Halus = $\frac{3577}{1000}$ = 3,577

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Pekerjaan : ..... Diperiksa :.....
..... Tgl. Pemeriksaan :.....

PEMERIKSAAN
BERAT JENIS & PENYERAPAN AGREGAT HALUS

	Nomor Pemeriksaan	I
A	Berat Contoh Jenuh Kering Permukaan (SSD) – (500)	500 gram
B	Berat Contoh Kering	495 gram
C	Berat Labu + Air, Temperatur 25° C	712 gram
D	Berat Labu+Contoh (SSD) + Air, Temperatur 25° C	1029 gram
E	Berat Jenis Bulk $= \frac{(A)}{(C+500-D)}$	2.73
F	BJ Jenuh Kering Permukaan(SSD) $= \frac{(B)}{(C+500-D)}$	2.699
G	Berat Jenis Semu (*Apparent*) $= \frac{(B)}{(C+B-D)}$	2.78
H	Penyerapan (*Absorption*) $= \frac{(500-B)}{(B)} \text{ x } 100\ \%$	1.01 %

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PEMERIKSAAN KANDUNGAN LUMPUR AGREGAT HALUS

A. Waktu pemeriksaan : 20 Maret 2017

B. Bahan

a. Pasir kering tungku, asal : Kali Progo, berat : 100 gram

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

C. Alat

a. Gelas ukur, ukuran: 250 cc

b. Timbangan

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

d. Pasir + piring masuk tungku tanggal 20 Maret 2017 jam 09.00 WIB

D. Hasil

Pasir + piring keluar tungku tanggal 21 Maret 2017 jam 10.00 WIB

a. Berat pasir = 100,15 gram

b. Berat pasir kering oven = 98.38 gram

$$\text{Kandungan Lumpur} = \frac{100-98{,}38}{100} \times 100\% = 1.7991\%$$

Kesimpulan: Kandungan lumpur 1,7991% < 5%, syarat terpenuhi (OK)

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PEMERIKSAAN KANDUNGAN ZAT ORGANIK AGREGAT HALUS

A. Waktu pemeriksaan : 20 Maret 2017

B. Bahan

a. Pasir kering tungku, asal : Kali Progo, berat : 120 gram

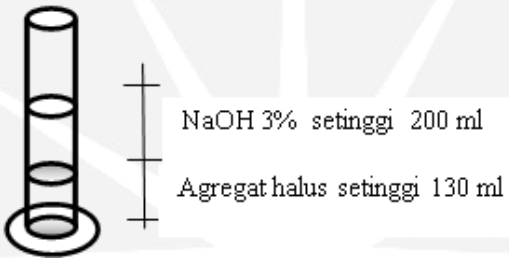
b. Air jernih, asal : LSBB TS FT-UAJY

b. Larutan NaOH 3%

C. Alat

Gelas ukur, ukuran : 250 cc

D. Sketsa



E. Hasil

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

Kesimpulan:

Warna Gardner Standard Color No. 8 yaitu kuning muda, maka syarat terpenuhi (OK).

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LABORATORIUM PENELITIAN DAN PENGUJIAN TERPADU

SURAT KETERANGAN
Nomor :15.04/VI/LPPT-UGM/2017

Yang bertanda tangan dibawah ini,

Nama : Prof. Dr. Abdul Rohman, M.Si., Apt.
NIP : 197701202005011002
Jabatan : Manajer Teknik LPPT UGM

dengan ini menerangkan bahwa,

Nama : Quentino Elgar Pramarsantya
NIM : 130214677
Prodi/Fakultas : Teknik Sipil
Institusi : Universitas Atma Jaya Yogyakarta

Judul Penelitian:

"Pengaruh Variasi Fly Ash terhadap Sifat Mekanik Self-Compacting Fibre Reinforced Concrete (SCFRC)"

Benar-benar melakukan permintaan pengujian di LPPT-UGM, yaitu :

Nama sampel : Fly Ash
Nomor permintaan : 17030100536
Parameter uji : XRF
Tanggal Permintaan : 27 Maret 2017

Demikian Surat Keterangan ini dibuat untuk dapat digunakan sebagaimana mestinya

Yogyakarta,15 Juni 2017
Manajer Teknik LPPT UGM,

Prof. Dr. Abdul Rohman, M.Si., Apt.

Analyzed result

Sample name	fly ash	Date	4/5/2017 3:37 PM
File name	fly ash_201704051537	Counts	1
Application	fly ash	Sample model	Bulk

No.	Component	Result	Unit	Statistical error	Detection limit	Quantitation limit
1	Al	13.2	mass%	0.0936	0.323	0.968
2	Si	36.2	mass%	0.0479	0.147	0.441
3	P	2.18	mass%	0.0154	0.0179	0.0537
4	S	1.33	mass%	0.0059	0.0161	0.0482
5	K	1.91	mass%	0.0372	0.0717	0.215
6	Ca	1.65	mass%			
7	Ti	1.68	mass%	0.0112	0.0249	0.0746
8	V	0.121	mass%	0.0041	0.0065	0.0195
9	Mn	0.413	mass%	0.0042	0.0110	0.0329
10	Fe	39.2	mass%	0.0139	0.0031	0.0094
11	Cu	0.0985	mass%	0.0012	0.0030	0.0090
12	Zn	0.113	mass%	0.0010	0.0019	0.0056
13	Ga	0.0141	mass%	0.0005	0.0005	0.0015
14	As	0.0205	mass%	0.0003	0.0010	0.0029
15	Rb	0.0459	mass%	0.0003	0.0007	0.0022
16	Sr	0.621	mass%	0.0009	0.0004	0.0012
17	Y	0.0351	mass%	0.0003	0.0006	0.0019
18	Zr	0.171	mass%	0.0006	0.0013	0.0039
19	Nb	0.0034	mass%	0.0003	0.0009	0.0026
20	Mo	<0.0001	mass%	0.0003	0.0010	0.0031
21	Cd	0.0105	mass%	0.0003	0.0007	0.0022
22	Sn	0.0046	mass%	0.0004	0.0012	0.0035
23	Ba	0.638	mass%	0.0027	0.0071	0.0214
24	Pr	<0.0001	mass%	0.0036	0.0109	0.0327
25	Hf	0.0718	mass%	0.0021	0.0031	0.0094
26	Ta	0.0390	mass%	0.0020	0.0037	0.0111
27	W	0.0834	mass%	0.0016	0.0059	0.0177
28	Ir	0.0227	mass%	0.0012	0.0024	0.0072
29	Pt	0.0318	mass%	0.0009	0.0028	0.0084
30	Pb	0.0299	mass%	0.0007	0.0025	0.0074
31	Th	0.0259	mass%	0.0006	0.0010	0.0031
32	U	0.0107	mass%	0.0006	0.0014	0.0042

Analyzed result

Sample name	fly ash	Date	4/5/2017 3:37 PM
File name	fly ash_201704051537	Counts	1
Application	fly ash	Sample model	Bulk

No.	Component	Result	Unit	Statistical error	Detection limit	Quantitation limit
1	Al2O3	13.4	mass%	0.148	0.297	0.890
2	SiO2	36.2	mass%	0.0677	0.247	0.740
3	P2O5	1.99	mass%	0.0233	0.0496	0.149
4	SO3	1.28	mass%	0.0096	0.0147	0.0440
5	K2O	1.69	mass%	0.0309	0.0684	0.205
6	CaO	13.4	mass%	0.0628	0.0333	0.1000
7	TiO2	1.62	mass%	0.0185	0.0351	0.105
8	V2O5	0.0934	mass%	0.0071	0.0176	0.0527
9	MnO	0.282	mass%	0.0044	0.0040	0.0120
10	Fe2O3	29.1	mass%			
11	CuO	0.0465	mass%	0.0009	0.0019	0.0057
12	ZnO	0.0522	mass%	0.0008	0.0010	0.0031
13	Ga2O3	0.0073	mass%	0.0004	0.0008	0.0025
14	As2O3	0.0099	mass%	0.0003	0.0006	0.0019
15	Rb2O	0.0182	mass%	0.0002	0.0005	0.0014
16	SrO	0.264	mass%	0.0007	0.0002	0.0007
17	Y2O3	0.0160	mass%	0.0002	0.0005	0.0014
18	ZrO2	0.0832	mass%	0.0005	0.0002	0.0007
19	Nb2O5	0.0017	mass%	0.0003	0.0008	0.0023
20	MoO3	<0.0001	mass%	0.0003	0.0009	0.0028
21	CdO	0.0044	mass%	0.0002	0.0006	0.0018
22	SnO2	0.0021	mass%	0.0003	0.0009	0.0028
23	BaO	0.263	mass%	0.0019	0.0018	0.0053
24	Pr6O11	<0.0001	mass%	0.0028	0.0083	0.0248
25	HfO2	0.0310	mass%	0.0016	0.0027	0.0081
26	Ta2O5	0.0171	mass%	0.0015	0.0036	0.0109
27	WO3	0.0386	mass%	0.0013	0.0030	0.0090
28	Ir2O3	0.0093	mass%	0.0009	0.0021	0.0064
29	PtO2	0.0137	mass%	0.0006	0.0008	0.0025
30	PbO	0.0119	mass%	0.0005	0.0008	0.0025
31	ThO2	0.0106	mass%	0.0004	0.0010	0.0029
32	U3O8	0.0044	mass%	0.0004	0.0011	0.0034

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PERHITUNGAN *MIX DESIGN*

(SNI 03 – 2834 – 2000)

A. Data Bahan

1. Agregat Halus (pasir) : Kali Progo, Yogyakarta
2. Agregat Kasar (krikil) : Clereng, Yogyakarta
3. Jenis Semen : Semen PPC merk Gresik

B. Data *Specific Gravity*

1. *Specific gravity* agregat halus : 2,699 ≈ 2,70
2. *Specific gravity* agregat kasar : 2,62

C. Hitungan

1. Kuat beton rencana (f'_c) pada umur 28 hari. F'_c = 40 MPa.
2. Menentukan nilai devisiasi standar berdasarkan tingkat mutu pengendalian pelaksanaan campuran.
3. Nilai margin ditentukan sebesar 12 MPa karena jumlah benda uji kurang dari 15 buah.
4. Menetapkan kuat tekan beton rata – rata yang direncanakan berdasarkan SNI butir 4.2.3.1.3.

   $f'_c = f'_c + M = 40 + 12 = 52$ MPa.
5. Menentukan jenis semen

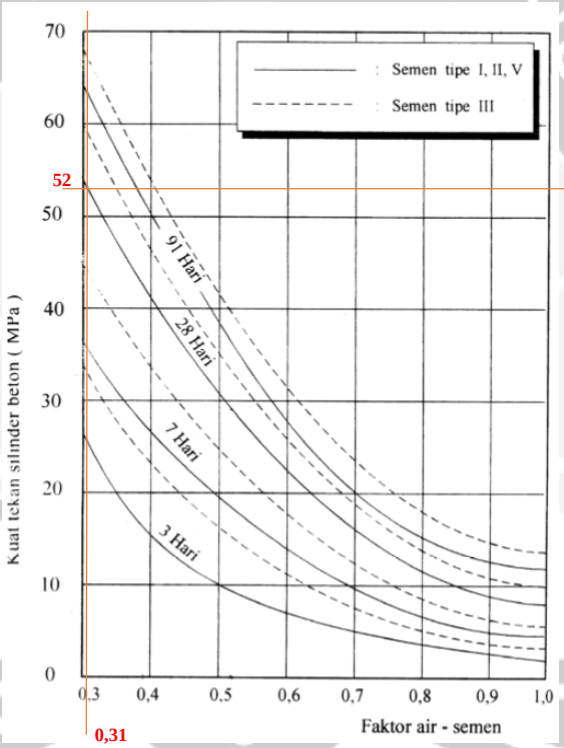
   Jenis semen PPC dengan merk Gresik.
6. Menetapkan jenis agregat

   a) Agregat halus : Pasir alam (golongan 2)

b) Agregat kasar : Batu Pecah (*split*)

7. Menetapkan faktor air – semen, berdasarkan jenis semen yang dipakai dan kuat tekan rata – rata silinder beton yang direncanakan pada umur tertentu.

   Direncanakan sebesar 0,31.



8. Menetapkan faktor air – semen maksimum

Persyaratan Jumlah Semen Minimum dan Faktor Air Semen Maksimum Untuk Berbagai Macam Pembetonan dalam Lingkungan Khusus

Lokasi	Jumlah Semen minimum per m^3 beton (kg)	Nilai Faktor Air Semen Maksimum
Beton di dalam ruang bangunan: a. keadaan keliling non-korosif b. keadaan keliling korosif disebabkan oleh kondensasi atau uap korosif	275 325	0,6 0,52
Beton di luar ruangan bangunan; **a. tidak terlindung dari hujan dan terik matahari langsung** b. terlindung dari hujan dan terik matahari langsung	**325** 275	**0,6** 0,6
Beton masuk ke dalam tanah: a. mengalami keadaan basah dan kering berganti – ganti b. mendapatkan pengaruh sulfat dan alkali dari tanah	325	0,55 Lihat Tabel 5
Beton yang kontinu berhubungan: a. air tawar b. air laut		Lihat Tabel 6

(*Sumber: SNI 03 – 2834 – 2000 : Tabel 4)*

Berdasarkan Tabel 4 SNI 03 – 2834 – 2000, untuk beton dalam ruang bangunan sekeliling non-korosif fas maksimum 0,6. Dibandingkan dengan No.7, dipakai terpakai terkecil. Jadi digunakan fas 0,31.

9. Menetapkan nilai *slump*, direncanakan sebesar 60 – 180 mm
10. Ukuran butir maksimum krikil adalah 10 mm.
11. Menetapkan jumlah air yang diperlukan tiap m^3 beton.
    a) Ukuran butir maksimum 10 mm,
    b) Nilai *slump* 60 – 180 mm,
    c) Agregat halus berupa batu tak dipecah, maka $W_h = 225$

d) Agregat kasar berupa batu pecah, maka W_k = 250

$$W = \frac{2}{3} W_h + \frac{1}{3} W_k$$

dengan: W_h adalah perkiraan jumlah air untuk agregat halus

W_k adalah perkiraan jumlah air untuk agregat kasar

$$W = \frac{2}{3} \times 225 + \frac{1}{3} \times 2500 = 233.25\ liter$$

12. Menghitung berat semen yang diperlukan:

a) Berdasarkan tabel 4 SNI 03 – 2384 – 2000, diperoleh semen minimum 325 kg.

b) Berdasar *fas* = 0,31. Semen per m^3 beton $= \frac{A}{fas} = \frac{233,25}{0,31}$

= 752, 419 kg

Dipilih berat semen terbesar. Digunakan semen 752, 419 kg.

13. Penyesuaian jumlah air atau fas.

$fas_{rencana}$ = 0,31

$fas_{maks} > fas_{rencana}$

0,6 > 0,31……ok!

14. Perbandingan agregat halus dan kasar

a) Ukuran maksimum 10 mm.

b) Nilai *slump* 60 – 180 mm

c) fas 0,31

d) Jenis gradasi pasir no. 2

Diambil proporsi pasir = 47,5%

15. Berat jenis agregat campuran:

$$= \frac{P}{100} \times Bj\ agregat\ halus + \frac{K}{100} \times Bj\ agregat\ kasar$$

di mana:

P = % agregat halus terhadap agregat campuran

K = % agregat kasar terhadap agregat campuran

16. Berat jenis beton diperoleh hasil 2340 kg/m^3

17. Berat agregat campuran

= berat tiap m^3 – keperluan air dan semen

= 1354,331 kg/m^3

18. Menghitung berat agregat halus

berat agregat halus = % berat agregat halus x keperluan agregat campuran

= 643,307 kg/m^3

19. Menghitung berat agregat kasar

berat agregat kasar = % berat agregat kasar x keperluan agregat campuran

= 711,024 kg/m^3

Proporsi per m^3 :

Kode	Semen (kg)	Pasir (kg)	Split (kg)	Fly Ash (kg)	Serat (kg)	Air (liter)	SP (liter)
BSFA–0	752,42	643,31	711,02	0	0,6	233,25	8,28
BSFA–5	714,8	643,31	711,02	37,62	0,6	233,25	8,28
BSFA–10	677,18	643,31	711,02	75,24	0,6	233,25	8,28
BSFA–15	639,56	643,31	711,02	112,86	0,6	233,25	8,28
BSFA–20	601,94	643,31	711,02	150,48	0,6	233,25	8,28

Volume per silinder :

Dimensi silinder:

d = 0,15 m

t = 0,30 m

$Volume_{silinder}$ = ¼ x π x d^2 x t

= ¼ x π x $(0,15)^2$ x (0,30)

= 0,0053 m^3

Volume per balok :

Dimensi silinder:

penampang = 0,1 m x 0,1 m

= 0,01 m^2

panjang (ℓ) = 0,50 m

$Volume_{balok}$ = $L_{penampang}$ x ℓ

= 0,01 x 0,5

= 0,005 m^3

Total kebutuhan volume:

Cetakan	**Volume per cetakan (m^3)**	**Jumlah Cetakan yang Dibutuhkan per Variasi**	**Kebutuhan Volume Total (m^3)**
Silinder	0,0053	12	0,0636
Balok	0,005	4	0,02
Kebutuhan Volume Total per Variasi			0,0836

Proporsi Campuran setiap Variasi (**SF = 1,25**)

Kode	**Semen (kg)**	**Pasir (kg)**	**Split (kg)**	**Fly Ash (kg)**	**Serat (kg)**	**Air (liter)**	**SP (liter)**
BSFA–0	78,63	67,23	74,3	0	0,063	24,38	0,87
BSFA– 5	74,7	67,23	74,3	3,93	0,063	24,38	0,87
BSFA–10	70,77	67,23	74,3	7,86	0,063	24,38	0,87
BSFA–15	66,83	67,23	74,3	11,79	0,063	24,38	0,87
BSFA–20	62,9	67,23	74,3	15,73	0,063	24,38	0,87

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PENGUJIAN BETON SEGAR *SELF-COMPACTING CONCRETE*

HASIL PENGUJIAN

Kode	*Filling Ability*	
	***Slumpflow* (mm)**	***V – Funnel* (detik)**
BSFA – 0	770	6.5
BSFA – 5	735	7
BSFA – 10	695	9.5
BSFA – 15	677	10.8
BSFA – 20	655	12

Kode	*Passing Ability*
	***L – Shaped Box* (h_2 / h_1)**
BSFA – 0	1
BSFA – 5	1
BSFA – 10	0,96
BSFA – 15	0,86
BSFA – 20	0,81

Kode	*Viscosity*	
	***T500 Slumpflow* (detik)**	***V – Funnel* (detik)**
BSFA – 0	2.6	6.5
BSFA – 5	3	7
BSFA – 10	3.6	9.5
BSFA – 15	4.5	10.8
BSFA – 20	4.8	12

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PENGUJIAN KUAT TEKAN SILINDER BETON

Contoh perhitungan:

BSFA-0 Nomor 1

P_{maks} = 935 KN = 935000 N

Luas (A) $= \frac{1}{4} \times \pi \times d^2$ $= \frac{1}{4} \times \pi \times 149{,}4^2$

= 17530,36975 mm^2

f'c $= \frac{P}{A} = \frac{935000}{17350{,}36975}$ = 53,31 MPa

Kode Sampel	No	Berat	Dimensi				Berat Volume	Beban Maks	f'c	Rata - Rata
		Kg	D mm	Rata-Rata	T mm	Rata-Rata	Kg/m³	KN	MPa	MPa
BSFA-0	1	13.461	149.4	150.52	299.1	299.58	2566.23	935	53.31	**48.89**
	2	13.486	150.3		300.5		2528.46	500	28.17*	
	3	13.502	151		301.3		2501.38	720	40.19	
	10	13.192	150.3		298.6		2489.08	1045	58.88	
	11	13.06	150.7		299.2		2446.19	850	47.64	
	12	13.634	151.4		298.8		2533.53	800	44.42	

Keterangan: Nilai dengan tanda (*) tidak diperhitungkan dalam perhitungan rata-rata

Kode Sampel	No	Berat	Dimensi				Berat Volume	Beban Maks	f'c	Rata - Rata
		Kg	D mm	Rata-Rata	T mm	Rata-Rata	Kg/m³	KN	MPa	MPa
BSFA-5	1	13.396	150.8	150.83	301.7	300.7	2485.04	1220	68.28	**60.81**
	2	13.331	151.6		298.4		2474.01	900	49.84	
	3	13.519	150.9		301.1		2509.52	1210	67.63	
	4	13.18	150.8		304.2		2424.87	1150	64.36	
	5	13.276	150.6		298.4		2496.63	875	49.10	
	6	13.5	150.3		300.4		2531.93	1165	65.64	

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Kode Sampel	No	Berat	Dimensi				Berat Volume	Beban Maks	f'c	Rata - Rata
		Kg	D mm	Rata-Rata	T mm	Rata-Rata	Kg/m³	KN	MPa	MPa
BSFA-10	1	13.552	150.25	13.52	302.3	297.99	2527.39	1100	62.02	63.40
	2	13.562	149.95		299.1		2566.55	1170	66.23	
	3	13.69	147.6		303.3		2636.90	1200	70.10	
	10	13.305	150.1		298.85		2514.99	1170	66.09	
	11	13.086	149.9		294.3		2518.54	1255	71.08	
	12	13.94	151.6		290.1		2661.04	810	44.86	

Kode Sampel	No	Berat	Dimensi				Berat Volume	Beban Maks	f'c	Rata - Rata
		Kg	D mm	Rata-Rata	T mm	Rata-Rata	Kg/m³	KN	MPa	MPa
BSFA-15	1	13.512	150.3	150.91	302.7	301.52	2514.92	1340	75.50	69.84
	3	13.711	151.3		305.6		2494.44	1250	69.50	
	7	13.959	151.6		302.2		2557.98	1350	74.76	
	10	13.501	151.3		292.6		2565.37	1310	72.83	
	11	13.643	150.7		303.5		2519.19	1125	63.05	
	12	13.547	150.25		302.5		2524.78	1125	63.42	

Kode Sampel	No	Berat	Dimensi				Berat Volume	Beban Maks	f'c	Rata - Rata
		Kg	D mm	Rata-Rata	T mm	Rata-Rata	Kg/m³	KN	MPa	MPa
BSFA-20	1	13.667	150.1	151.93	298.3	298.25	2588.18	1170	66.09	62.57
	2	14.283	152.6		303		2576.34	1050	57.39	
	3	13.754	151.15		300.2		2552.33	1205	67.13	
	10	13.566	152.6		293		2530.52	1260	68.86	
	11	13.847	153		297.4		2531.44	1090	59.26	
	12	13.242	152.1		297.6		2447.92	1030	56.66	

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PENGUJIAN KUAT TARIK BELAH BETON

Contoh perhitungan :

BSFA–0 Nomor 4

P_{maks} = 260 KN = 260000 N

Luas selimut = $\pi \times d \times t$ = $\pi \times 148{,}6 \times 299{,}2$

= 139678,728 mm^2

f't = $\frac{2P}{\pi \times d \times t}$ = $\frac{2 \times 260000}{139678{,}728}$

= 3,721 MPa

Kode	No.	Tinggi (mm)	Diameter (mm)	Berat (kg)	Berat Jenis (kg/m^3)	Beban (KN)	Kuat Tarik Belah (MPa)	Rata - Rata (MPa)
BSFA - 0	4	299.2	148.6	12.69	2444.5435	260	3.721	4.503
	5	298.3	152.1	13.465	2483.3048	250	3.506	
	6	297.6	149.9	13.196	2511.5479	305	4.351	
	7	302.2	148.9	13.147	2497.3428	430	6.081	
	8	301.1	149.4	12.966	2455.4405	425	6.012	
	9	299.7	152.22	13.077	2396.6979	240	3.348	

Kode	No.	Tinggi (mm)	Diameter (mm)	Berat (kg)	Berat Jenis (kg/m^3)	Beban (KN)	Kuat Tarik Belah (MPa)	Rata - Rata (MPa)
BSFA - 5	7	300.9	151.5	13.19	2430.7075	385	5.374	4.527
	8	296.35	150.3	13.17	2503.7919	370	5.286	
	9	303.6	150.5	13.774	2549.2983	250	3.482	
	10	299.2	149.7	13.25	2515.0466	310	4.404	
	11	300.2	150.7	13.206	2465.2982	280	3.939	
	12	297.6	150.8	13.399	2519.8351	330	4.679	

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Kode	No.	Tinggi (mm)	Diameter (mm)	Berat (kg)	Berat Jenis (kg/m^3)	Beban (KN)	Kuat Tarik Belah (MPa)	Rata - Rata (MPa)
BSFA - 10	4	299.8	150.6	13.445	2516.6023	280	3.946	4.620
	5	299.55	153.1	13.456	2439.1113	335	4.648	
	6	298	149	13.311	2560.6913	260	3.726	
	7	302.15	150.1	13.456	2515.7492	285	3.999	
	8	297.45	149.55	13.337	2551.5653	420	6.008	
	9	302.3	150.35	13.415	2498.5096	385	5.390	

Kode	No.	Tinggi (mm)	Diameter (mm)	Berat (kg)	Berat Jenis (kg/m^3)	Beban (KN)	Kuat Tarik Belah (MPa)	Rata - Rata (MPa)
BSFA - 15	2	302.5	151.1	13.667	2518.5712	365	5.082	4.633
	4	301.6	151.3	13.345	2460.0545	225	3.138	
	5	297	150.8	13.348	2515.3152	265	3.765	
	6	310.7	150.75	13.265	2391.0393	350	4.755	
	8	299	151.3	13.765	2559.5435	415	5.838	
	9	304.2	152.265	13.597	2453.6865	380	5.221	

Kode	No.	Tinggi (mm)	Diameter (mm)	Berat (kg)	Berat Jenis (kg/m^3)	Beban (KN)	Kuat Tarik Belah (MPa)	Rata - Rata (MPa)
BSFA - 20	4	297.4	149.6	13.537	2607.4632	335	4.792	4.588
	5	300.5	152	13.636	2555.2613	270	3.762	
	6	298	150.4	13.939	2550.2474	345	4.898	
	7	300.6	149	13.507	2578.2107	340	4.831	
	8	295.5	149.2	13.519	2615.6811	300	4.330	
	9	300.1	151	13.748	2557.1428	350	4.915	

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PENGUJIAN KUAT LENTUR MURNI BETON

Keterangan	BSFA-0				BSFA-5				BSFA-10			
	1	2	3	4	1	2	3	4	1	2	3	4
Umur Benda Uji (hari)	28	28	28	28	28	28	28	28	28	28	28	28
Berat Benda Uji (kg)	12.76	12.62	12.6	13.16	12.38	11.5	12.06	11.78	11.42	11.84	11.98	11.82
Beban Maksimum (kgf)	1515	1550	1045	1420	1690	1300	1480	1200	1880	1505	1550	1585
Beban Maksimum (N)	14862.2	15205.5	10251.5	13930.2	16578.9	12753	14518.8	11772	18442.8	14764.1	15205.5	15548.9
Panjang Tampak Melintang = *p*(mm)	450	450	450	450	450	450	450	450	450	450	450	450
Lebar Tampak Melintang = *b*(mm)	100	100	100	100	100	100	100	100	100	100	100	100
Tinggi Tampak Melintang = *h*(mm)	100	100	100	100	100	100	100	100	100	100	100	100
Kuat Lentur Uji (Mpa)	6.688	6.842	4.613	6.269	7.461	5.739	6.533	5.297	8.299	6.644	6.842	6.997
Rata - Rata (Mpa)	6.103				6.258				7.196			

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Keterangan	BSFA-15				BSFA-20			
	1	2	3	4	1	2	3	4
Umur Benda Uji (hari)	28	28	28	28	28	28	28	28
Berat Benda Uji (kg)	11.84	12.3	12.66	12.3	12.54	12.88	12.14	12.32
Beban Maksimum (kgf)	1430	1420	1670	2040	1460	1710	1370	1370
Beban Maksimum (N)	14028.3	13930.2	16382.7	20012.4	14322.6	16775.1	13439.7	13439.7
Panjang Tampak Melintang = p (mm)	450	450	450	450	450	450	450	450
Lebar Tampak Melintang = b (mm)	100	100	100	100	100	100	100	100
Tinggi Tampak Melintang = h (mm)	100	100	100	100	100	100	100	100
Kuat Lentur Uji (Mpa)	6.313	6.269	7.372	9.006	6.445	7.549	6.048	6.048
Rata - Rata (Mpa)	7.240				6.522			

Contoh perhitungan :

BSFA-15 Nomor 1

- Lebar beton (b) = 100 mm
- Panjang beton (L) = 450 mm
- Tinggi beton (d) = 200 mm

- Beban maksimum (P) = 1430 kgf x 9.81
  = 14028.3 N
- Kuat Lentur (R) $= \frac{P \times L}{b \times d^2} = \frac{14028.3 \times 4500}{100 \times 100^2}$
  = 6.313 MPa

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PENGUJIAN MODULUS ELASTISITAS BETON

Contoh perhitungan:

BSFA-0 (1)

- Diameter silinder beton (d) = 150,3 mm
- Beban (kgf) = 21000 kgf
- Perpendekan (0,5 ΔP) = 68,5 mm
- Panjang awal (Po) = 202,76 mm
- Luas alas silinder beton (A) $= \frac{1}{4} \times \pi \times d^2 = \frac{1}{4} \times \pi \times 150{,}3^2$
  $= 17749{,}356\ mm^2$
- Tegangan (f) $= \frac{beban \times 9{,}81}{A} = \frac{21000 \times 9{,}81}{17749{,}356}$
  $= 11{,}6027\ MPa$
- Regangan (ε) $= \frac{0{,}5\ \Delta P}{Po} = \frac{68{,}5 \times 0{,}001}{202{,}76 \times 10}$
  $= 33{,}784 \times 10^{-5}$
- Koreksi (*x*) $= \frac{0{,}254}{0{,}3249}$
  $= 0{,}7823276$
- Regangan koreksi (ε) = Regangan (ε) - koreksi
  $= 33{,}001 \times 10^{-5}$
- Modulus elastisitas (Ec) $= \frac{f}{\varepsilon} = \frac{13{,}6056}{33{,}001 \times 10^{-4}}$
  $= 35158{,}2227\ MPa$

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Silinder BSFA-0 (1)
Ec = 35158,2227 MPa

Beban	ΔP (mm)	0.5 ΔP (mm)	Tegangan (f) (MPa)	Regangan (ε) (10^{-4})	Regangan Koreksi (ε) (10^{-4})
0	2	1	0.0000	0.782327586	0.000
500	8	4	0.2763	1.973	1.190
1000	10	5	0.5525	2.466	1.684
1500	13	6.5	0.8288	3.206	2.423
2000	17	8.5	1.1050	4.192	3.410
2500	19	9.5	1.3813	4.685	3.903
3000	22	11	1.6575	5.425	4.643
3500	25	12.5	1.9338	6.165	5.383
4000	28	14	2.2100	6.905	6.122
4500	30	15	2.4863	7.398	6.616
5000	33	16.5	2.7626	8.138	7.355
5500	38	19	3.0388	9.371	8.588
6000	43	21.5	3.3151	10.604	9.821
6500	47	23.5	3.5913	11.590	10.808
7000	50	25	3.8676	12.330	11.548
7500	53	26.5	4.1438	13.070	12.287
8000	55	27.5	4.4201	13.563	12.781
8500	60	30	4.6963	14.796	14.013
9000	63	31.5	4.9726	15.536	14.753
9500	67	33.5	5.2489	16.522	15.740
10000	69	34.5	5.5251	17.015	16.233
10500	72	36	5.8014	17.755	16.973
11000	75	37.5	6.0776	18.495	17.712
11500	78	39	6.3539	19.235	18.452
12000	80	40	6.6301	19.728	18.945
12500	82	41	6.9064	20.221	19.439
13000	85	42.5	7.1826	20.961	20.178
13500	88	44	7.4589	21.701	20.918
14000	92	46	7.7352	22.687	21.905
14500	102	51	8.0114	25.153	24.371
15000	104	52	8.2877	25.646	24.864
15500	106	53	8.5639	26.139	25.357
16000	109	54.5	8.8402	26.879	26.097
16500	112	56	9.1164	27.619	26.837
17000	115	57.5	9.3927	28.359	27.576
17500	118	59	9.6689	29.098	28.316
18000	123	61.5	9.9452	30.331	29.549
18500	126	63	10.2214	31.071	30.289
19000	128	64	10.4977	31.564	30.782
19500	129	64.5	10.7740	31.811	31.029
20000	132	66	11.0502	32.551	31.768
20500	134	67	11.3265	33.044	32.262
21000	137	68.5	11.6027	33.784	33.001

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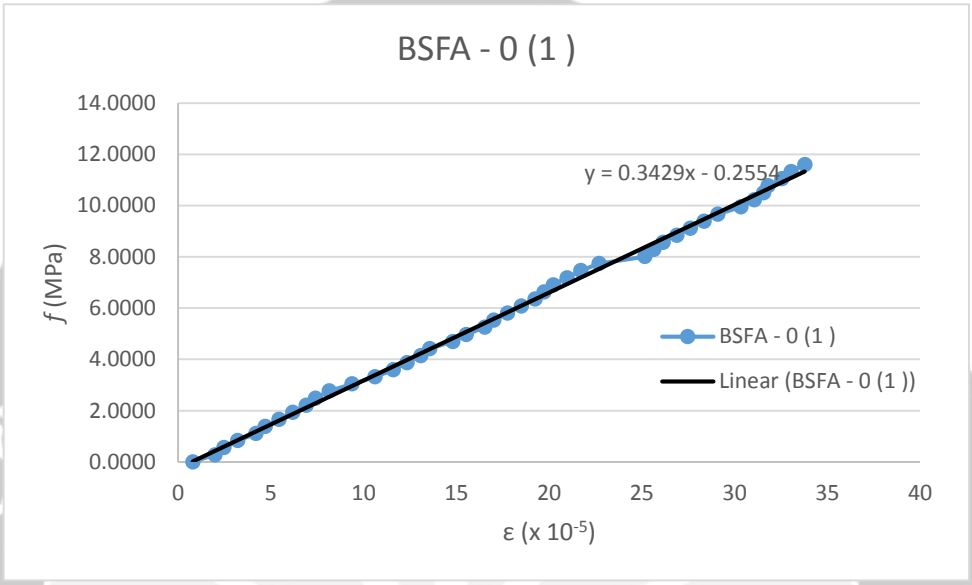

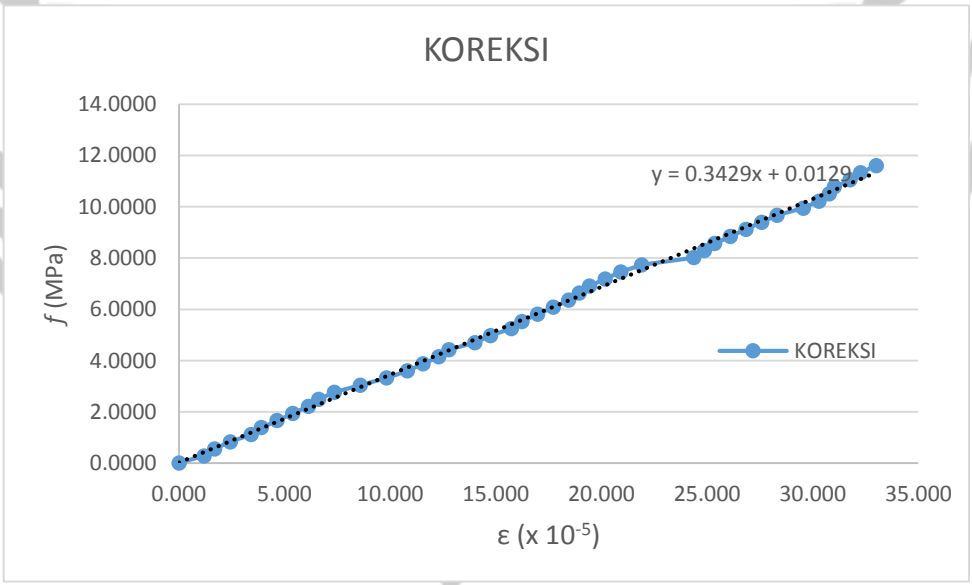

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Silinder BSFA-0 (10)
Ec = 26925,4142 MPa

Beban	ΔP (mm)	0.5 ΔP (mm)	Tegangan (f) (MPa)	Regangan (ε) (10^{-4})	Regangan Koreksi (ε) (10^{-4})
0	0	0	0.0000	-0.68540978	0.000
500	5	2.5	0.2726	1.231	1.916
1000	8	4	0.5452	1.969	2.654
1500	13	6.5	0.8178	3.199	3.885
2000	18	9	1.0905	4.430	5.115
2500	20	10	1.3631	4.922	5.608
3000	22	11	1.6357	5.414	6.100
3500	26	13	1.9083	6.399	7.084
4000	30	15	2.1809	7.383	8.069
4500	34	17	2.4535	8.368	9.053
5000	38	19	2.7262	9.352	10.038
5500	42	21	2.9988	10.337	11.022
6000	46	23	3.2714	11.321	12.007
6500	48	24	3.5440	11.813	12.499
7000	52	26	3.8166	12.798	13.483
7500	56	28	4.0892	13.782	14.468
8000	60	30	4.3619	14.767	15.452
8500	64	32	4.6345	15.751	16.437
9000	68	34	4.9071	16.736	17.421
9500	72	36	5.1797	17.720	18.405
10000	76	38	5.4523	18.704	19.390
10500	81	40.5	5.7249	19.935	20.620
11000	84	42	5.9975	20.673	21.359
11500	88	44	6.2702	21.658	22.343
12000	93	46.5	6.5428	22.888	23.574
12500	98	49	6.8154	24.119	24.804
13000	102	51	7.0880	25.103	25.789
13500	107	53.5	7.3606	26.334	27.019
14000	110	55	7.6332	27.072	27.758
14500	115	57.5	7.9059	28.303	28.988
15000	119	59.5	8.1785	29.287	29.973
15500	124	62	8.4511	30.518	31.203
16000	128	64	8.7237	31.502	32.188
16500	132	66	8.9963	32.487	33.172
17000	137	68.5	9.2689	33.717	34.403
17500	141	70.5	9.5415	34.702	35.387
18000	145	72.5	9.8142	35.686	36.372
18500	150	75	10.0868	36.917	37.602
19000	153	76.5	10.3594	37.655	38.340
19500	157	78.5	10.6320	38.639	39.325
20000	162	81	10.9046	39.870	40.555
20500	165	82.5	11.1772	40.608	41.294
21000	170	85	11.4499	41.839	42.524

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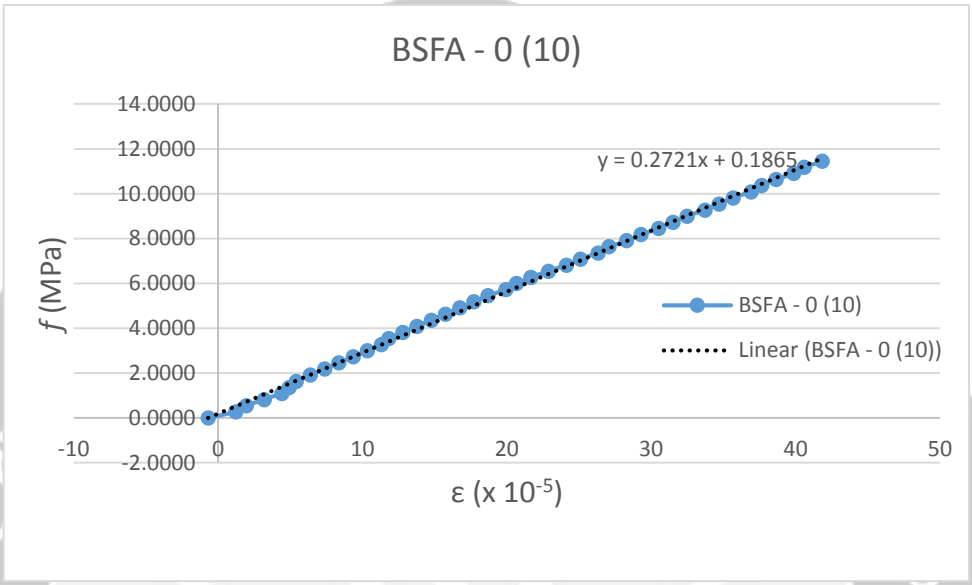

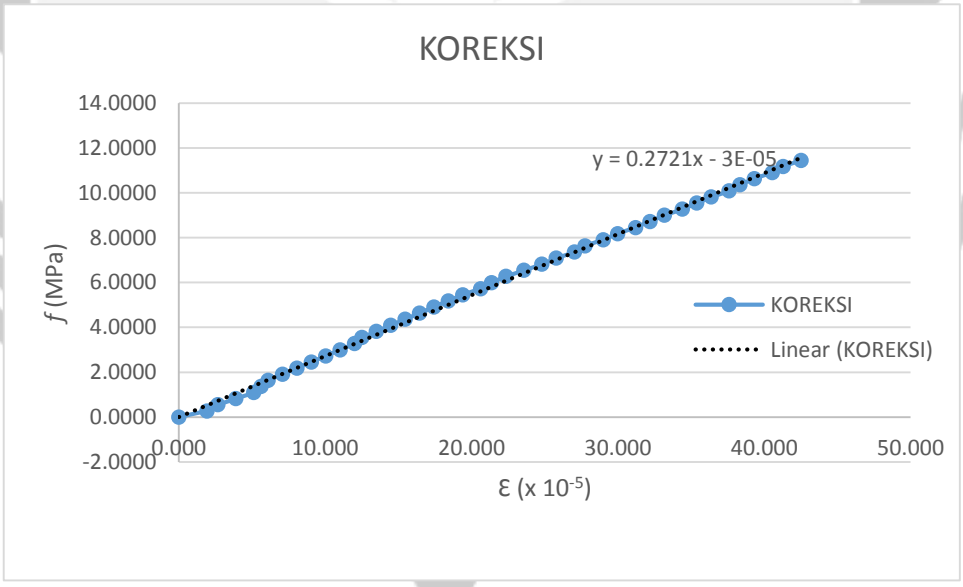

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Silinder BSFA-0 (11)
Ec = 29820,5797 MPa

Beban	ΔP (mm)	0.5 ΔP (mm)	Tegangan (f) (MPa)	Regangan (ε) (10^{-4})	Regangan Koreksi (ε) (10^{-4})
0	2	1	0.0000	-0.04365212	0.000
500	5	2.5	0.2748	1.231	1.275
1000	8	4	0.5496	1.970	2.014
1500	12	6	0.8244	2.955	2.998
2000	15	7.5	1.0992	3.693	3.737
2500	17	8.5	1.3740	4.186	4.230
3000	22	11	1.6487	5.417	5.461
3500	27	13.5	1.9235	6.648	6.692
4000	30	15	2.1983	7.387	7.431
4500	33	16.5	2.4731	8.126	8.169
5000	39	19.5	2.7479	9.603	9.647
5500	42	21	3.0227	10.342	10.385
6000	47	23.5	3.2975	11.573	11.617
6500	50	25	3.5723	12.312	12.355
7000	52	26	3.8471	12.804	12.848
7500	55	27.5	4.1219	13.543	13.586
8000	58	29	4.3967	14.281	14.325
8500	61	30.5	4.6714	15.020	15.064
9000	65	32.5	4.9462	16.005	16.049
9500	70	35	5.2210	17.236	17.280
10000	73	36.5	5.4958	17.975	18.019
10500	76	38	5.7706	18.714	18.757
11000	80	40	6.0454	19.699	19.742
11500	84	42	6.3202	20.684	20.727
12000	87	43.5	6.5950	21.422	21.466
12500	92	46	6.8698	22.653	22.697
13000	95	47.5	7.1446	23.392	23.436
13500	100	50	7.4194	24.623	24.667
14000	104	52	7.6941	25.608	25.652
14500	108	54	7.9689	26.593	26.637
15000	112	56	8.2437	27.578	27.622
15500	114	57	8.5185	28.071	28.114
16000	118	59	8.7933	29.055	29.099
16500	122	61	9.0681	30.040	30.084
17000	127	63.5	9.3429	31.272	31.315
17500	130	65	9.6177	32.010	32.054
18000	134	67	9.8925	32.995	33.039
18500	138	69	10.1673	33.980	34.024
19000	140	70	10.4421	34.473	34.516
19500	146	73	10.7168	35.950	35.994
20000	151	75.5	10.9916	37.181	37.225
20500	154	77	11.2664	37.920	37.963
21000	157	78.5	11.5412	38.659	38.702

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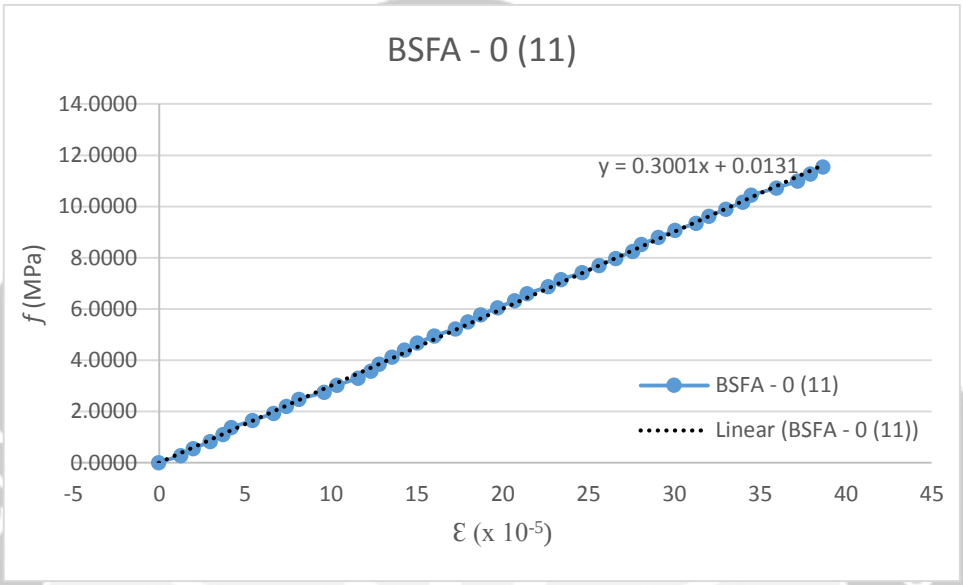

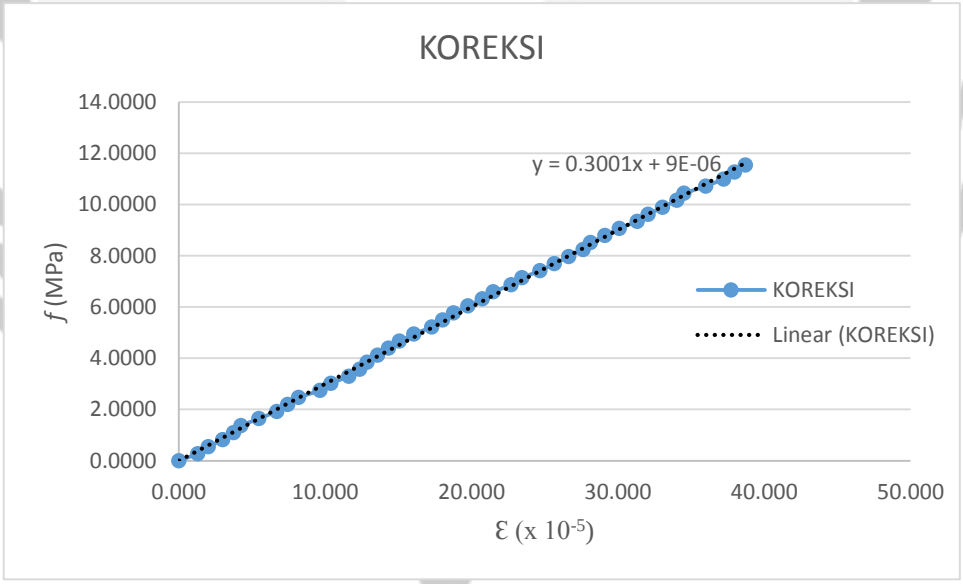

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Silinder BSFA-5 (2)
Ec = 31292,62037 MPa

Beban	ΔP (mm)	0.5 ΔP (mm)	Tegangan (f) (MPa)	Regangan (ε) (10^{-4})	Regangan Koreksi (ε) (10^{-4})
0	0	0	0.0000	0.972745	-0.002
500	5	2.5	0.2715	1.231	0.256
1000	9	4.5	0.5431	2.216	1.241
1500	12	6	0.8146	2.954	1.979
2000	16	8	1.0862	3.939	2.964
2500	19	9.5	1.3577	4.677	3.702
3000	23	11.5	1.6292	5.662	4.687
3500	28	14	1.9008	6.893	5.918
4000	32	16	2.1723	7.878	6.903
4500	36	18	2.4438	8.863	7.888
5000	40	20	2.7154	9.847	8.872
5500	45	22.5	2.9869	11.078	10.103
6000	48	24	3.2585	11.817	10.842
6500	52	26	3.5300	12.802	11.827
7000	56	28	3.8015	13.786	12.811
7500	60	30	4.0731	14.771	13.796
8000	64	32	4.3446	15.756	14.781
8500	66	33	4.6161	16.248	15.273
9000	70	35	4.8877	17.233	16.258
9500	74	37	5.1592	18.218	17.243
10000	78	39	5.4308	19.202	18.227
10500	81	40.5	5.7023	19.941	18.966
11000	84	42	5.9738	20.679	19.704
11500	87	43.5	6.2454	21.418	20.443
12000	91	45.5	6.5169	22.403	21.428
12500	94	47	6.7884	23.141	22.166
13000	99	49.5	7.0600	24.372	23.397
13500	102	51	7.3315	25.111	24.136
14000	106	53	7.6031	26.096	25.121
14500	109	54.5	7.8746	26.834	25.859
15000	112	56	8.1461	27.573	26.598
15500	116	58	8.4177	28.557	27.582
16000	119	59.5	8.6892	29.296	28.321
16500	122	61	8.9607	30.034	29.059
17000	126	63	9.2323	31.019	30.044
17500	128	64	9.5038	31.512	30.537
18000	131	65.5	9.7754	32.250	31.275
18500	134	67	10.0469	32.989	32.014
19000	136	68	10.3184	33.481	32.506
19500	141	70.5	10.5900	34.712	33.737
20000	146	73	10.8615	35.943	34.968
20500	149	74.5	11.1330	36.681	35.706
21000	152	76	11.4046	37.420	36.445

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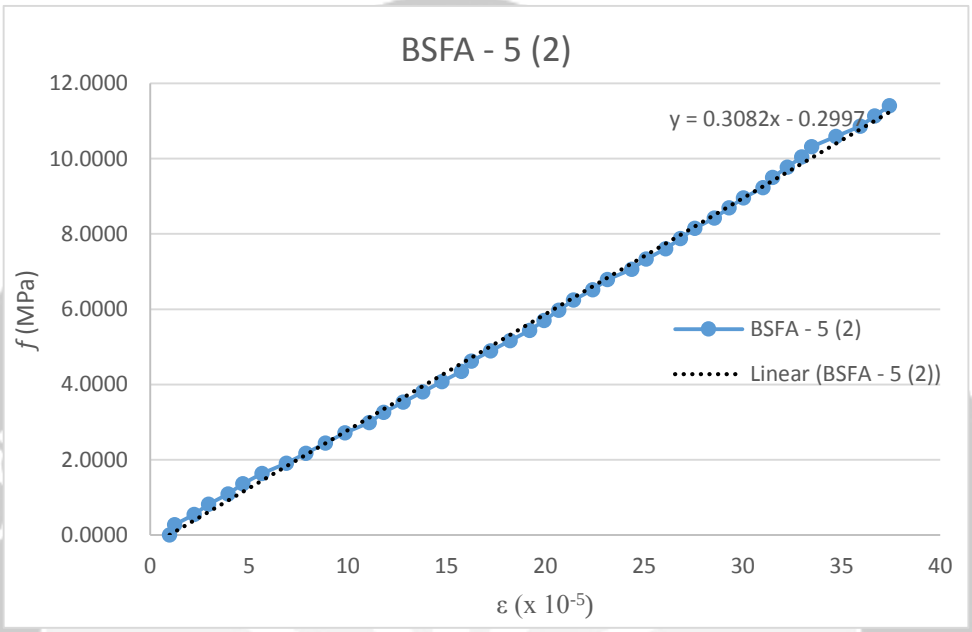

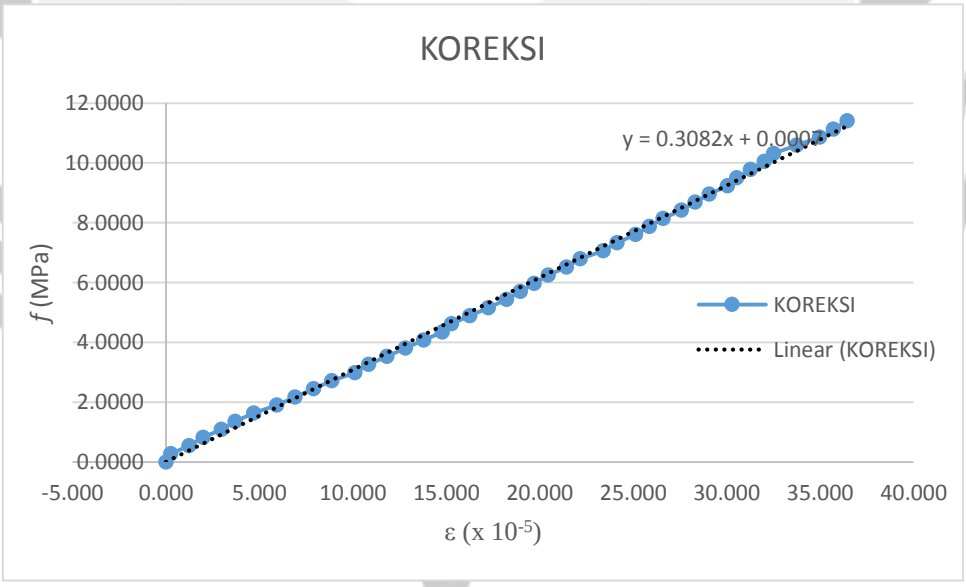

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Silinder BSFA-5 (6)
Ec = 39456,66174 MPa

Beban	ΔP (mm)	0.5 ΔP (mm)	Tegangan (f) (MPa)	Regangan (ε) (10^{-4})	Regangan Koreksi (ε) (10^{-4})
0	0	0	0.0000	-0.72178	0.000
500	2	1	0.2763	0.495	1.216
1000	4	2	0.5525	0.989	1.711
1500	6	3	0.8288	1.484	2.205
2000	9	4.5	1.1050	2.226	2.947
2500	11	5.5	1.3813	2.720	3.442
3000	14	7	1.6575	3.462	4.184
3500	16	8	1.9338	3.956	4.678
4000	19	9.5	2.2100	4.698	5.420
4500	22	11	2.4863	5.440	6.162
5000	25	12.5	2.7626	6.182	6.904
5500	28	14	3.0388	6.924	7.646
6000	31	15.5	3.3151	7.666	8.387
6500	33	16.5	3.5913	8.160	8.882
7000	36	18	3.8676	8.902	9.624
7500	39	19.5	4.1438	9.644	10.366
8000	42	21	4.4201	10.386	11.108
8500	45	22.5	4.6963	11.128	11.849
9000	49	24.5	4.9726	12.117	12.838
9500	52	26	5.2489	12.859	13.580
10000	55	27.5	5.5251	13.600	14.322
10500	58	29	5.8014	14.342	15.064
11000	60	30	6.0776	14.837	15.559
11500	63	31.5	6.3539	15.579	16.300
12000	66	33	6.6301	16.320	17.042
12500	70	35	6.9064	17.310	18.031
13000	73	36.5	7.1826	18.051	18.773
13500	76	38	7.4589	18.793	19.515
14000	78	39	7.7352	19.288	20.010
14500	81	40.5	8.0114	20.030	20.751
15000	83	41.5	8.2877	20.524	21.246
15500	86	43	8.5639	21.266	21.988
16000	88	44	8.8402	21.761	22.482
16500	90	45	9.1164	22.255	22.977
17000	93	46.5	9.3927	22.997	23.719
17500	96	48	9.6689	23.739	24.461
18000	100	50	9.9452	24.728	25.450
18500	104	52	10.2214	25.717	26.439
19000	107	53.5	10.4977	26.459	27.181
19500	109	54.5	10.7740	26.954	27.675
20000	111	55.5	11.0502	27.448	28.170
20500	113	56.5	11.3265	27.943	28.664
21000	116	58	11.6027	28.684	29.406

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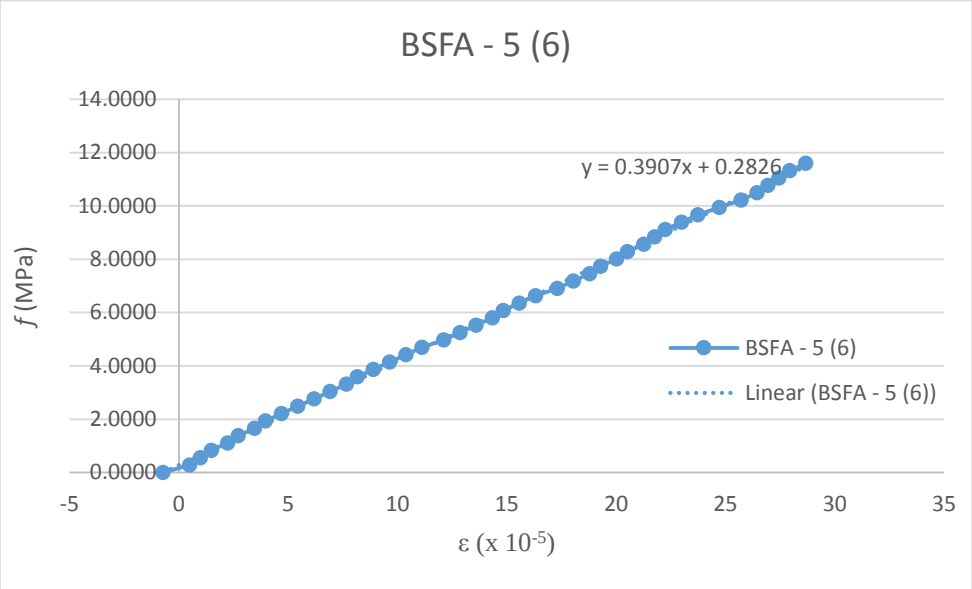

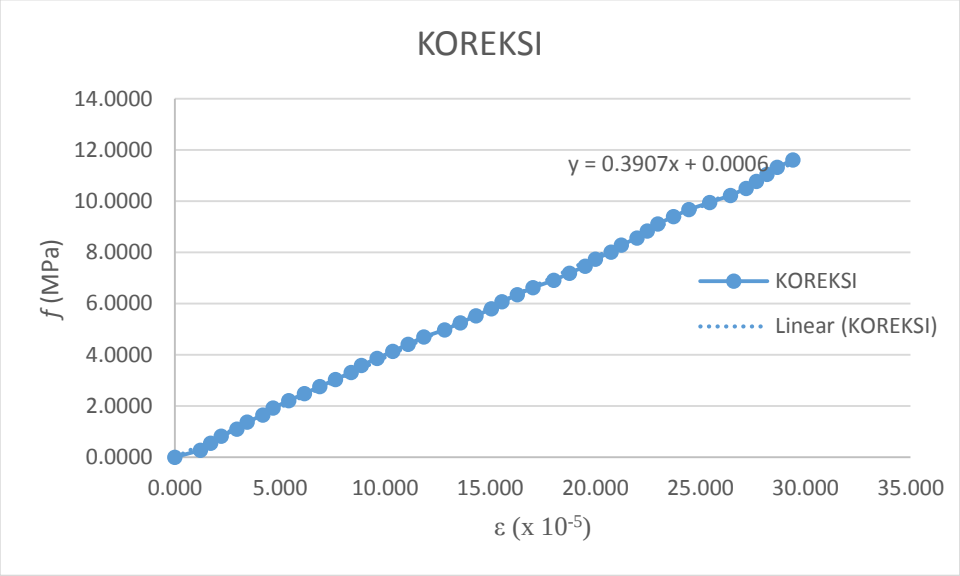

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Silinder BSFA-5 (3)
Ec = 21693,48525 MPa

Beban	ΔP (mm)	0.5 ΔP (mm)	Tegangan (f) (MPa)	Regangan (ε) (10^{-4})	Regangan Koreksi (ε) (10^{-4})
0	2	1	0.0000	-0.38973	0.000
500	6	3	0.2741	1.484	1.873
1000	10	5	0.5481	2.473	2.863
1500	14	7	0.8222	3.462	3.852
2000	18	9	1.0963	4.451	4.841
2500	22	11	1.3703	5.440	5.830
3000	26	13	1.6444	6.429	6.819
3500	31	15.5	1.9184	7.666	8.055
4000	37	18.5	2.1925	9.149	9.539
4500	42	21	2.4666	10.386	10.775
5000	48	24	2.7406	11.869	12.259
5500	55	27.5	3.0147	13.600	13.990
6000	63	31.5	3.2888	15.579	15.968
6500	68	34	3.5628	16.815	17.205
7000	74	37	3.8369	18.299	18.688
7500	80	40	4.1109	19.782	20.172
8000	85	42.5	4.3850	21.019	21.409
8500	89	44.5	4.6591	22.008	22.398
9000	94	47	4.9331	23.244	23.634
9500	99	49.5	5.2072	24.481	24.870
10000	106	53	5.4813	26.212	26.601
10500	112	56	5.7553	27.695	28.085
11000	117	58.5	6.0294	28.932	29.321
11500	124	62	6.3034	30.663	31.052
12000	128	64	6.5775	31.652	32.042
12500	132	66	6.8516	32.641	33.031
13000	136	68	7.1256	33.630	34.020
13500	142	71	7.3997	35.114	35.503
14000	148	74	7.6738	36.597	36.987
14500	153	76.5	7.9478	37.834	38.224
15000	158	79	8.2219	39.070	39.460
15500	163	81.5	8.4959	40.307	40.696
16000	168	84	8.7700	41.543	41.933
16500	172	86	9.0441	42.532	42.922
17000	179	89.5	9.3181	44.263	44.653
17500	185	92.5	9.5922	45.747	46.137
18000	188	94	9.8663	46.489	46.878
18500	194	97	10.1403	47.972	48.362
19000	196	98	10.4144	48.467	48.857
19500	200	100	10.6885	49.456	49.846
20000	205	102.5	10.9625	50.692	51.082
20500	210	105	11.2366	51.929	52.319
21000	213	106.5	11.5106	52.671	53.060

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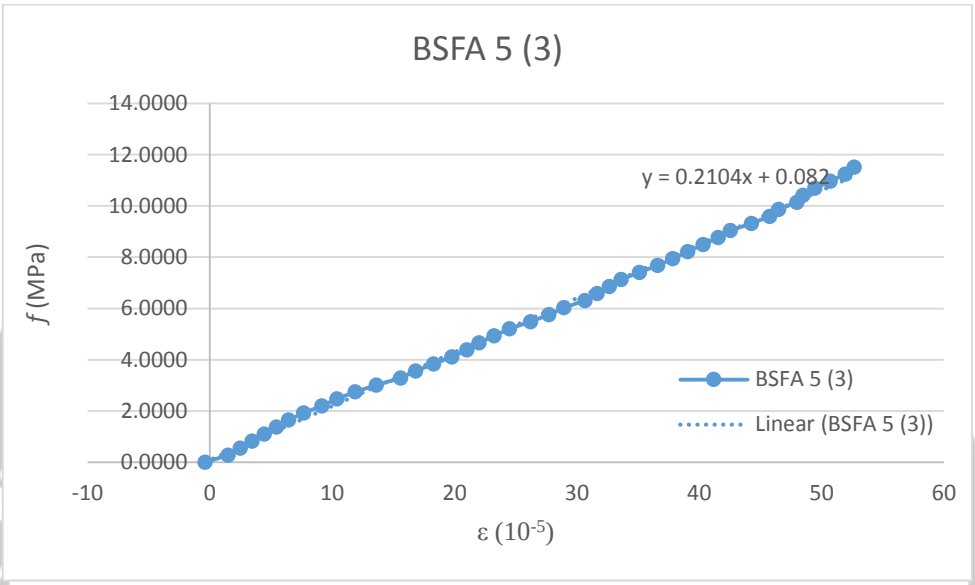

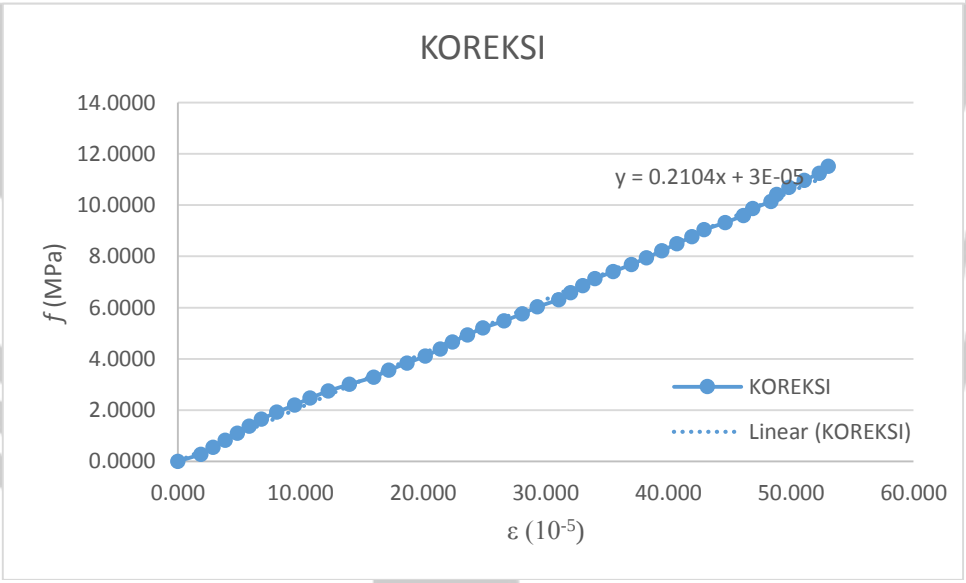

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Silinder BSFA-10 (1)
Ec = 32326,563 MPa

Beban	ΔP (mm)	0.5 ΔP (mm)	Tegangan (f) (MPa)	Regangan (ε) (10^{-4})	Regangan Koreksi (ε) (10^{-4})
0	0	0	0.0000	-1.590519878	0.000
500	2	1	0.2770	0.495	2.085
1000	4	2	0.5540	0.990	2.580
1500	6	3	0.8310	1.485	3.075
2000	8	4	1.1080	1.980	3.570
2500	11	5.5	1.3850	2.722	4.313
3000	14	7	1.6620	3.464	5.055
3500	17	8.5	1.9389	4.207	5.797
4000	20	10	2.2159	4.949	6.540
4500	23	11.5	2.4929	5.692	7.282
5000	27	13.5	2.7699	6.682	8.272
5500	30	15	3.0469	7.424	9.014
6000	34	17	3.3239	8.414	10.004
6500	38	19	3.6009	9.404	10.994
7000	41	20.5	3.8779	10.146	11.737
7500	44	22	4.1549	10.888	12.479
8000	48	24	4.4319	11.878	13.469
8500	51	25.5	4.7089	12.621	14.211
9000	55	27.5	4.9859	13.610	15.201
9500	58	29	5.2628	14.353	15.943
10000	62	31	5.5398	15.343	16.933
10500	66	33	5.8168	16.333	17.923
11000	69	34.5	6.0938	17.075	18.666
11500	72	36	6.3708	17.817	19.408
12000	76	38	6.6478	18.807	20.398
12500	79	39.5	6.9248	19.550	21.140
13000	82	41	7.2018	20.292	21.883
13500	86	43	7.4788	21.282	22.872
14000	89	44.5	7.7558	22.024	23.615
14500	92	46	8.0328	22.767	24.357
15000	96	48	8.3098	23.756	25.347
15500	100	50	8.5868	24.746	26.337
16000	104	52	8.8637	25.736	27.327
16500	106	53	9.1407	26.231	27.822
17000	110	55	9.4177	27.221	28.812
17500	113	56.5	9.6947	27.963	29.554
18000	117	58.5	9.9717	28.953	30.544
18500	121	60.5	10.2487	29.943	31.534
19000	125	62.5	10.5257	30.933	32.523
19500	128	64	10.8027	31.675	33.266
20000	132	66	11.0797	32.665	34.256
20500	135	67.5	11.3567	33.408	34.998
21000	139	69.5	11.6337	34.397	35.988

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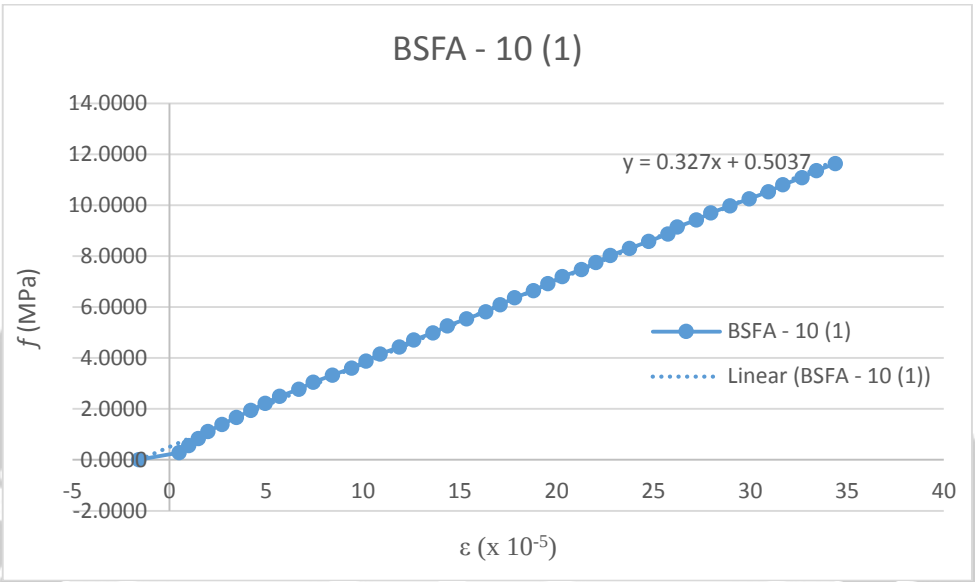

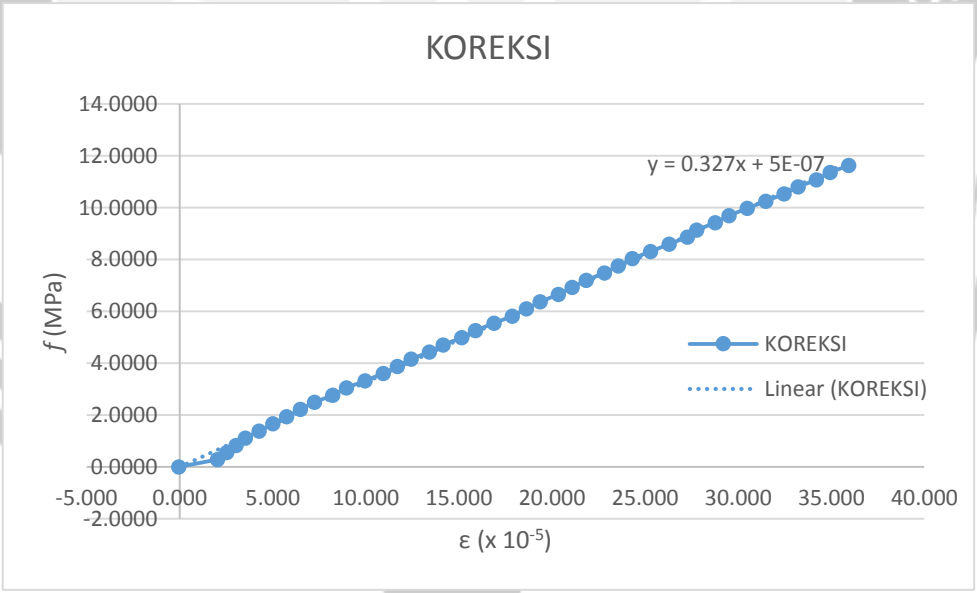

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Silinder BSFA-10 (2)
Ec = 36321,348 MPa

Beban	ΔP (mm)	0.5 ΔP (mm)	Tegangan (f) (MPa)	Regangan (ε) (10^{-4})	Regangan Koreksi (ε) (10^{-4})
0	0	0	0.0000	-1.312430323	0.000
500	2	1	0.2680	0.495	1.807
1000	4	2	0.5360	0.989	2.302
1500	6	3	0.8040	1.484	2.796
2000	8	4	1.0720	1.978	3.291
2500	11	5.5	1.3400	2.720	4.033
3000	13	6.5	1.6079	3.215	4.527
3500	15	7.5	1.8759	3.710	5.022
4000	18	9	2.1439	4.451	5.764
4500	21	10.5	2.4119	5.193	6.506
5000	23	11.5	2.6799	5.688	7.000
5500	26	13	2.9479	6.430	7.742
6000	29	14.5	3.2159	7.172	8.484
6500	32	16	3.4839	7.914	9.226
7000	35	17.5	3.7519	8.656	9.968
7500	38	19	4.0199	9.398	10.710
8000	41	20.5	4.2879	10.139	11.452
8500	44	22	4.5558	10.881	12.194
9000	48	24	4.8238	11.871	13.183
9500	51	25.5	5.0918	12.613	13.925
10000	54	27	5.3598	13.354	14.667
10500	57	28.5	5.6278	14.096	15.409
11000	61	30.5	5.8958	15.086	16.398
11500	64	32	6.1638	15.827	17.140
12000	68	34	6.4318	16.817	18.129
12500	71	35.5	6.6998	17.559	18.871
13000	74	37	6.9678	18.301	19.613
13500	78	39	7.2357	19.290	20.602
14000	81	40.5	7.5037	20.032	21.344
14500	84	42	7.7717	20.774	22.086
15000	87	43.5	8.0397	21.515	22.828
15500	90	45	8.3077	22.257	23.570
16000	92	46	8.5757	22.752	24.064
16500	96	48	8.8437	23.741	25.054
17000	98	49	9.1117	24.236	25.548
17500	100	50	9.3797	24.730	26.043
18000	103	51.5	9.6477	25.472	26.785
18500	107	53.5	9.9157	26.462	27.774
19000	110	55	10.1836	27.203	28.516
19500	112	56	10.4516	27.698	29.011
20000	115	57.5	10.7196	28.440	29.752
20500	117	58.5	10.9876	28.935	30.247
21000	120	60	11.2556	29.677	30.989

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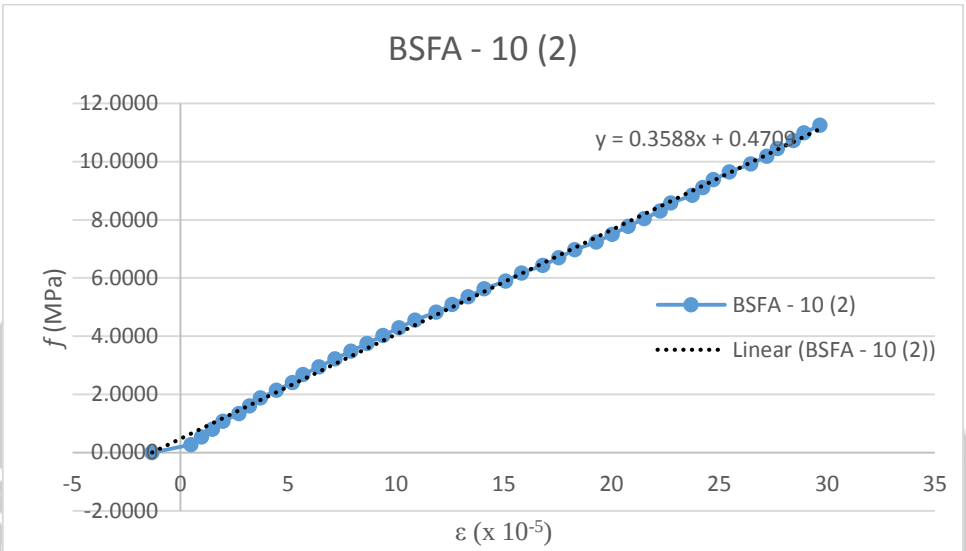

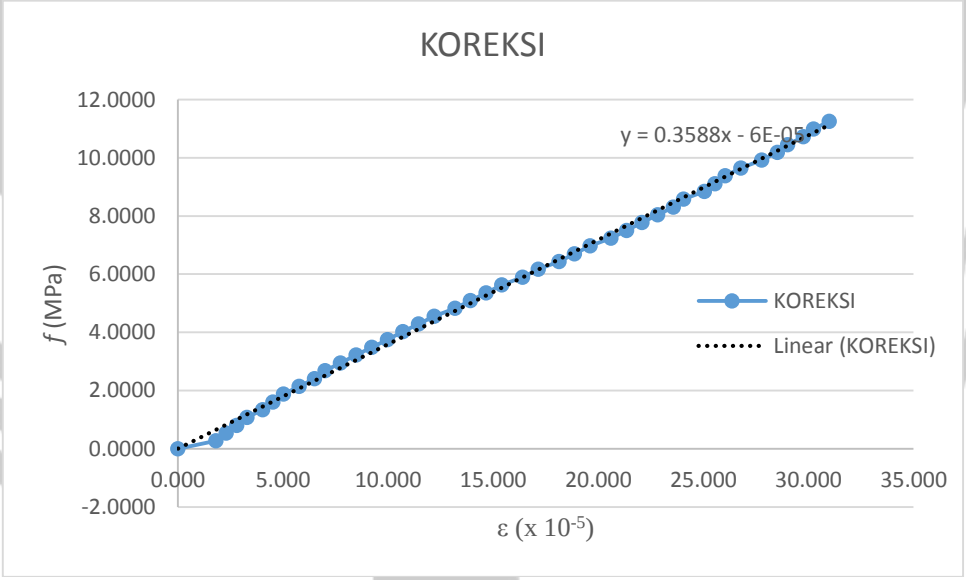

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Silinder BSFA-10 (12)
Ec = 32326,563 MPa

Beban	ΔP (mm)	0.5 ΔP (mm)	Tegangan (f) (MPa)	Regangan (ε) (10^{-4})	Regangan Koreksi (ε) (10^{-4})
0	3	1.5	0.0000	0.385856505	0.000
500	6	3	0.2698	1.483	1.097
1000	10	5	0.5395	2.472	2.086
1500	13	6.5	0.8093	3.213	2.828
2000	16	8	1.0790	3.955	3.569
2500	19	9.5	1.3488	4.696	4.311
3000	22	11	1.6185	5.438	5.052
3500	26	13	1.8883	6.427	6.041
4000	29	14.5	2.1580	7.168	6.782
4500	33	16.5	2.4278	8.157	7.771
5000	38	19	2.6976	9.393	9.007
5500	43	21.5	2.9673	10.629	10.243
6000	48	24	3.2371	11.865	11.479
6500	51	25.5	3.5068	12.606	12.220
7000	55	27.5	3.7766	13.595	13.209
7500	59	29.5	4.0463	14.584	14.198
8000	62	31	4.3161	15.325	14.939
8500	67	33.5	4.5858	16.561	16.175
9000	70	35	4.8556	17.303	16.917
9500	75	37.5	5.1254	18.539	18.153
10000	78	39	5.3951	19.280	18.894
10500	82	41	5.6649	20.269	19.883
11000	84	42	5.9346	20.763	20.377
11500	87	43.5	6.2044	21.505	21.119
12000	92	46	6.4741	22.741	22.355
12500	95	47.5	6.7439	23.482	23.096
13000	99	49.5	7.0136	24.471	24.085
13500	103	51.5	7.2834	25.460	25.074
14000	107	53.5	7.5532	26.448	26.063
14500	111	55.5	7.8229	27.437	27.051
15000	115	57.5	8.0927	28.426	28.040
15500	119	59.5	8.3624	29.415	29.029
16000	123	61.5	8.6322	30.403	30.018
16500	125	62.5	8.9019	30.898	30.512
17000	128	64	9.1717	31.639	31.253
17500	131	65.5	9.4414	32.381	31.995
18000	134	67	9.7112	33.122	32.737
18500	138	69	9.9810	34.111	33.725
19000	142	71	10.2507	35.100	34.714
19500	146	73	10.5205	36.089	35.703
20000	152	76	10.7902	37.572	37.186
20500	155	77.5	11.0600	38.313	37.927
21000	160	80	11.3297	39.549	39.163

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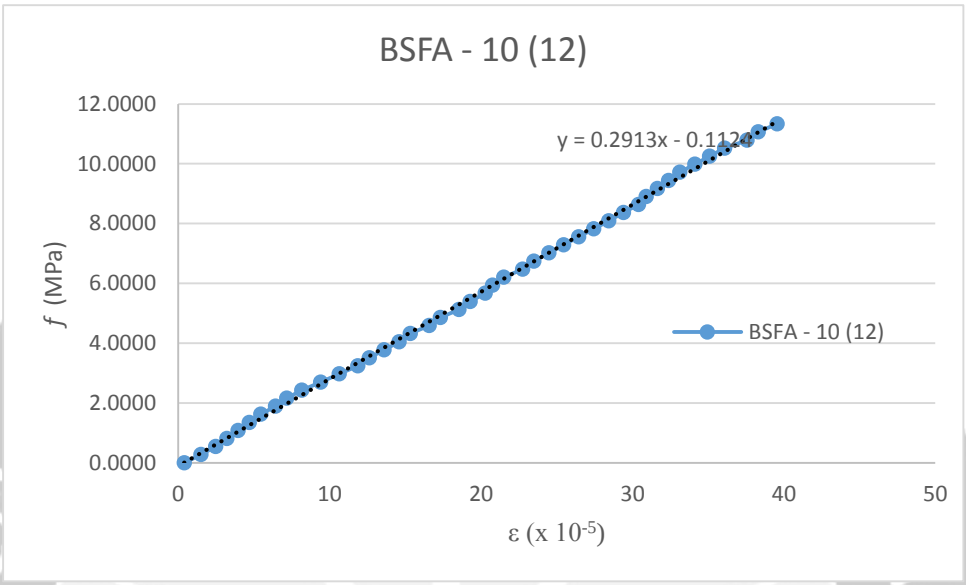

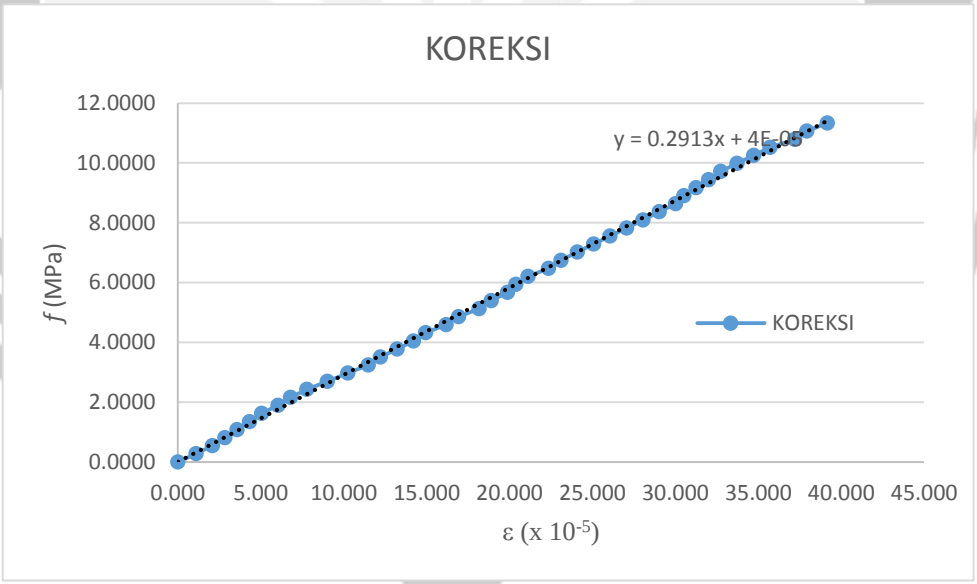

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Silinder BSFA-15 (3)
Ec = 39428,35682 MPa

Beban	ΔP (mm)	0.5 ΔP (mm)	Tegangan (f) (MPa)	Regangan (ε) (10^{-4})	Regangan Koreksi (ε) (10^{-4})
0	0	0	0.0000	-1.3203518	0.000
500	1	0.5	0.2865	0.247	1.568
1000	3	1.5	0.5729	0.742	2.063
1500	5	2.5	0.8594	1.237	2.557
2000	8	4	1.1458	1.979	3.300
2500	11	5.5	1.4323	2.721	4.042
3000	13	6.5	1.7187	3.216	4.537
3500	15	7.5	2.0052	3.711	5.031
4000	18	9	2.2916	4.453	5.774
4500	20	10	2.5781	4.948	6.268
5000	23	11.5	2.8645	5.690	7.011
5500	25	12.5	3.1510	6.185	7.505
6000	29	14.5	3.4375	7.175	8.495
6500	31	15.5	3.7239	7.669	8.990
7000	34	17	4.0104	8.412	9.732
7500	37	18.5	4.2968	9.154	10.474
8000	40	20	4.5833	9.896	11.216
8500	42	21	4.8697	10.391	11.711
9000	45	22.5	5.1562	11.133	12.453
9500	48	24	5.4426	11.875	13.196
10000	52	26	5.7291	12.865	14.185
10500	55	27.5	6.0155	13.607	14.927
11000	58	29	6.3020	14.349	15.670
11500	62	31	6.5885	15.339	16.659
12000	64	32	6.8749	15.834	17.154
12500	67	33.5	7.1614	16.576	17.896
13000	70	35	7.4478	17.318	18.639
13500	73	36.5	7.7343	18.060	19.381
14000	76	38	8.0207	18.803	20.123
14500	79	39.5	8.3072	19.545	20.865
15000	83	41.5	8.5936	20.534	21.855
15500	85	42.5	8.8801	21.029	22.350
16000	88	44	9.1666	21.771	23.092
16500	91	45.5	9.4530	22.514	23.834
17000	94	47	9.7395	23.256	24.576
17500	97	48.5	10.0259	23.998	25.318
18000	100	50	10.3124	24.740	26.061
18500	103	51.5	10.5988	25.482	26.803
19000	105	52.5	10.8853	25.977	27.298
19500	108	54	11.1717	26.719	28.040
20000	112	56	11.4582	27.709	29.029
20500	115	57.5	11.7446	28.451	29.772
21000	118	59	12.0311	29.193	30.514

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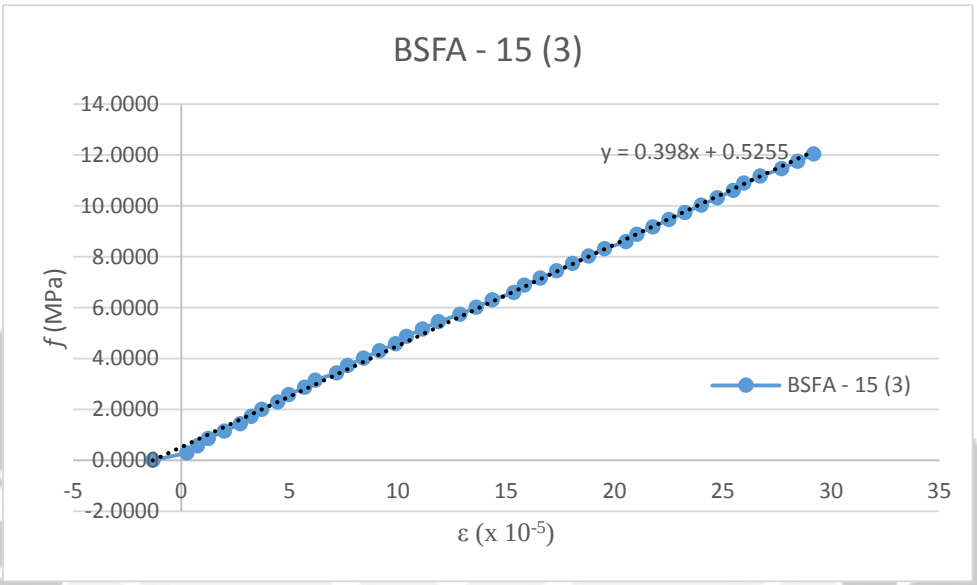

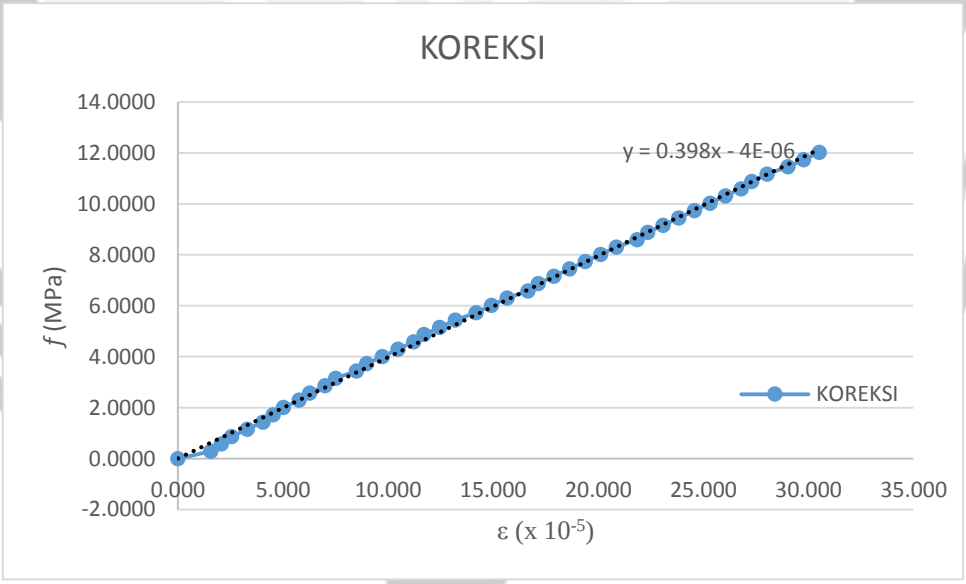

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Silinder BSFA-15 (10)
Ec = 33645,05253 MPa

Beban	ΔP (mm)	0.5 ΔP (mm)	Tegangan (f) (MPa)	Regangan (ε) (10^{-4})	Regangan Koreksi (ε) (10^{-4})
0	0	0	0.0000	-0.6499558	0.000
500	3	1.5	0.2770	0.743	1.393
1000	6	3	0.5540	1.486	2.136
1500	9	4.5	0.8310	2.229	2.879
2000	13	6.5	1.1080	3.219	3.869
2500	15	7.5	1.3850	3.715	4.365
3000	17	8.5	1.6620	4.210	4.860
3500	19	9.5	1.9389	4.705	5.355
4000	23	11.5	2.2159	5.696	6.346
4500	26	13	2.4929	6.439	7.089
5000	29	14.5	2.7699	7.182	7.832
5500	33	16.5	3.0469	8.172	8.822
6000	36	18	3.3239	8.915	9.565
6500	39	19.5	3.6009	9.658	10.308
7000	42	21	3.8779	10.401	11.051
7500	46	23	4.1549	11.392	12.042
8000	49	24.5	4.4319	12.135	12.785
8500	53	26.5	4.7089	13.125	13.775
9000	56	28	4.9859	13.868	14.518
9500	60	30	5.2628	14.859	15.509
10000	63	31.5	5.5398	15.602	16.252
10500	67	33.5	5.8168	16.592	17.242
11000	70	35	6.0938	17.335	17.985
11500	73	36.5	6.3708	18.078	18.728
12000	77	38.5	6.6478	19.069	19.719
12500	79	39.5	6.9248	19.564	20.214
13000	83	41.5	7.2018	20.555	21.205
13500	86	43	7.4788	21.298	21.948
14000	90	45	7.7558	22.288	22.938
14500	94	47	8.0328	23.279	23.929
15000	97	48.5	8.3098	24.022	24.672
15500	100	50	8.5868	24.765	25.415
16000	103	51.5	8.8637	25.508	26.158
16500	106	53	9.1407	26.251	26.901
17000	109	54.5	9.4177	26.994	27.644
17500	112	56	9.6947	27.737	28.386
18000	116	58	9.9717	28.727	29.377
18500	120	60	10.2487	29.718	30.368
19000	123	61.5	10.5257	30.461	31.111
19500	126	63	10.8027	31.204	31.854
20000	130	65	11.0797	32.194	32.844
20500	133	66.5	11.3567	32.937	33.587
21000	137	68.5	11.6337	33.928	34.578

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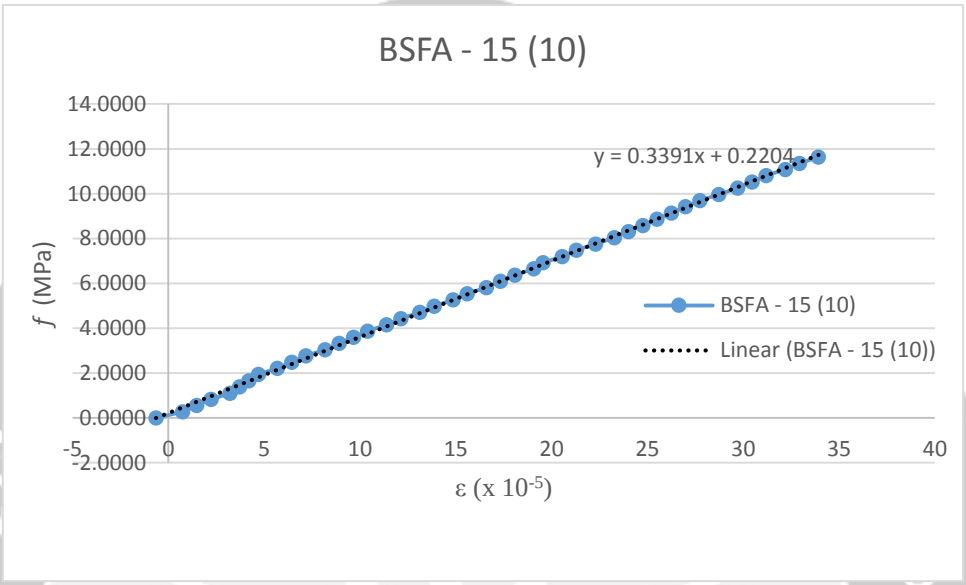

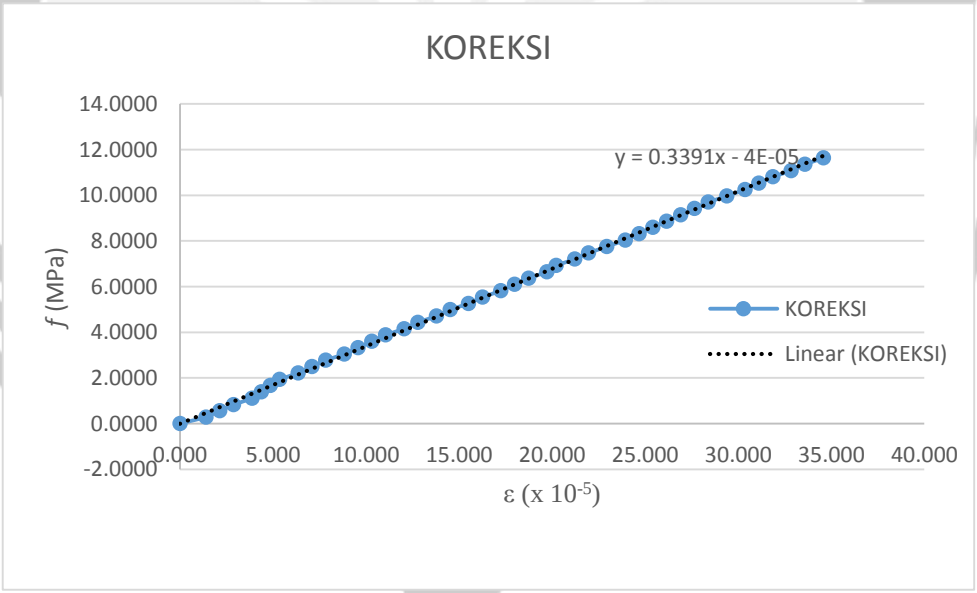

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Silinder BSFA-15 (11)
Ec = 32692,23272 MPa

Beban	ΔP (mm)	0.5 ΔP (mm)	Tegangan (f) (MPa)	Regangan (ε) (10^{-4})	Regangan Koreksi (ε) (10^{-4})
0	0	0	0.0000	-0.9926245	0.000
500	0	0	0.2777	0.000	0.993
1000	4	2	0.5555	0.991	1.984
1500	7	3.5	0.8332	1.734	2.727
2000	10	5	1.1109	2.478	3.470
2500	13	6.5	1.3887	3.221	4.214
3000	16	8	1.6664	3.964	4.957
3500	19	9.5	1.9441	4.708	5.700
4000	23	11.5	2.2219	5.699	6.691
4500	26	13	2.4996	6.442	7.435
5000	29	14.5	2.7773	7.185	8.178
5500	33	16.5	3.0550	8.176	9.169
6000	37	18.5	3.3328	9.167	10.160
6500	40	20	3.6105	9.911	10.903
7000	44	22	3.8882	10.902	11.895
7500	48	24	4.1660	11.893	12.886
8000	51	25.5	4.4437	12.636	13.629
8500	55	27.5	4.7214	13.627	14.620
9000	58	29	4.9992	14.371	15.363
9500	62	31	5.2769	15.362	16.354
10000	65	32.5	5.5546	16.105	17.098
10500	70	35	5.8324	17.344	18.337
11000	73	36.5	6.1101	18.087	19.080
11500	76	38	6.3878	18.831	19.823
12000	79	39.5	6.6656	19.574	20.566
12500	82	41	6.9433	20.317	21.310
13000	86	43	7.2210	21.308	22.301
13500	90	45	7.4988	22.299	23.292
14000	93	46.5	7.7765	23.043	24.035
14500	96	48	8.0542	23.786	24.779
15000	100	50	8.3320	24.777	25.770
15500	103	51.5	8.6097	25.520	26.513
16000	106	53	8.8874	26.264	27.256
16500	109	54.5	9.1651	27.007	28.000
17000	113	56.5	9.4429	27.998	28.991
17500	116	58	9.7206	28.741	29.734
18000	120	60	9.9983	29.732	30.725
18500	123	61.5	10.2761	30.476	31.468
19000	126	63	10.5538	31.219	32.212
19500	130	65	10.8315	32.210	33.203
20000	134	67	11.1093	33.201	34.194
20500	137	68.5	11.3870	33.944	34.937
21000	140	70	11.6647	34.688	35.680

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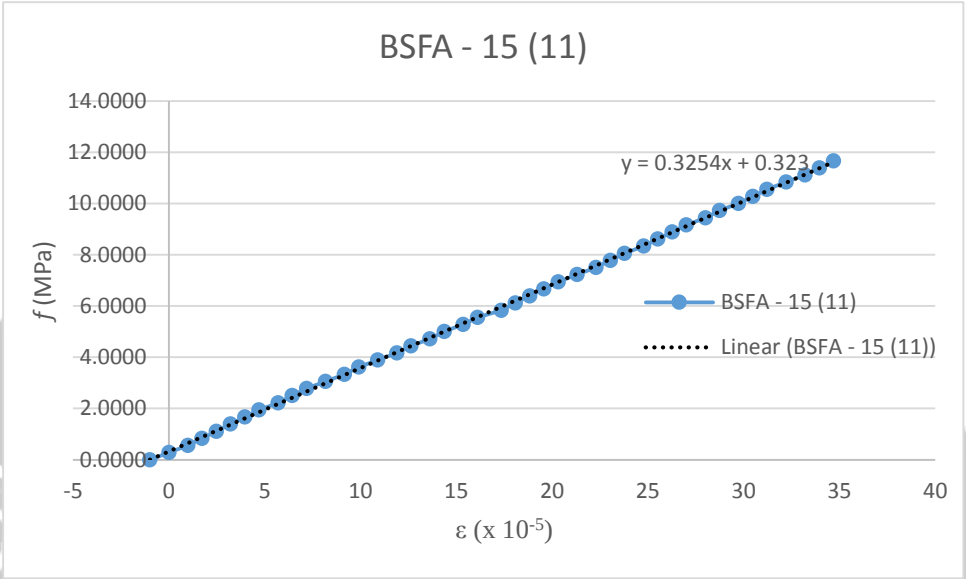

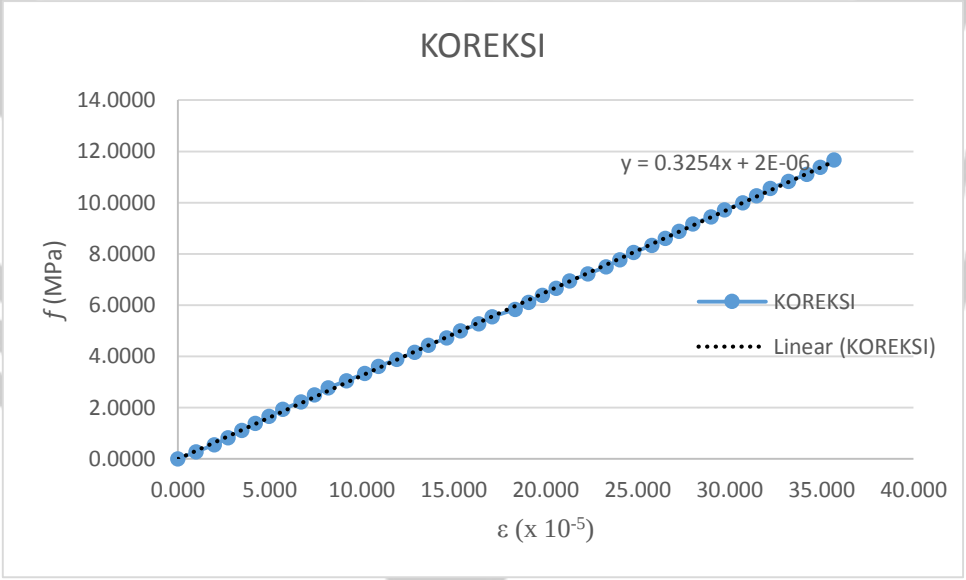

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Silinder BSFA-20 (1)
Ec = 34121,26382 MPa

Beban	ΔP (mm)	0.5 ΔP (mm)	Tegangan (f) (MPa)	Regangan (ε) (10^{-4})	Regangan Koreksi (ε) (10^{-4})
0	0	0	0.0000	0.28969835	0.000
500	4	2	0.2796	0.992	0.702
1000	6	3	0.5592	1.487	1.198
1500	10	5	0.8388	2.479	2.189
2000	14	7	1.1184	3.471	3.181
2500	18	9	1.3980	4.462	4.172
3000	22	11	1.6776	5.454	5.164
3500	24	12	1.9572	5.949	5.660
4000	29	14.5	2.2368	7.189	6.899
4500	32	16	2.5163	7.933	7.643
5000	35	17.5	2.7959	8.676	8.387
5500	38	19	3.0755	9.420	9.130
6000	41	20.5	3.3551	10.164	9.874
6500	44	22	3.6347	10.907	10.618
7000	47	23.5	3.9143	11.651	11.361
7500	50	25	4.1939	12.395	12.105
8000	53	26.5	4.4735	13.138	12.849
8500	56	28	4.7531	13.882	13.592
9000	59	29.5	5.0327	14.626	14.336
9500	62	31	5.3123	15.369	15.080
10000	65	32.5	5.5919	16.113	15.823
10500	68	34	5.8715	16.857	16.567
11000	71	35.5	6.1511	17.600	17.311
11500	73	36.5	6.4307	18.096	17.806
12000	77	38.5	6.7103	19.088	18.798
12500	79	39.5	6.9898	19.584	19.294
13000	83	41.5	7.2694	20.575	20.285
13500	86	43	7.5490	21.319	21.029
14000	88	44	7.8286	21.815	21.525
14500	91	45.5	8.1082	22.558	22.269
15000	95	47.5	8.3878	23.550	23.260
15500	99	49.5	8.6674	24.541	24.252
16000	103	51.5	8.9470	25.533	25.243
16500	105	52.5	9.2266	26.029	25.739
17000	110	55	9.5062	27.268	26.979
17500	113	56.5	9.7858	28.012	27.722
18000	117	58.5	10.0654	29.003	28.714
18500	121	60.5	10.3450	29.995	29.705
19000	125	62.5	10.6246	30.987	30.697
19500	127	63.5	10.9042	31.482	31.193
20000	132	66	11.1838	32.722	32.432
20500	135	67.5	11.4633	33.466	33.176
21000	140	70	11.7429	34.705	34.415

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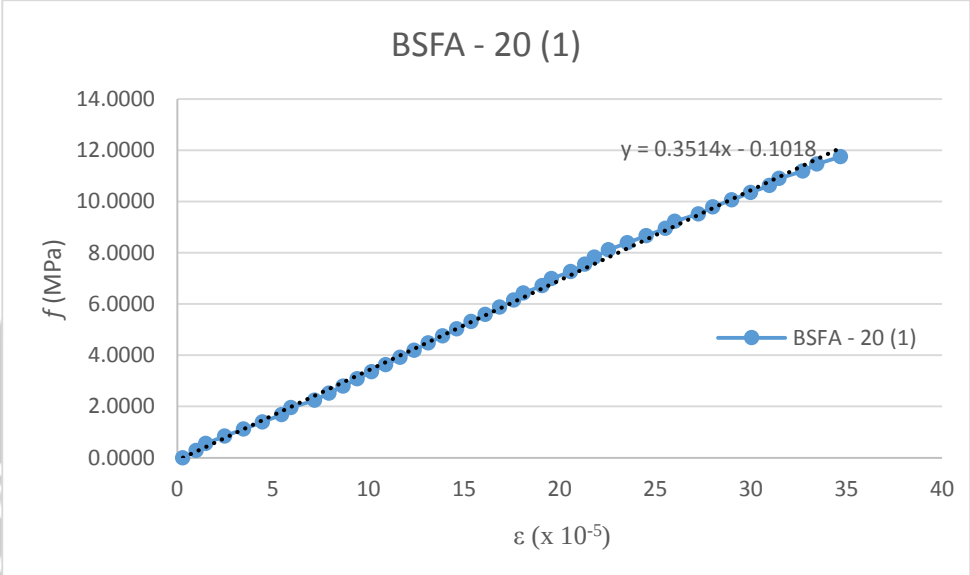

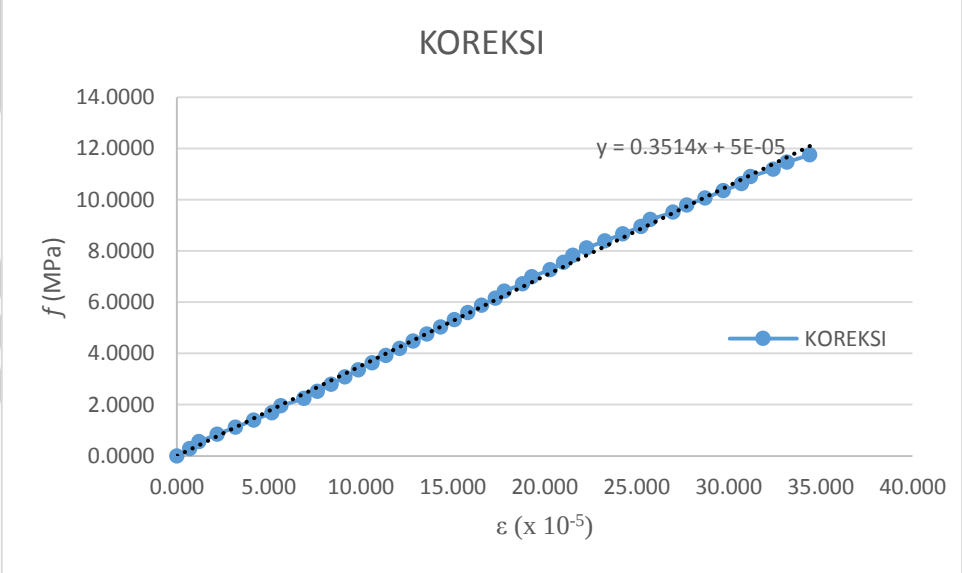

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Silinder BSFA-20 (2)
Ec = 29784,67545 MPa

Beban	ΔP (mm)	0.5 ΔP (mm)	Tegangan (f) (MPa)	Regangan (ε) (10^{-4})	Regangan Koreksi (ε) (10^{-4})
0	0	0	0.0000	0.62901113	0.000
500	6	3	0.2763	1.484	0.855
1000	10	5	0.5525	2.474	1.845
1500	15	7.5	0.8288	3.711	3.082
2000	20	10	1.1050	4.948	4.319
2500	22	11	1.3813	5.443	4.814
3000	25	12.5	1.6575	6.185	5.556
3500	28	14	1.9338	6.927	6.298
4000	32	16	2.2100	7.917	7.288
4500	36	18	2.4863	8.906	8.277
5000	41	20.5	2.7626	10.143	9.514
5500	43	21.5	3.0388	10.638	10.009
6000	47	23.5	3.3151	11.628	10.999
6500	51	25.5	3.5913	12.618	11.989
7000	54	27	3.8676	13.360	12.731
7500	58	29	4.1438	14.349	13.720
8000	62	31	4.4201	15.339	14.710
8500	65	32.5	4.6963	16.081	15.452
9000	68	34	4.9726	16.823	16.194
9500	70	35	5.2489	17.318	16.689
10000	74	37	5.5251	18.308	17.679
10500	79	39.5	5.8014	19.545	18.916
11000	83	41.5	6.0776	20.534	19.905
11500	86	43	6.3539	21.277	20.648
12000	89	44.5	6.6301	22.019	21.390
12500	93	46.5	6.9064	23.008	22.379
13000	95	47.5	7.1826	23.503	22.874
13500	99	49.5	7.4589	24.493	23.864
14000	103	51.5	7.7352	25.482	24.853
14500	105	52.5	8.0114	25.977	25.348
15000	108	54	8.2877	26.719	26.090
15500	114	57	8.5639	28.204	27.575
16000	118	59	8.8402	29.193	28.564
16500	121	60.5	9.1164	29.936	29.307
17000	125	62.5	9.3927	30.925	30.296
17500	130	65	9.6689	32.162	31.533
18000	135	67.5	9.9452	33.399	32.770
18500	140	70	10.2214	34.636	34.007
19000	144	72	10.4977	35.626	34.997
19500	147	73.5	10.7740	36.368	35.739
20000	152	76	11.0502	37.605	36.976
20500	155	77.5	11.3265	38.347	37.718
21000	160	80	11.6027	39.584	38.955

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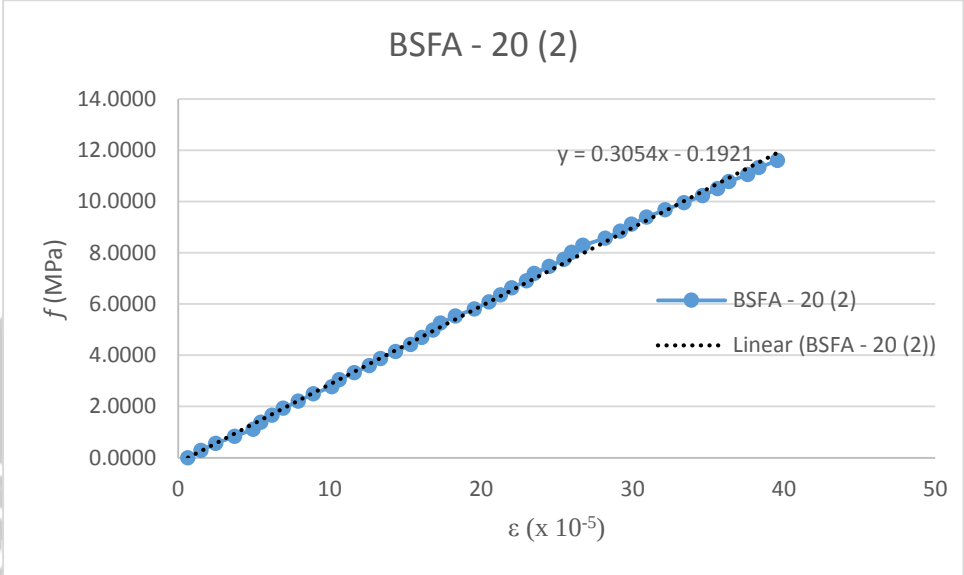

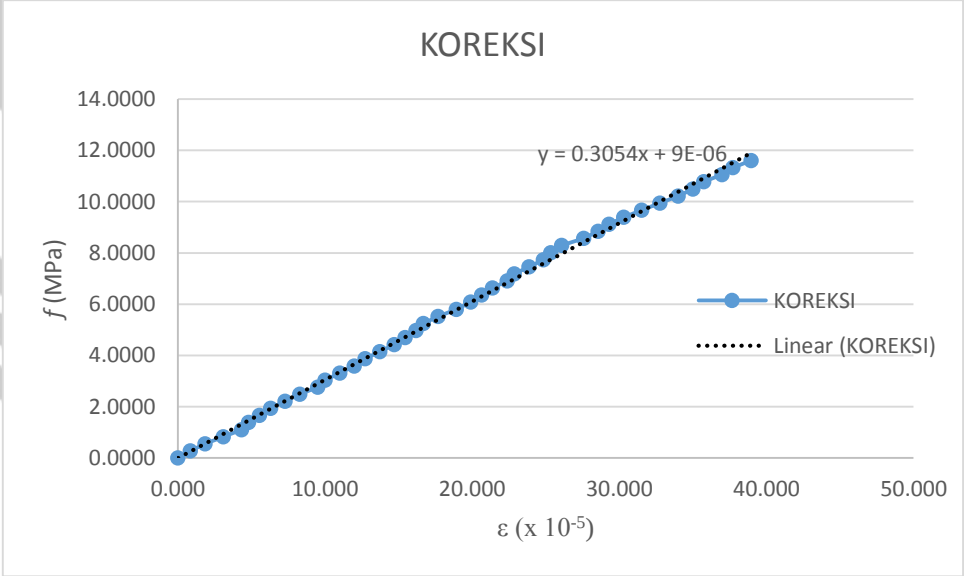

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Silinder BSFA-20 (11)
Ec = 33618,03554 MPa

Beban	ΔP (mm)	0.5 ΔP (mm)	Tegangan (f) (MPa)	Regangan (ε) (10^{-4})	Regangan Koreksi (ε) (10^{-4})
0	0	0	0.0000	0.28876697	0.000
500	4	2	0.2748	0.989	0.700
1000	6	3	0.5496	1.484	1.195
1500	10	5	0.8244	2.473	2.184
2000	14	7	1.0992	3.462	3.173
2500	18	9	1.3740	4.451	4.162
3000	22	11	1.6487	5.440	5.151
3500	24	12	1.9235	5.935	5.646
4000	29	14.5	2.1983	7.171	6.882
4500	32	16	2.4731	7.913	7.624
5000	35	17.5	2.7479	8.655	8.366
5500	38	19	3.0227	9.397	9.108
6000	41	20.5	3.2975	10.138	9.850
6500	44	22	3.5723	10.880	10.592
7000	47	23.5	3.8471	11.622	11.333
7500	50	25	4.1219	12.364	12.075
8000	53	26.5	4.3967	13.106	12.817
8500	56	28	4.6714	13.848	13.559
9000	59	29.5	4.9462	14.590	14.301
9500	62	31	5.2210	15.331	15.043
10000	65	32.5	5.4958	16.073	15.784
10500	68	34	5.7706	16.815	16.526
11000	71	35.5	6.0454	17.557	17.268
11500	73	36.5	6.3202	18.051	17.763
12000	77	38.5	6.5950	19.041	18.752
12500	79	39.5	6.8698	19.535	19.246
13000	83	41.5	7.1446	20.524	20.235
13500	86	43	7.4194	21.266	20.977
14000	88	44	7.6941	21.761	21.472
14500	91	45.5	7.9689	22.502	22.214
15000	95	47.5	8.2437	23.492	23.203
15500	99	49.5	8.5185	24.481	24.192
16000	103	51.5	8.7933	25.470	25.181
16500	105	52.5	9.0681	25.964	25.676
17000	110	55	9.3429	27.201	26.912
17500	113	56.5	9.6177	27.943	27.654
18000	117	58.5	9.8925	28.932	28.643
18500	121	60.5	10.1673	29.921	29.632
19000	125	62.5	10.4421	30.910	30.621
19500	127	63.5	10.7168	31.405	31.116
20000	132	66	10.9916	32.641	32.352
20500	135	67.5	11.2664	33.383	33.094
21000	140	70	11.5412	34.619	34.330

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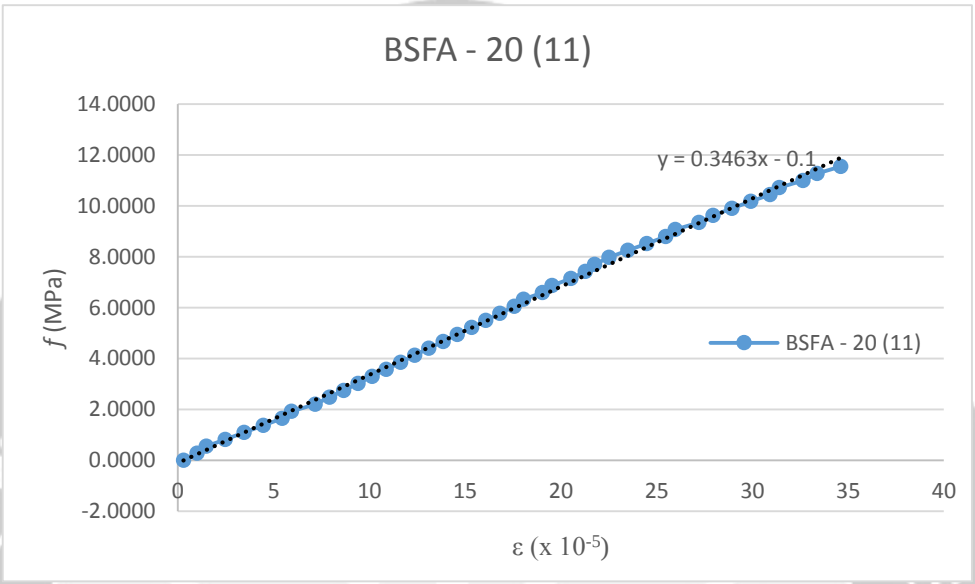
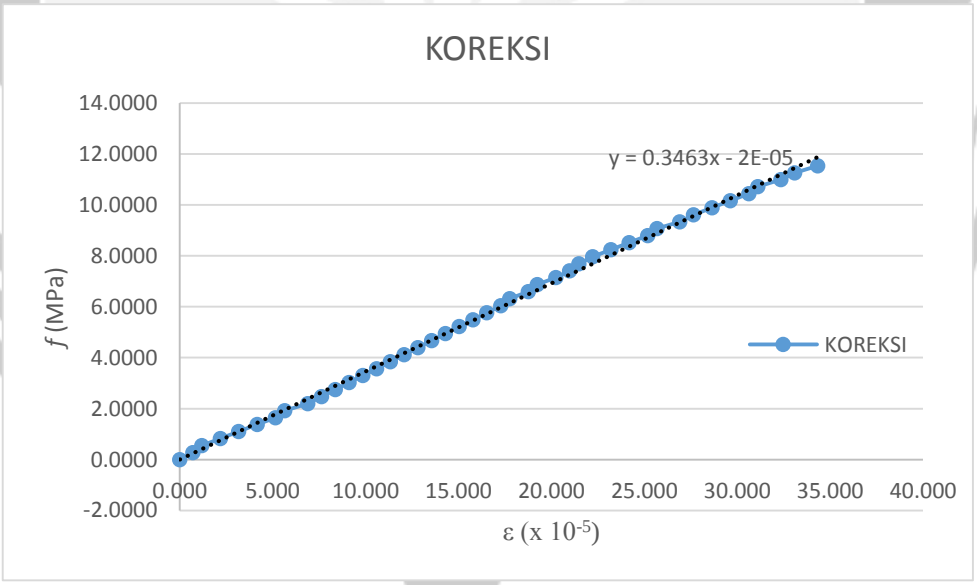




BUILDING TRUST

PRODUCT DATA SHEET

Sika® Fibre

POLYPROPYLENE FIBRES FOR CONCRETE

DESCRIPTION

SikaFibre is high quality micro monofilament polypropylene fibres. It is designed to minimize and control plastic shrinkage cracks in concrete. SikaFibre is available in pre-measured, ready to use degradable bags for 1 m^3 of concrete.

USES

SikaFibre reinforces fresh concrete and reduce the incidence of shrinkage cracking in pre-hardening stage.

SikaFibre is used in:
- Slabs
- Pavements
- Precast concrete products
- Heavy-duty industrial floors
- Overlays
- Shotcrete
- Mortar screeds and plasters

Note : Polypropylene fibres are not intended to replace reinforcement

CHARACTERISTICS / ADVANTAGES

Thanks to their fineness and special-surface treatment, SikaFibre is uniformly distributed to provide internal reinforcement to:
- Reduce plastic shrinkage cracking
- Improve fresh concrete cohesion
- Improve impact and abrasion resistance
- Improve concrete durability

PRODUCT INFORMATION

Chemical Base	Polypropylene fibres with surface agent
Packaging	0.6 kg/bag at 40 bags per box
Appearance / Colour	Natural
Shelf Life	3 years if stored in original unopened packaging
Storage Conditions	Store in cool, dry condition
Fiber Length	12 mm
Fiber Diameter	18 micron – nominal
Water Absorbsion	Nil
Density	0.91 gr/ cm^3

TECHNICAL INFORMATION

Tensile Adhesion Strength	300 – 440 MPa
Elastic Modulus	6 000 – 9 000 N/mm^2
Softening Point	160 °C
Concreting Guidance	SikaFibre is compatible with all Sika admixtures. The standard procedures for placing, finishing and curing concrete shall be followed. In addition, proper reinforcement and joint spacing should be observed.

APPLICATION INSTRUCTIONS

DISPENSING

Put 1 (one) bag of 0.6 kg SikaFibre per m3 concrete directly into the mixture. A mixing time of 3 to 5 minutes is necessary to ensure that the bag is fully degraded and ensure uniform fibre dispersion throughout the mix.

BASIS OF PRODUCT DATA

All technical data stated in this Product Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control.

LOCAL RESTRICTIONS

Please note that as a result of specific local regulations the declared data and recommended uses for this product may vary from country to country. Please consult the local Product Data Sheet for the exact product data and uses.

ECOLOGY, HEALTH AND SAFETY

For information and advice on the safe handling, storage and disposal of chemical products, users shall refer to the most recent Safety Data Sheet (SDS) containing physical, ecological, toxicological and other safety-related data.

LEGAL NOTES

The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the product's suitability for the intended application and purpose. Sika re- serves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.

PT. Sika Indonesia
Jl. Raya Cibinong-Bekasi km.20.
Cileungsi, Bogor 16820 - Indonesia
Tel. +62 21 8230025
Fax. +62 21 8230026
Website: idn.sika.com
email: sikacare@id.sika.com

BUILDING TRUST

PRODUCT DATA SHEET

Sika® ViscoCrete®-1003

CONCRETE ADMIXTURE FOR HIGH FLOW / SELF-COMPACTING CONCRETE

DESCRIPTION

Sika® ViscoCrete®-1003 is a third generation superplasticiser for concrete and mortar. It is particularly developed for the production of high flow concrete with exceptional flow retention properties and significant reduction in bleeding and segregation.

USES

Sika® ViscoCrete®-1003 facilitates extreme water reduction, excellent flowability with optimal cohesion and strong self-compacting behaviour.
Sika® ViscoCrete®-1003 is used for the following types of concrete:
- High flow concrete
- Self-compacting concrete (S.C.C.)
- Concrete with very high water reduction (up to 30 %)
- High strength concrete
- Concrete in hot weather and with extended transportation and workability requirements etc.

The combination of high water reduction, excellent flowability and high early strength provides clear benefits in the above mentioned applications.

CHARACTERISTICS / ADVANTAGES

Sika® ViscoCrete®-1003 acts by surface adsorption on the cement particles producing a sterical separation effect. Concrete produced with Sika® ViscoCrete®-1003 exhibits the following properties:
- Excellent flowability (resulting in highly reduced placing and compacting efforts)
- Strong self-compacting behaviour
- Extremely high water reduction (resulting in high density and strengths)
- Improved shrinkage and creep behaviour
- Increased carbonation resistance of the concrete
- Improved finish
- Reduce tendency to bleeding and segregation

Sika® ViscoCrete®-1003 does not contain chlorides or other ingredients which promotes steel corrosion. Therefore, it may be used without restriction for reinforced and pre-stressed concrete construction.
Sika® ViscoCrete®-1003 gives the concrete extended workability and depending on the mix design and the quality of materials used, self-compacting properties can be maintained for more than 1 hour at 30 °C.

PRODUCT INFORMATION

Chemical base	Aqueous solution of modified polycarboxylate copolymers	
Packaging	200 L drums and bulk deliveries	
Appearance / Colour	Liquid / Brownish	
Shelf life	12 months from the date of production when stored in original unopened packaging	
Storage conditions	Store in dry conditions at temperature between +5 °C and +30 °C. Protect from direct sunlight and frost.	
Density	at +20 °C	1.065 ± 0.01 kg/L

TECHNICAL INFORMATION

Concreting Guidance	The standard rules of good concreting practice, concerning production and placing, are to be followed. Laboratory trials before concreting on site are strongly recommended when using a new mix design or producing new concrete components. Fresh concrete must be cured properly and as early as possible.

APPLICATION INFORMATION

Recommended Dosage	For soft plastic concrete For flowing and self compacting concrete (S.C.C.)	0.2 - 0.6 % by weight of binder 0.6 - 2.0 % by weight of binder
Compatibility	Sika® ViscoCrete®-1003 may be combined with the following products: • Plastiment® P121R • Plastiment® VZ • Sika® Fume • SikaFibre® Do not use viscocrete / viscoflow series combined with sikament series. To produce flowing and / or self-compacting concrete, special concrete mix design is required. Pre-trials are recommended and mandatory if combinations with the above products are required. Please consult to our Technical Service Department.	

APPLICATION INSTRUCTIONS

DISPENSING

Sika® Viscocrete®-1003 is added to the gauging water or simultaneously poured with it into the concrete mixer. For optimum utilisation of its high water reduction property, we recommend thorough mixing at a minimal wet mixing time of 60 seconds.
The addition of the remaining gauging water (to fine tune concrete consistency) may only be started after two-thirds of the wet mixing time, to avoid surplus water in the concrete.

BASIS OF PRODUCT DATA

All technical data stated in this Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control.

LOCAL RESTRICTIONS

Please note that as a result of specific local regulations the declared data and recommended uses for this product may vary from country to country. Please consult the local Product Data Sheet for the exact product data and uses.

ECOLOGY, HEALTH AND SAFETY

For information and advice on the safe handling, storage and disposal of chemical products, users shall refer to the most recent Safety Data Sheet (SDS) containing physical, ecological, toxicological and other safety-related data.

LEGAL NOTES

The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the product's suitability for the intended application and purpose. Sika reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.

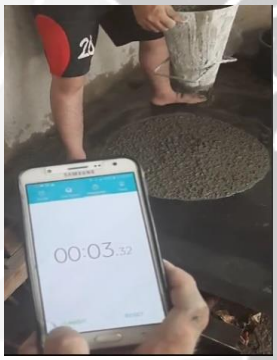
PT. Sika Indonesia
Jl. Raya Cibinong-Bekasi km.20.
Cileungsi, Bogor 16820 - Indonesia
Tel. +62 21 8230025
Fax. +62 21 8230026
Website: idn.sika.com
email: sikacare@id.sika.com

DOKUMENTASI PENELITIAN

Pengujian kandungan lumpur agregat halus

Pengujian *slump flow*

Pengujian *L-Shaped box*



Pengujian *T-500 slumpflow*

Penimbangan berat agregat kasar

Beton segar di cetakan silinder

Mixing dengan *concrete mixer*

Beton segar di cetakan balok

Pengujian *V-funnel*

Pengujian modulus elastisitas beton

Pengujian kuat tekan beton

Pengujian kuat tarik belah beton

Pengujian kuat lentur murni balok

Balok setelah runtuh

Cetakan silinder Ø 15 cm x 30 cm yang dipakai

Contoh pembacaan angka di mesin CTM ELE setelah benda uji runtuh

Pengujian Agregat Kasar

Pengujian Agregat Halus

Ekstensometer

Pencucian agregat kasar