

BAB VI

KESIMPULAN DAN SARAN

6.1 Kesimpulan

Melalui penelitian dan hasil pembahasan serta analisis yang telah dilakukan pada perkuatan balok beton bertulang dengan menggunakan bahan tambah kimia *superplasticizer* Glenium ACE 8590. Penelitian ini meninjau kapasitas perkuatan balok beton pada kondisi lentur dengan bahan tambah kimia *superplasticizer* Glenium ACE 8590 pada saat menerima pembebanan. Berikut ini beberapa kesimpulan yang dapat diambil setelah dilakukan penelitian dan pengujian berlangsung.

1. Rata - rata beban maksimum yang mampu diterima oleh balok setelah diuji adalah BN : 33,01 kN, BG 1,2 % : 37,10 kN, BG 1,5 % : 38,13 kN, sedangkan rata-rata beban maksimum balok hasil analisis teoritis yaitu BN : 28,66 kN, BG 1,2 % : 29,12 kN, BG 1,5 % : 29,86 kN.
2. Beban retak pertama dari hasil pengujian masing-masing adalah BN : 8,98 kN, BG 1,2 % : 17,36 kN, BG 1,5 % : 19,19 kN. Untuk rata-rata beban retak pertama dari hasil analisis berturut-turut untuk BN : 7,20 kN, BG 1,2 % : 7,90 kN, BG 1,5 % : 9,69 kN.
3. Beban maksimum yang dihasilkan dari penelitian ini mengalami peningkatan, hal ini dapat dilihat pada perbandingan nilai beban maksimum yang diterima balok beton normal dibandingkan dengan

balok beton dengan bahan tambah Glenium ACE 8590. Untuk nilai beban maksimum yang dihasilkan pada Balok Glenium dengan kadar 1,2 % (BG 1,2 %) mengalami peningkatan sebesar 12,39 % dan pada Balok Glenium kadar 1,5 % mengalami peningkatan sebesar 15,49 % dari nilai beban maksimum yang diperoleh Balok Normal.

4. Persentase perbandingan beban retak pertama balok normal terhadap balok beton dengan bahan tambah Glenium ACE 8590 hasil pengujian yaitu sebesar 93,44 untuk BG 1,2 % dan 113,77 % untuk BG 1,5 % dibandingkan dengan BN.
5. Dengan penambahan Glenium ACE 8590 pada balok beton didapatkan peningkatan nilai kekakuan dari balok beton normal, yang dilihat dari hubungan P (beban) dengan Lendutan (defleksi). Penambahan kadar Glenium ACE 8590 sebesar 1,5 % dari pengurangan air memiliki nilai kekakuan terbesar.
6. Melalui pengujian balok yang dilakukan di Laboratorium Teknologi Bahan Konstruksi Universitas Atma Jaya Yogyakarta, didapatkan bahwa balok hasil pengujian telah sesuai dengan perencanaan awal, yang diharuskan mengalami keruntuhan lentur. Hal ini dibuktikan dengan timbulnya pola retakan dan setelah dilakukan analisis hasil pengujian, benar dinyatakan balok beton mengalami keruntuhan lentur.

6.2 Saran

Berdasarkan penelitian yang telah dilakukan, berikut ini beberapa saran yang diperlukan untuk penelitian selanjutnya sebagai berikut.

1. Proses persiapan alat dan bahan yang diperlukan selama penelitian berlangsung, diharapkan lebih diperhatikan.
2. Proses pemadatan beton harus dilakukan dengan benar dan merata, antar variasi juga harus mendapatkan perlakuan yang sama, agar balok yang dihasilkan padat dan tidak keropos.
3. Penggunaan bekesting yang lebih kuat sehingga balok yang dicetak tidak mengalami lendutan dan sesuai dengan dimensi yang telah ditentukan.
4. Pemasangan atau *setting* alat pengujian kuat lentur, terutama pemasangan LVDT harus sesuai dengan ketentuan yang berlaku.
5. Untuk penelitian selanjutnya perlu dilakukan perkuatan yang ditinjau pada kondisi geser balok atau penelitian dengan cara mengganti agregat kasar (kerikil) dengan pengganti agregat yang sesuai atau pengisi agregat ringan yang lain.

DAFTAR PUSTAKA

- Austen, A, 2014, Pengaruh Komposisi Beton Non-Pasir dengan substitusi Fly Ash dan Superplasticizer Terhadap Kuat Lentur dan Tarik Belah, Univeristas Atma Jaya Yogyakarta.
- Chapra, S.C. dan Canale, R.P, 1989, *Numerical Methods for Engineers with Personal Computer Applications*, MacGraw-Hill Book Company.
- Dipohusodo, L., 1996, *Struktur Beton Bertulang*, PT. Gramedia Pustaka Utama, Jakarta.
- Hariandja, B., 1986, *Disain Beton Bertulang*, Erlangga, Jakarta.
- Hendrico, A.Y., 2015, Pengaruh Suhu Pembakaran Pada Sifat Mekanik Beton dengan *Chemical Additive* Glenium ACE 8590, *Laporan Penelitian Tugas Akhir Universitas Atma Jaya Yogyakarta*, Yogyakarta.
- Nababan, B.A., 2015, Pengaruh Komposisi Glenium ACE 8590 Terhadap Sifat Mekanik Beton, *Laporan Penelitian Tugas Akhir Universitas Atma Jaya Yogyakarta*, Yogyakarta.
- Priscawaty, E, 2015, Pengaruh Suhu Pembakaran Terhadap Kuat Tekan Dan Porositas Beton Mutu Tinggi Berbasis Glenium ACE 8590, Fly Ash, dan Filler Pasir Kuarsa, *Laporan Penelitian Tugas Akhir Universitas Atma Jaya Yogyakarta*, Yogyakarta.
- Panitia Teknik Konstruksi dan Bangunan, 1989, *Spesifikasi Bahan Bangunan Bagian A (SNI S-04-1989-1990-F)*, Badan Standarisasi Nasional.
- Panitia Teknik Konstruksi dan Bangunan, 1990, *Metode Pengujian Kuat Tekan Beton (SNI 03-1974-1990)*, Badan Standarisasi Nasional.
- Panitia Teknik Konstruksi dan Bangunan, 2000, *Tata Cara Pembuatan Rencana Campuran Beton Normal (SNI 03-2834-2000)*, Badan Standarisasi Nasional.
- Panitia Teknik Konstruksi dan Bangunan, 2002, *Tata Cara Perencanaan Struktur Baja Untuk Bangunan Gedung (SNI 03-1729-2002)*, Badan Standarisasi Nasional.

- Panitia Teknik Konstruksi dan Bangunan, 2002, *Tata Cara Perhitungan Struktur Beton Untuk Bangunan Gedung (SNI 03-2847-2002)*, Badan Standarisasi Nasional.
- Panitia Teknik Konstruksi dan Bangunan, 2011, *Cara Uji Kuat Lentur Beton Normal dengan Dua Titik Pembebanan (SNI 03-4431-2011)*, Badan Standarisasi Nasional.
- Setiawan, Y. A., 2015, Pengaruh Komposisi Glenium ACE 8590 dengan Fly Ash dan Filler Pasir Kuarsa Terhadap Sifat Mekanik Beton Mutu Tinggi, *Laporan Penelitian Tugas Akhir Universitas Atma Jaya Yogyakarta*, Yogyakarta.
- Siahaan, H., 2014, Pengaruh Penggunaan Baja Profil Siku Terhadap Kuat Lentur Balok, *Laporan Penelitian Tugas Akhir Universitas Atma Jaya Yogyakarta*, Yogyakarta.
- Sugiharto, H., 2006, *Penelitian Mengenai Peningkatan Kekuatan Awal Beton Pada Self Compacting Concrete*, Universitas Kristen Petra.
- Timoshenko, S. P., Gere, J. M., 2000, *Mekanika Bahan*, Erlangga, Jakarta.
- Tjokrodimuljo, K., 1992, *Teknologi Beton*, Biro Penerbit Yogyakarta 1992, Yogyakarta.
- Vernando, D., 2002, *Studi Eksperimental Pengaruh Penambahan Superplasticizer Terhadap Kuat Lentur Beton Ringan ALWA Mutu Rencana $f'c = 35$ MPa*, Universitas Kristen Maranatha Bandung.
- Vis, W.C., dan Gideon H.K., 1993, *Dasar-dasar Perencanaan Beton Bertulang*, Erlangga, Jakarta.
- Wibawa, S. A., 2015, Studi Perilaku Mekanik Kekuatan Beton Ringan Terhadap Kuat Lentur Balok, *Laporan Penelitian Tugas Akhir Universitas Atma Jaya Yogyakarta*, Yogyakarta.
- Wigroho, H.Y., 2008, *Kuat Lentur Profil C Tunggal Dengan Perkuatan Tulangan Vertikal Dan Cor Beton Pengisi*, Univeritas Atma Jaya Yogyakarta.
- Zebua, P. P., 2015, Perkuatan Balok Beton Bertulang dengan *Fiber Glass Jacket* pada Kondisi Lentur, *Laporan Penelitian Tugas Akhir Universitas Atma Jaya Yogyakarta*, Yogyakarta.



LAMPIRAN



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

LAMPIRAN I

PENGUJIAN BAHAN

PEMERIKSAAN GRADASI BESAR BUTIRAN PASIR

Bahan : Pasir

Asal : Clereng, Kulon Progo, Daerah Istimewa Yogyakarta

Diperiksa : 26 Oktober 2015

DAFTAR AYAKAN

Lubang Ayakan	Berat Ayakan (gr)	Berat ayakan + pasir (gr)			Berat pasir Tertahan (gr)	Persentase Tertahan (%)	Jumlah Persentase Tertahan (%)	Persentase Lolos (%)
		Perc. 1	Perc.2	Jumlah				
3/4"	0	0	0	0	0	0	0	100
3/8"	533,2	557,5	549,04	1106,54	40.14	4.038	4.038	95.962
4	477,18	515,32	510,32	1025,64	71.28	7.171	11.209	88.791
16	324,61	380,22	394,55	774,77	125.55	12.631	23.840	76.160
30	405,81	636,78	677,81	1314,59	502.97	50.601	74.441	25.559
50	293,67	340,29	325,18	665,47	78.13	7.860	82.302	17.698
100	286,36	369,46	345,53	714,99	142.27	14.313	96.615	3.385
200	338,4	355,11	352,23	707,34	30.54	3.072	99.687	0.313
Pan	375,88	377,64	377,23	754,87	3.11	0.313	100.000	0.000
Jumlah				993,99		292.446		

$$\text{Modulus Halus Butir} = \frac{292,446}{100} = 2,92446$$

Kesimpulan MHB pasir $1,5 \leq 2,92446 \leq 3,8$ (Syarat Terpenuhi)

Yogyakarta, Februari 2016

Mengetahui,

Dinar Gumilang S.T.,M.T.
(Kepala LSBB UAJY)



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

PEMERIKSAAN BERAT JENIS DAN PENYERAPAN PASIR

Bahan : Pasir

Asal : Sungai Progo, Kulon Progo, Daerah Istimewa Yogyakarta

Diperiksa : 26 Oktober 2015

	Nomor Pemeriksaan	I	II
A	Berat Contoh Kering Udara (gr) (A)	454.6	620.12
B	Berat Contoh Kering Permukaan (SSD) (gr) (B)	470	639.62
C	Berat Contoh Dalam Air (gr) (C)	285	390
D	Berat Jenis <i>Bulk</i> = $\frac{(A)}{(B)-(C)}$	2.6199	2.588
E	BJ Jenuh Kering Permukaan (SSD) = $\frac{(B)}{(B)-(C)}$	2.6858	2.6424
F	Berat Jenis Semu (<i>Apparent</i>) = $\frac{(A)}{(A)-(C)}$	2.8046	2.737
G	Penyerapan (<i>Absorption</i>) = $\frac{(B)}{(B)-(A)} \times 100\%$	2.5123	2.104

Rata-rata Berat Jenis *Bulk* = 2.604 gr/cm³

Rata-rata BJ Jenuh Kering Permukaan (SSD) = 2.6641 gr/cm³

Rata-rata Berat Jenis Semu (*Apparent*) = 2.7708 gr/cm³

Rata-rata Penyerapan (*Absorption*) = 2.3081 gr/cm³

Yogyakarta, Februari 2016

Mengetahui,

Dinar Gumilang S.T.,M.T.
(Kepala LSBB UAJY)



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

PEMERIKSAAN KANDUNGAN LUMPUR DALAM PASIR

- I. Waktu Pemeriksaan: 27 Oktober 2015
- II. Bahan
- a. Pasir kering tungku, Asal : Kali Progo, Berat: 100 gram
- b. Air jernih asal : L.SBB Prodi TS FT-UAJY
- III. Alat
- a. Gelas ukur, ukuran: 250 cc
- b. Timbangan
- c. Tungku (*oven*), suhu dibuat antara 105-110°C
- d. Air tetap jernih setelah 7 kali pengocokan
- e. Pasir + piring masuk tungku tanggal 14 Mei jam 09.48 WIB
- IV. Hasil
- Setelah pasir keluar tungku tanggal 15 Mei jam 10.00 WIB
- a. Berat Pasir Awal (A) = 100 gr
- b. Berat Pasir Kering Oven = 99.2 gr
- c. Kandungan Lumpur = $\frac{100 - 99.2}{100} \times 100\% = 0.8\%$
- V. Kesimpulan
- Kandungan lumpur $\leq 1\%$, maka pasir baik untuk digunakan.

Yogyakarta, Februari 2016

Mengetahui,

Dinar Gumilang S.T.,M.T.
(Kepala LSBB UAJY)



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

PEMERIKSAAN KANDUNGAN ZAT ORGANIK DALAM PASIR

I. Waktu Pemeriksaan: 26 Oktober 2015

II. Bahan

- a. Pasir kering tungku, Asal: Kali Progo, Volume: 120 gram
- b. Larutan NaOH 3%

III. Alat

Gelas ukur, ukuran: 250 cc

IV. Hasil

Setelah didiamkan selama 24 jam, warna larutan di atas pasir sesuai dengan warna *Gardner Standard Color* No.5.

Yogyakarta, Februari 2016
Mengetahui,

Dinar Gumilang S.T.,M.T.
(Kepala LSBB UAJY)



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

PEMERIKSAAN GRADASI BESAR BUTIRAN *SPLIT*

Bahan : Batu Pecah (*Split*)
Asal : Clereng, Kulon Progo, Daerah Istimewa Yogyakarta
Diperiksa : 26 Oktober 2015

DAFTAR AYAKAN

Lubang saringan	Berat saringan (gr)	Berat saringan + pasir (gr)			Berat pasir tertahan (gr)	Sisa Ayakan (%)	Jumlah Sisa Ayakan (%)	Jumlah yang Melalui ayakan (%)
		Perc. 1	perc.2	Jumlah				
50	481.92	481.92	481.92	963.84	0	0	0	100
37.5	564.11	564.11	564.11	1128.22	0	0	0	100
25	510.4	510.4	510.4	1020.8	0	0	0	100
19	558.86	572.53	571	1143.53	25.81	3.115	3.115	96.884
12.5	456.12	602.03	573.73	1175.76	263.52	31.809	34.925	65.075
9.5	462.05	717.28	570.99	1288.27	364.17	43.959	78.883	21.117
4.75	533.2	617.93	623.13	1241.06	174.66	21.083	99.966	0.034
2.36	477.18	477.18	477.46	954.64	0.28	0	100	0
1.18	324.61	324.61	324.61	649.22	0	0	100	0
0.6	405.81	0	0	0	0	0	100	0
0.3	293.67	0	0	0	0	0	100	0
0.15	286.36	0	0	0	0	0	100	0
0.075	338.4	0	0	0	0	0	100	0
Pan	375.88	0	0	0	0	0	100	0
Jumlah					828.44		716.890	

$$\text{Modulus Halus Butir} = \frac{716.890}{100} = 7.16889$$

Kesimpulan = $5,0 \leq 7.16889 \leq 8,0$ Syarat Terpenuhi (OK)

Yogyakarta, Februari 2016

Mengetahui,

Dinar Gumilang S.T.,M.T.
(Kepala LSBB UAJY)



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

PEMERIKSAAN BERAT JENIS DAN PENYERAPAN *SPLIT*

Bahan : Batu Pecah (*Split*)

Asal : Clereng

Diperiksa : 26 Oktober 2015

	Nomor Pemeriksaan	I	II
A	Berat Contoh Kering (gr) (A)	454.6	620.12
B	Berat Contoh Kering Permukaan (SSD) (gr) (B)	470	639.62
C	Berat Contoh Dalam Air (gr) (C)	285	390
D	Berat Jenis <i>Bulk</i> $= \frac{(A)}{(B) - (C)}$	2.457	2.484
E	BJ Jenuh Kering Permukaan (SSD) $= \frac{(B)}{(B) - (C)}$	2.54	2.562
F	Berat Jenis Semu (<i>Apparent</i>) $= \frac{(A)}{(A) - (C)}$	2.6804	2.6947
G	Penyerapan (<i>Absorption</i>) $= \frac{(B)}{(B) - (A)} \times 100\%$	3.3876	3.144

Rata-rata Berat Jenis *Bulk* = 2.4707 gr/cm³

Rata-rata BJ Jenuh Kering Permukaan (SSD) = 2.5514 gr/cm³

Rata-rata Berat Jenis Semu (*Apparent*) = 2.6876 gr/cm³

Rata-rata Penyerapan (*Absorption*) = 3.266 gr/cm³

Yogyakarta, Februari 2016

Mengetahui,

Dinar Gumilang S.T.,M.T.
(Kepala LSBB UAJY)



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.ujy.ac.id

PEMERIKSAAN KANDUNGAN LUMPUR DALAM *SPLIT*

- I. Waktu Pemeriksaan: 27 Oktober 2015
- II. Bahan
 - a. *Split* kering tungku asal : Clereng, Berat: 500 gram
 - b. Air jernih asal : L.SBB Prodi TS FT-UAJY
- III. Alat
 - a. Pan
 - b. Timbangan
 - c. Tungku (*oven*), suhu dibuat antara 105-110°C
 - d. Air tetap jernih setelah 8 kali pencucian dalam air
 - e. *Split* + pan masuk tungku tanggal 26 Oktober jam 10.30 WIB

IV. Hasil

Setelah pasir keluar tungku tanggal 27 Oktober jam 10.45 WIB

- a. Berat Pasir Awal (A) = 500 gr
- b. Berat Pasir Kering Oven = 492.15 gr
- c. Kandungan Lumpur = $\frac{500 - 492.15}{500} \times 100\% = 1.57\%$

Kesimpulan: Kandungan lumpur $\geq 1\%$, maka sebaiknya dicuci terlebih dahulu.

Yogyakarta, Februari 2016
Mengetahui,

Dinar Gumilang S.T.,M.T.
(Kepala LSBB UAJY)



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

PEMERIKSAAN LOS ANGELES ABRASION TEST

Bahan : Batu Pecah (*Split*)

Asal : Clereng

Diperiksa : 26 Oktober 2015

Gradasi Saringan		Nomor Contoh
		I
Lolos	Tertahan	Berat masing-masing agregat
¾"	½"	2500 gram
½"	3/8"	2500 gram

Nomor Contoh	I
Berat sebelumnya (A)	5000 gram
Berat sesudah diayak saringan no.12 (B)	3550 gram
Berat sesudah (A)-(B)	1450 gram
$\text{Keausan} = \frac{(A) - (B)}{(A)} \times 100\%$	29%
Keausan rerata	29%

Kesimpulan Keausan rerata $\leq 40\%$ (syarat terpenuhi)

Yogyakarta, Februari 2016

Mengetahui,

Dinar Gumilang S.T.,M.T.
(Kepala LSBB UAJY)

Master Glenium ACE[®] 8590

(Formerly known as Glenium 190)

New high-range superplasticiser for precast application

DESCRIPTION

Master Glenium ACE[®] 8590 is a polycarboxylic ether (PCE) based superplasticiser developed for high early strength development suited to precast manufacturing requirements. **Master Glenium ACE[®] 8590** provides superior water reduction while offering good workability under hot weather condition.

The rapid development of early strength of **Master Glenium ACE[®] 8590** allows for zero or minimum application of heating curing processes. The combination of early strength, slump retention and late strength development allows **Master Glenium ACE[®] 8590** to meet demanding concreting requirements, often exceeding the performance of conventional superplasticisers.

Master Glenium ACE[®] 8590 is not compatible with RHEOBUILD range of superplasticisers.

CHEMISTRY AND MECHANISM

Master Glenium ACE[®] 8590 is differentiated from conventional superplasticisers in that it is based on a unique polycarboxylate ether polymer with long lateral chains. This greatly improves cement dispersion. Conventional superplasticisers, such as those based on sulphonated melamine and naphthalene formaldehyde condensates, at the time of mixing, become absorbed onto the surface of the cement particles. This absorption takes place at a very early stage in the hydration process. The sulphonic groups of the polymer chains increase the negative charge on the surface of the cement particle and dispersion of the cement occurs by electrostatic repulsion.

At the start of the mixing process the same electrostatic dispersion occurs as described previously, but the presence of the lateral chains, linked to the polymer backbone, generate a steric hindrance, which stabilises the cement particles capacity to separate and disperse. This mechanism provides flowable concrete with greatly reduced water demand.

FEATURES AND BENEFITS

Master Glenium ACE[®] 8590 offers the following benefits:

- High water reduction capacity over conventional superplasticizers

- Low permeability and high durability concrete
- Flowability for ease of placement and compaction
- Optimize curing cycle by shortening curing time or decreasing curing temperature
- Eliminate energy required for placing, consolidation and curing
- Improved surface appearance and concrete quality

APPLICATION

Master Glenium ACE[®] 8590 is a liquid admixture to be added to the concrete during the mixing process. The best results are obtained when the admixture is added after all the other components are already in the mixer and after the addition of at least 80% of the total water.

DOSAGE

The normally recommended dosage rate is 0.7 to 1.2 litres per 100 kg of binder. Other dosages may be used in special cases according to specific job site conditions. In this case please consult our Master Builders Solutions representative.

PACKAGING

Master Glenium ACE[®] 8590 is available in bulk and 205L drums.

SHELF LIFE

Master Glenium ACE[®] 8590 must be stored in a place where the temperature is not below 0°C. In case the product freezes, increase the temperature of the product to 30°C and remix.

PRECAUTIONS

Health: **Master Glenium ACE[®] 8590** does not contain any hazardous substances need to be labelled. It is safe for use with standard precautions followed in the construction industry, such as use of hand gloves, safety goggles, etc. For detailed health, safety and environmental recommendations, please consult and follow all instructions on the product Material Safety Data Sheet.



The Chemical Company

Master Glenium ACE[®] 8590

(Formerly known as Glenium 190)



AN/ Master Glenium ACE[®] 8590//v1/19031

STATEMENT OF RESPONSIBILITY The technical information and application advice given in this BASF publication are based on the present state of our best scientific and practical knowledge. As the information herein is of a general nature, no assumption can be made as to a product's suitability for a particular use or application and no warranty as to its accuracy, reliability or completeness either expressed or implied is given other than those required by law. The user is responsible for checking the suitability of products for their intended use.

NOTE Field service where provided does not constitute supervisory responsibility. Suggestions made by BASF either orally or in writing may be followed, modified or rejected by the owner, engineer or contractor since they, and not BASF, are responsible for carrying out procedures appropriate to a specific application.

PT BASF Indonesia

Head Office

DBS Bank Tower, 27th Floor
Ciputra World 1 Jakarta
Jl. Prof. Dr. Satrio Kav 3-5
Jakarta 12940, Indonesia
Tel.: +62 21 29886000
Fax: +62 21 29885930

Cengkareng Site

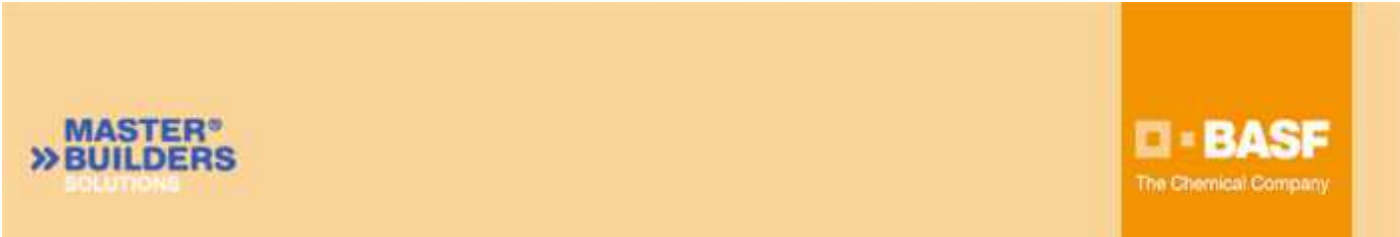
Jl. Daan Mogot Km.14
Cengkareng
Jakarta 11750
Tel.: +62 21 29392200
Fax: +62 21 6190741

Cikarang Site

Jl. Jababeka V Blok I-1
Cikarang Industrial
Estate
Bekasi 17530
Tel.: +62 21 8934339
Fax: +62 21 8934342

Merak Site

Jl. Raya Salira-Merak,
Desa Mangunreja
Kec. Pulo Ampel, Kab.
Serang
Banten 42438
Tel.: +62 254 5750011
Fax: +62 254 5750012



Products > MasterGleniumAce

MasterGlenium ACE 8590
New high-range superplasticiser for precast application
Formerly Glenium 190

Downloads
No downloads available

How does MasterGlenium ACE 8590 work?

MasterGlenium ACE 8590 is a polycarboxylic ether (PCE) based superplasticiser developed for high early strength development suited to precast manufacturing requirements.

What makes MasterGlenium ACE 8590 a unique solution?

MasterGlenium ACE 8590 is differentiated from conventional superplasticisers in that it is based on a unique polycarboxylate ether polymer with long lateral chains. This greatly improves cement dispersion.

What are the features and benefits of MasterGlenium ACE 8590?

MasterGlenium ACE 8590 offers the following benefits:

- High water reduction capacity over conventional superplasticizers
- Low permeability and high durability concrete
- Flowability for ease of placement and compaction
- Optimize curing cycle by shortening curing time or decreasing curing temperature
- Eliminate energy required for placing, consolidation and curing
- Improved surface appearance and concrete quality

Follow us

- Facebook
- Google+
- Twitter
- LinkedIn
- YouTube
- Flickr

Page Functions

- Tell a friend
- Share
- Contact
- Print

General Information

- Disclaimer
- Data protection
- Credits
- Copyright 2015
- © Registered trademark of the BASF Group in many countries of the world



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

LAMPIRAN II

HASIL PENGUJIAN KUAT TARIK BAJA

1. Baja Tulangan P10-01

Beban (kgf)	Beban (N)	$\Delta P(10^{-2})$	Tegangan (f) (MPa)	Regangan (e) (10^{-4})	Regangan Koreksi (e) (10^{-4})
0	0	0	0	0,266	0
100	980,67	1,5	12,486	0,911	0,645
200	1961,34	3	24,973	1,821	1,556
300	2942,01	4	37,459	2,429	2,163
400	3922,68	5	49,945	3,036	2,770
500	4903,36	6	62,431	3,643	3,377
600	5884,03	7	74,918	4,250	3,984
700	6864,70	8	87,404	4,857	4,592
800	7845,37	9	99,890	5,464	5,199
900	8826,04	10	112,377	6,072	5,806
1000	9806,71	11	124,863	6,679	6,413
1100	10787,38	11,5	137,349	6,982	6,717
1200	11768,05	12	149,835	7,286	7,020
1300	12748,72	13	162,322	7,893	7,627
1400	13729,39	15	174,808	9,107	8,842
1500	14710,07	16	187,294	9,715	9,449
1600	15690,74	17,5	199,781	10,625	10,360
1700	16671,41	19	212,267	11,536	11,270
1800	17652,08	19,5	224,753	11,840	11,574
1900	18632,75	20	237,240	12,143	11,878
2000	19613,42	21	249,726	12,750	12,485
2100	20594,09	23	262,212	13,965	13,699
2200	21574,76	24	274,698	14,572	14,306
2300	22555,43	25	287,185	15,179	14,913
2400	23536,10	26	299,671	15,786	15,521
2500	24516,78	27	312,157	16,393	16,128
2600	25497,45	28	324,644	17,001	16,735
2700	26478,12	29	337,130	17,608	17,342



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

Diameter = 10 mm
Luas = 78,540 mm²
Po = 164,7 mm
Beban maksimum = 3930 Kgf
Tegangan leleh = 344,7372 MPa
Tegangan maksimum = 490,8759 MPa
Modulus Elastisitas = 194400,426 MPa

2. Baja Tulangan P10-02

Beban (kgf)	Beban (N)	$\Delta P(10^{-2})$	Tegangan (f) (MPa)	Regangan (e) (10^{-4})	Regangan Koreksi (e) (10^{-4})
0	0	0	0	-1,034	0
100	980,67	0	12,486	0,000	1,034
200	1961,34	0,5	24,973	0,303	1,337
300	2942,01	1	37,459	0,606	1,640
400	3922,68	2	49,945	1,211	2,245
500	4903,36	3,5	62,431	2,120	3,154
600	5884,03	4	74,918	2,423	3,457
700	6864,70	5	87,404	3,028	4,063
800	7845,37	6	99,890	3,634	4,668
900	8826,04	6,5	112,377	3,937	4,971
1000	9806,71	7,5	124,863	4,543	5,577
1100	10787,38	9	137,349	5,451	6,485
1200	11768,05	10	149,835	6,057	7,091
1300	12748,72	10,5	162,322	6,360	7,394
1400	13729,39	11,5	174,808	6,965	8,000
1500	14710,07	12,5	187,294	7,571	8,605
1600	15690,74	13,5	199,781	8,177	9,211
1700	16671,41	14,5	212,267	8,783	9,817
1800	17652,08	15,5	224,753	9,388	10,422
1900	18632,75	16,5	237,240	9,994	11,028
2000	19613,42	18	249,726	10,902	11,937
2100	20594,09	19	262,212	11,508	12,542
2200	21574,76	20	274,698	12,114	13,148
2300	22555,43	21	287,185	12,720	13,754



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

2400	23536,10	21,5	299,671	13,022	14,056
2500	24516,78	22,5	312,157	13,628	14,662
2600	25497,45	23	324,644	13,931	14,965
2700	26478,12	24	337,130	14,537	15,571

Diameter = 10 mm
Luas = 78,540 mm²
Po = 165,1 mm
Beban maksimum = 3940 Kgf
Tegangan leleh = 342,2391 MPa
Tegangan maksimum = 492,1249 MPa
Modulus Elastisitas = 216515,762 MPa

3. Baja Tulangan P10-03

Beban (kgf)	Beban (N)	$\Delta P(10^{-2})$	Tegangan (f) (MPa)	Regangan (e) (10^{-4})	Regangan Koreksi (e) (10^{-4})
0	0	0	0	0,120	0
100	980,67	1,5	12,486	0,908	0,788
200	1961,34	2,5	24,973	1,513	1,393
300	2942,01	4	37,459	2,421	2,301
400	3922,68	5	49,945	3,027	2,906
500	4903,36	6	62,431	3,632	3,512
600	5884,03	7	74,918	4,237	4,117
700	6864,70	8	87,404	4,843	4,722
800	7845,37	9	99,890	5,448	5,328
900	8826,04	10	112,377	6,053	5,933
1000	9806,71	11,5	124,863	6,961	6,841
1100	10787,38	12,5	137,349	7,567	7,446
1200	11768,05	13,5	149,835	8,172	8,051
1300	12748,72	15	162,322	9,080	8,959
1400	13729,39	16	174,808	9,685	9,565
1500	14710,07	17	187,294	10,291	10,170
1600	15690,74	19	199,781	11,501	11,381
1700	16671,41	20	212,267	12,107	11,986
1800	17652,08	21	224,753	12,712	12,591



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

1900	18632,75	22	237,240	13,317	13,197
2000	19613,42	23	249,726	13,923	13,802
2100	20594,09	24	262,212	14,528	14,407
2200	21574,76	25	274,698	15,133	15,013
2300	22555,43	26	287,185	15,738	15,618
2400	23536,10	27	299,671	16,344	16,223
2500	24516,78	29	312,157	17,554	17,434
2600	25497,45	30	324,644	18,160	18,039
2700	26478,12	31	337,130	18,765	18,645

Diameter = 10 mm

Luas = 78,540 mm²

Po = 165,2 mm

Beban maksimum = 3940 Kg

Tegangan leleh = 344,7372 MPa

Tegangan maksimum = 492,1249 MPa

Modulus Elastisitas = 180818,0818 Mpa

4. Rerata dari pengujian Tulangan P10

	P10-01	P10-02	P10-03	Rata -rata
fy (MPa)	344,7372462	342,2391502	344,7372462	343,9045475
fu (MPa)	490,8758614	492,1249094	492,1249094	491,7085601
Ec	194400,4263	216515,7623	180818,0818	197244,7568
Po	164,7	165,1	165,2	165



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

5. Baja Tulangan P6-01

Diameter	= 4,85 mm
Luas	= 18,4745 mm ²
Beban Maksimum	= 760 kgf
Tegangan Leleh	= 276,1207 MPa
Tegangan Maksimum	= 403,561 MPa

6. Baja Tulangan P6-01

Diameter	= 4,85 mm
Luas	= 18,4745 mm ²
Beban Maksimum	= 795 kgf
Tegangan Leleh	= 289,3958 MPa
Tegangan Maksimum	= 422,1461 MPa

7. Baja Tulangan P6-03

Diameter	= 4,85 mm
Luas	= 18,4745 mm ²
Beban Maksimum	= 810 kgf
Tegangan Leleh	= 297,3608 MPa
Tegangan Maksimum	= 430,1111 MPa

8. Rerata dari Pengujian Tulangan P6

Tegangan Leleh	= 287,6257 MPa
Tegangan Maksimum	= 418,6061 MPa



LAMPIRAN III

PERENCANAAN ADUKAN UNTUK BETON NORMAL (SNI 03-2834-2000)

A. Data Bahan

1. Bahan Agregat halus (pasir) : Sungai Progo, Yogyakarta.
2. Bahan Agregat kasar : Clereng, Yogyakarta.
3. Jenis semen : Gresik (Tipe 1)

B. Data *Specific Gravity*

1. *Specific gravity* agregat halus (pasir) : 2.604 gr/cm³.
2. *Specific gravity* agregat kasar (krikil) : 2.4707 gr/cm³.
3. *Absorption* agregat halus (pasir) : 2.3081 %
4. *Absorption* agregat kasar (krikil) : 3.266 %

C. Hitungan

1. Kuat tekan beton yang disyaratkan (f_c') pada umur 28 hari. $f_c' = 20$ MPa.
2. Menentukan nilai deviasi standar berdasarkan tingkat mutu pengendalian pelaksanaan campuran.
3. Berdasarkan SNI butir 4.2.3.1 1 (5) nilai margin ditentukan sebesar 4,592 MPa.
4. Menetapkan kuat tekan beton rata-rata yang direncanakan berdasarkan SNI butir 4.2.3.1 3.

$$f_c' = f_c' + M = 20 + 4,592 = 24,592 \text{ MPa.}$$



5. Menentukan jenis semen

Jenis semen kelas I (PC).

6. Menetapkan jenis agregat

a) Agregat halus : pasir alam.

Direncanakan golongan 2.

b) Agregat kasar : batu pecah

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

Perkiraan Kekuatan Tekan (MPa) Beton dengan Faktor Air Semen, dan Agregat Kasar yang Biasa Dipakai di Indonesia

Jenis semen ...	Jenis agregat Kasar	Kekuatan tekan (MPa)			
		Pada umur (hari)			
		3	7	28	29
Semen Portland Tipe I	Batu tak dipecahkan	17	23	33	40
	Batu pecah	19	27	37	45
Semen tahan sulfat Tipe II, V	Batu tak dipecahkan	20	28	40	48
	Batu pecah	25	32	45	54
Semen Portland tipe III	Batu tak dipecahkan	21	28	38	44
	Batu pecah	25	33	44	48
	Batu tak dipecahkan Batu pecah	25	31	46	53
		30	40	53	60

(Sumber : SNI 03-2834-2000 : Tabel 2)

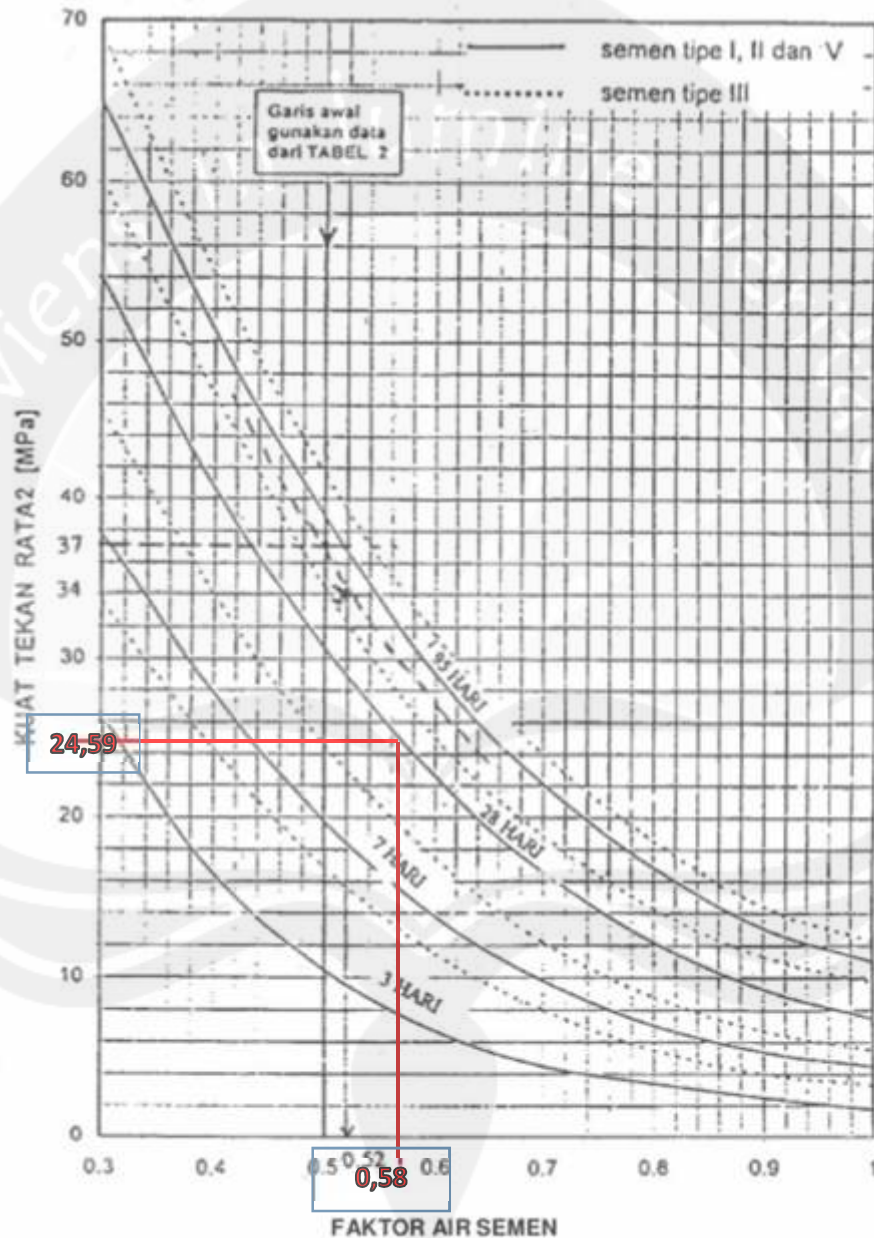
Berdasarkan tabel 2 SNI 03-2834-2000 didapat kuat tekan 37 MPa, Dari titik kekuatan tekan 37 MPa tarik garis datar hingga memotong garis tengah yang menunjukkan faktor air semen 0,50. Melalui titik potong ini lalu gambarkan kurva yang berbentuk kira-kira sama dengan kurva di sebelah atas dan di sebelah bawahnya (garis dengan warna kuning). Kemudian dari titik kekuatan tekan beton yang dirancang (dalam hal ini 32 MPa) tarik garis datar hingga memotong kurva garis kuning tadi. Dari titik potong ini tarik garis tegak ke bawah hingga memotong sumbu X



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

(absiska) dan dibaca faktor air semen yang diperoleh. Didapatkan sebesar 0,58.



Hubungan Kuat Tekan Silinder dengan Fas

(Sumber : SNI 03-2834-2000 : Grafik 1)



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

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	275	0,6
b. Keadaan keliling korosif disebabkan oleh kondensasi atau uap korosif	325	0,52
Beton diluar ruangan bangunan :		
a. tidak terlindung dari hujan dan terik matahari langsung	325	0,60
b. terlindung dari hujan dan terik matahari langsung	275	0,60
Beton masuk kedalam tanah :		
a. mengalami keadaan basah dan kering berganti-ganti	325	0,55
b. mendapat pengaruh sulfat dan alkali dari tanah		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 terkecil. Jadi digunakan fas 0,58.

9. Menetapkan nilai “slump”

Jenis konstruksi balok, berdasarkan SK SNI T-15-1990-03 digunakan nilai slump dengan nilai maksimum 150 mm dan minimum 75 mm.

Slump dalam cm		
Pemakaian beton	Maks.	Min.
Dinding, plat fondasi, dan fondasi telapak bertulang	12,5	5,0
Fondasi telapak tidak bertulang, kaisan, dan struktur di bawah tanah	9,0	2,5
Pelat, balok, kolom, dan dinding	15,0	7,5
Pengerasan jalan	7,5	5,0
Pembetonan massa	7,5	2,5



10. Ukuran butiran maksimum (krikil) adalah 20 mm.

11. Menetapkan jumlah air yang diperlukan tiap m³ beton.

Perkiraan Kadar Air Bebas (kg/m³) yang Dibutuhkan Untuk Beberapa Tingkat Kemudahan Pengerjaan Adukan Beton

Ukuran Agregat Maksimum (mm)	Jenis Batuan	Slump (mm)			
		0-10	10-30	30-60	60-180
10	Alami	150	180	205	225
	Batu pecah	180	205	230	250
20	Alami	135	160	180	195
	Batu pecah	170	190	210	225
40	Alami	115	140	160	175
	Batu pecah	155	175	190	205

(Sumber : SNI 03-2834-2000 : Tabel 3)

- a) Ukuran butir maksimum 20 mm.
- b) Nilai *Slump* 75 - 150 mm.
- c) Agregat halus berupa batu tak di pecah, maka $W_h = 195$
- d) Agregat kasar berupa batu pecah, maka $W_k = 225$

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

dengan : W_h adalah perkiraan jumlah air untuk agregat halus

W_k adalah perkiraan jumlah air untuk agregat kasar

$$W = \frac{2}{3} \times 195 + \frac{1}{3} \times 225 = 205 \text{ kg}$$

12. Menghitung berat semen yang diperlukan :

- a) Berdasarkan tabel 4 SNI 03-2834-2000, diperoleh semen minimum 275 kg.



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

b) Berdasarkan $f_{as} = 0,58$. Semen per m^3 beton $= \frac{A}{f_{as}} = \frac{205}{0,58}$

$$= 354,4873 \text{ kg}$$

Dipilih berat semen paling besar. Digunakan berat semen 354,4873 kg.

13. Penyesuaian jumlah air atau f_{as} .

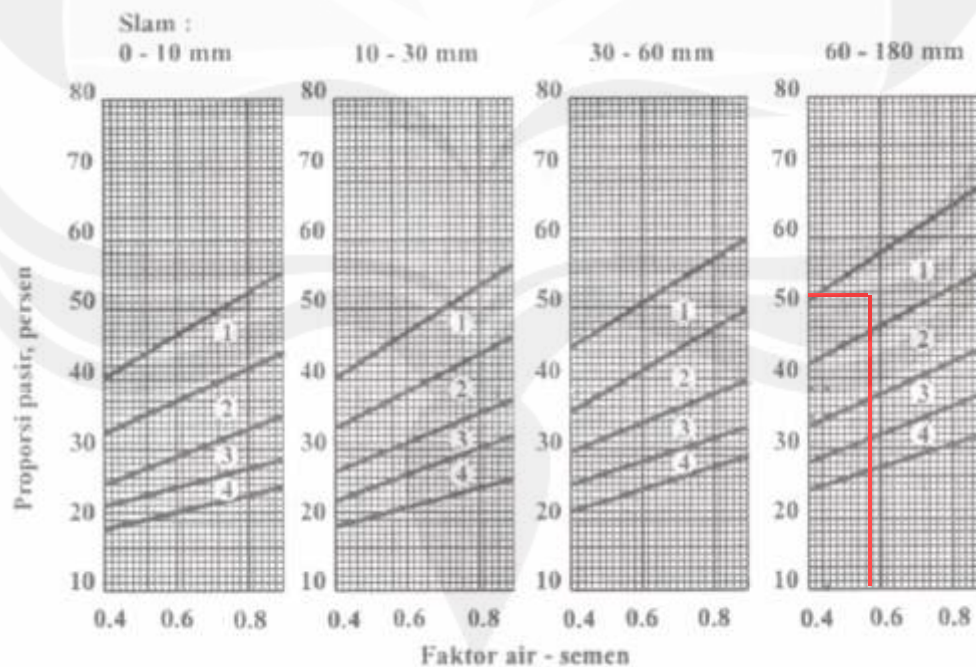
$$f_{as \text{ rencana}} = 0,58$$

$$f_{as \text{ mak}} > f_{as \text{ rencana}}$$

$$0,6 > 0,58 \text{ oke}$$

14. Perbandingan agregat halus dan kasar

**Persen Pasir Terhadap Kadar Total Agregat yang Dianjurkan
Untuk Ukuran Butir Maksimum 20 mm**



(Sumber : SNI 03-2834-2000 : Tabel 13)



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

- a) Ukuran maksimum 20 mm.
- b) Nilai *Slump* 75 mm – 150 mm
- c) *fas* 0,55.
- d) Jenis gradasi pasir no. 1.

Diambil proporsi pasir = 53 %.

15. Berat jenis agregat campuran :

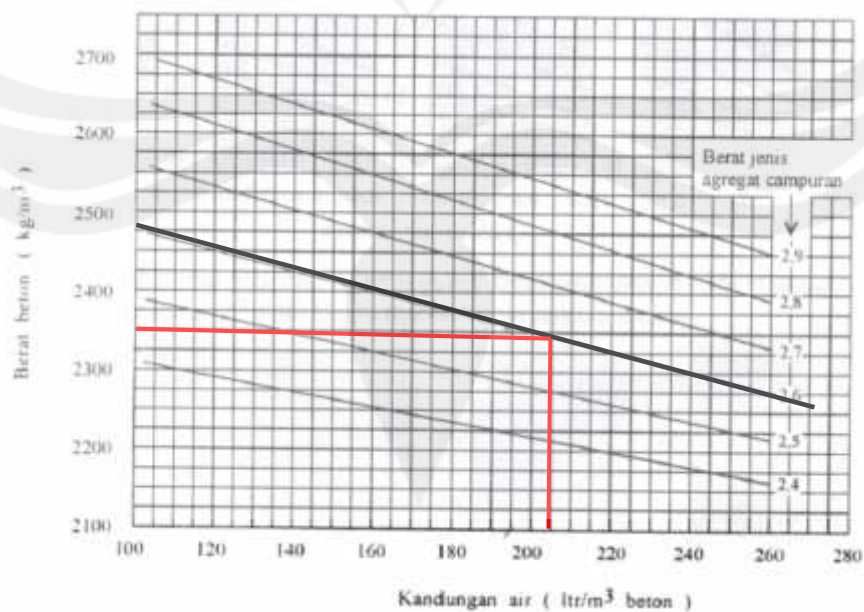
$$= \frac{P}{100} \times B_j \text{ agregat halus} + \frac{K}{100} \times B_j \text{ agregat kasar}$$
$$= 2,6112$$

dimana :

P = % agregat halus terhadap agregat campuran

K = % agregat kasar terhadap agregat campuran

16. Berat jenis beton



Perkiraan Berat Isi Beton yang Telah Selesai Didapatkan

(Sumber : SNI 03-2834-2000 : Grafik 16)



Bj campuran (langkah 15) $\rightarrow 2,6112 \text{ kg/m}^3 \rightarrow$ dibuat garis bantu diantara 2,6 dan 2,7.

Keperluan air yaitu 205 kg (langkah 11) $\rightarrow$ ditarik garis vertical ke atas sampai menyentuh garis, kemudian tarik ke kiri di dapat $2353,333 \text{ kg/m}^3$.

17. Berat agregat campuran

$$\begin{aligned} &= \text{berat tiap m}^3 - \text{keperluan air dan semen} \\ &= 1793,846 \text{ kg} \end{aligned}$$

18. Menghitung berat agregat halus

$$\begin{aligned} \text{berat agregat halus} &= \% \text{ berat agregat halus} \times \text{keperluan agregat} \\ &\quad \text{campuran} \\ &= 950,7384 \text{ kg} \end{aligned}$$

19. Menghitung berat agregat kasar

$$\begin{aligned} \text{berat agregat kasar} &= \% \text{ berat agregat kasar} \times \text{keperluan agregat} \\ &\quad \text{campuran} \\ &= 843,1076 \text{ kg} \end{aligned}$$

$$\begin{aligned} 20. \text{ Volume Silinder} &= \frac{1}{4} \cdot \pi \cdot D^2 \\ &= 5301,438 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Volume Balok} &= P \cdot L \cdot T \\ &= 200 \cdot 20 \cdot 10 \\ &= 40000 \text{ cm}^3 \end{aligned}$$

21. Penambahan Glenium ACE 8590, dapat mereduksi atau mengurangi pemakaian air sebesar 25 %.



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

22. Rekap kebutuhan dikalikan dengan *Safety Faktor* 1,15 per m³ =

Air = 235,75 liter

Semen = 407,6604 kg x 0,9 = 366,8943 kg

Agregat Halus = 1093,349 kg

Agregat Kasar = 969,5738 kg

Glenium 1,2% = 1,2% x 407,6604 kg = 4,8919 liter

Glenium 1,5% = 1,5% x 407,6604 kg = 6,1149 liter

Kebutuhan Bahan Susun Adukan Beton :

* Kebutuhan Satu Silinder

Semen	1,9451	Kg
Pasir	5,7963	Kg
Kerikil	5,1401	Kg
Air	1,2498	L
Glenium 1,2 %	0,0259	L
Glenium 1,5 %	0,0324	L

* Kebutuhan Satu Balok

Semen	14,6758	Kg
Pasir	43,7340	Kg
Kerikil	38,7830	Kg
Air	9,43	L
Glenium 1,2 %	0,1957	L
Glenium 1,5 %	0,2446	L



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

Kebutuhan Bahan Susun Adukan BN :

* Kebutuhan 2 Balok + 4 Silinder

Semen	41,2576	Kg
Pasir	110,6532	Kg
Kerikil	98,1264	Kg
Air	23,8593	L

Kebutuhan Bahan Susun Adukan BG 1,2 % :

* Kebutuhan 2 Balok + 4 Silinder

Semen	41,258	Kg
Pasir	110,6532	Kg
Kerikil	98,1264	Kg
Air	17,89	L
Glenium 1,2 %	0,495	L

Kebutuhan Bahan Susun Adukan BG 1,5 % :

* Kebutuhan 2 Balok + 4 Silinder

Semen	41,258	Kg
Pasir	110,6532	Kg
Kerikil	98,1264	Kg
Air	17,89	L
Glenium 1,2 %	0,619	L



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

LAMPIRAN IV

DATA PENGUJIAN SILINDER BETON

1. Beton BN

Beban (kgf)	Beban (N)	DP (10^{-3})	Tegangan (f) (MPa)	Regangan (e) (10^{-5})	Regangan koreksi (e) (10^{-5})
0	0			-0,7696	0
500	4903,355	2	0,2742	0,9901	1,7597
1000	9806,71	3,5	0,5483	1,7327	2,5023
1500	14710,065	4,5	0,8225	2,2277	2,9973
2000	19613,42	7,5	1,0967	3,7129	4,4825
2500	24516,775	11	1,3709	5,4455	6,2152
3000	29420,13	13,5	1,6450	6,6832	7,4528
3500	34323,485	15,5	1,9192	7,6732	8,4429
4000	39226,84	19	2,1934	9,4059	10,1756
4500	44130,195	22,5	2,4676	11,1386	11,9082
5000	49033,55	25	2,7417	12,3762	13,1459
5500	53936,905	27,5	3,0159	13,6139	14,3835
6000	58840,26	30	3,2901	14,8515	15,6211
6500	63743,615	34	3,5642	16,8317	17,6013
7000	68646,97	36	3,8384	17,8218	18,5914
7500	73550,325	39,5	4,1126	19,5545	20,3241
8000	78453,68	42,5	4,3868	21,0396	21,8092
8500	83357,035	45	4,6609	22,2772	23,0469
9000	88260,39	47,5	4,9351	23,5148	24,2845
9500	93163,745	52,5	5,2093	25,9901	26,7597
10000	98067,1	55	5,4835	27,2277	27,9973
10500	102970,455	57,5	5,7576	28,4653	29,2350
11000	107873,81	62,5	6,0318	30,9406	31,7102

Diameter = 150,9 mm

Luas = 17705,06 mm²

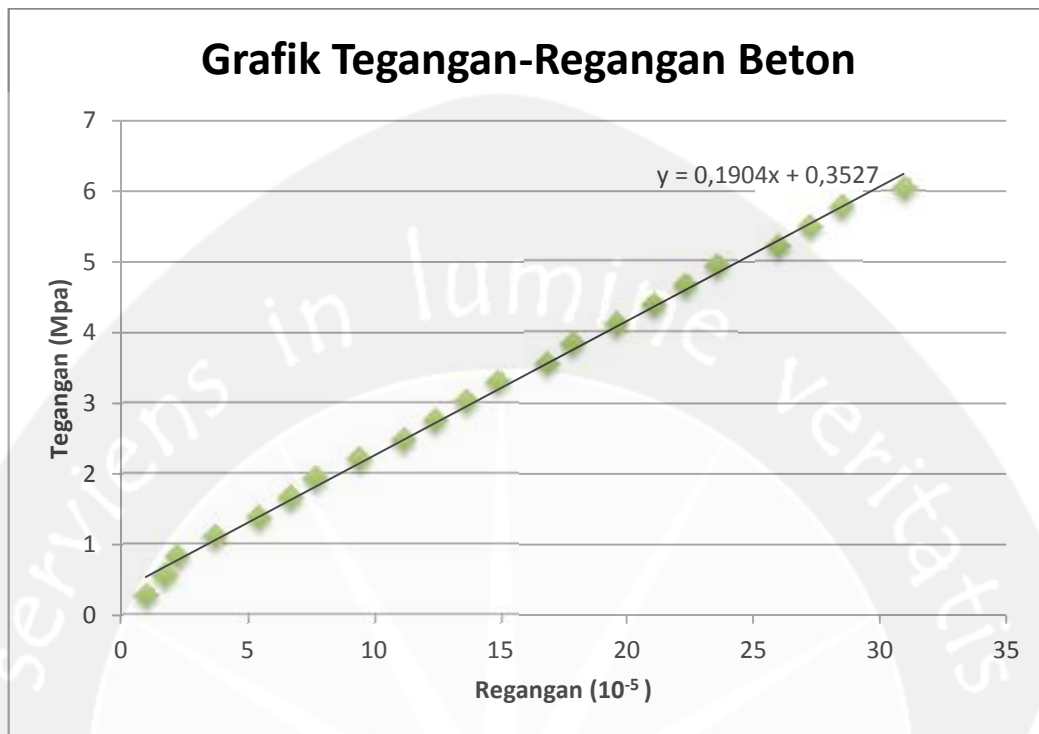
Po = 201,8 mm

Modulus Elastisitas = 19021,661 MPa



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id



Pengujian kuat tekan Beton BN

Keterangan	Ukuran/Dimensi		Berat (kg)	Kuat Desak (kN)	Kuat Desak (MPa)
	Tinggi (cm)	Diameter (cm)			
BN 01	30	15	12,39	420	23,7792
BN 02	29,96	15,09	12,36	360	20,1398
BN 03	30,25	15,03	12,42	365	20,5828
BN 04	30,06	15,01	12,34	410	23,1821
BN 05	30,17	14,96	12,38	340	19,3529
Rata-rata				379	21,4074



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

2. Beton BG 1,2%

Beban (kgf)	Beban (N)	DP (10^{-3})	Tegangan (f) (MPa)	Regangan (e) (10^{-5})	Regangan koreksi (e) (10^{-5})
0	0			-0,7696	0
500	4903,355	0,5	0,2797	0,2486	1,0183
1000	9806,71	2	0,5594	0,9945	1,7642
1500	14710,065	4,5	0,8391	2,2377	3,0073
2000	19613,42	6	1,1188	2,9836	3,7532
2500	24516,775	8,5	1,3985	4,2268	4,9964
3000	29420,13	11	1,6782	5,4699	6,2395
3500	34323,485	13	1,9579	6,4644	7,2341
4000	39226,84	15,5	2,2377	7,7076	8,4772
4500	44130,195	17,5	2,5174	8,7021	9,4718
5000	49033,55	20,5	2,7971	10,1939	10,9636
5500	53936,905	22,5	3,0768	11,1885	11,9581
6000	58840,26	25,5	3,3565	12,6803	13,4499
6500	63743,615	28	3,6362	13,9234	14,6930
7000	68646,97	31	3,9159	15,4152	16,1848
7500	73550,325	33,5	4,1956	16,6584	17,4280
8000	78453,68	36,5	4,4753	18,1502	18,9198
8500	83357,035	39	4,7550	19,3933	20,1630
9000	88260,39	42,5	5,0347	21,1338	21,9034
9500	93163,745	45	5,3144	22,3769	23,1466
10000	98067,1	49	5,5941	24,3660	25,1356
10500	102970,455	51,5	5,8738	25,6091	26,3788
11000	107873,81	55	6,1535	27,3496	28,1192

Diameter = 149,4 mm

Luas = 17733,46 mm²

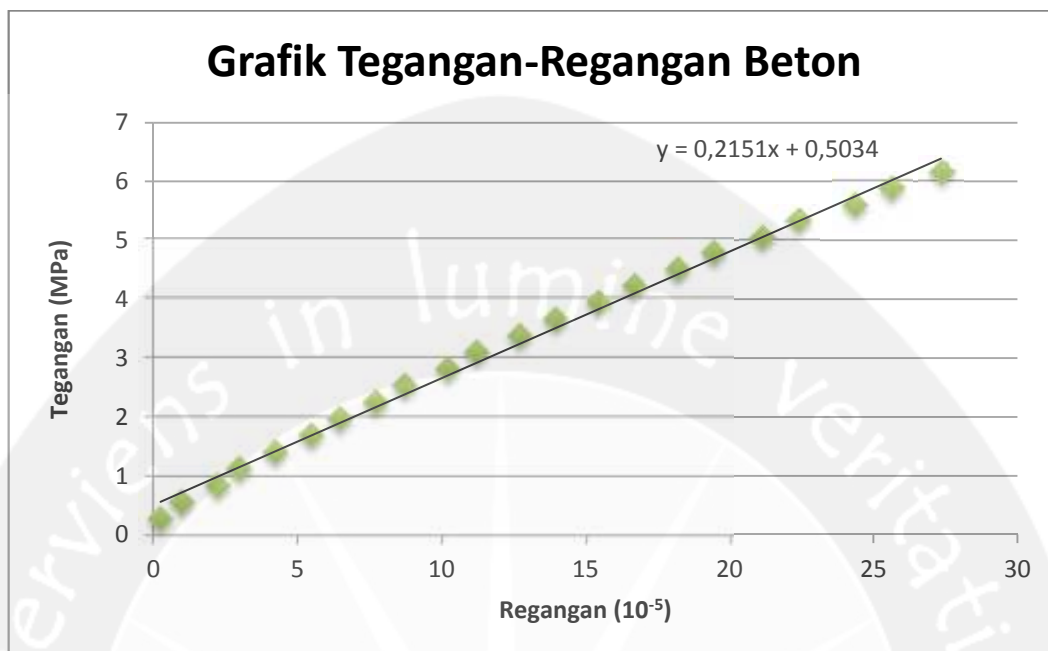
Po = 201,1 mm

Modulus Elastisitas = 21883,761 MPa



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
 Telp: (0274) 487711 Fax: (0274) 487748
 Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id



Pengujian kuat tekan Beton BG 1,2 %

Keterangan	Ukuran/Dimensi		Berat (kg)	Kuat Desak (kN)	Kuat Desak (MPa)
	Tinggi (cm)	Diameter (cm)			
SG 01	30,16	15,04	12,123	465	26,1871
SG 02	30,19	14,94	11,817	420	23,9706
SG 03	30,27	15,08	12,157	520	29,1294
SG 04	30,04	15	12,212	415	23,4961
SG 05	30,18	15,09	12,052	470	26,2936
Rata-rata				458	25,8153



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

3. Beton BG 1,5 %

Beban (kgf)	Beban (N)	DP (10^{-3})	Tegangan (f) (MPa)	Regangan (e) (10^{-5})	Regangan koreksi (e) (10^{-5})
0	0			-0,7696	0
500	4903,355	1	0,2778	0,4975	1,2671
1000	9806,71	2	0,5557	0,9950	1,7646
1500	14710,065	3,5	0,8335	1,7413	2,5109
2000	19613,42	5	1,1114	2,4876	3,2572
2500	24516,775	7	1,3892	3,4876	4,2522
3000	29420,13	8	1,6671	3,9801	4,7497
3500	34323,485	9,5	1,9449	4,7264	5,4960
4000	39226,84	11	2,2227	5,4726	6,2423
4500	44130,195	12,5	2,5006	6,2189	6,9885
5000	49033,55	14,5	2,7784	7,2139	7,9836
5500	53936,905	16	3,0563	7,9602	8,7298
6000	58840,26	18	3,3341	8,9552	9,7248
6500	63743,615	19,5	3,6120	9,7015	10,4711
7000	68646,97	21	3,8898	10,4478	11,2174
7500	73550,325	22,5	4,1677	11,1940	11,9637
8000	78453,68	25	4,4455	12,4378	13,2074
8500	83357,035	27	4,7233	13,4328	14,2025
9000	88260,39	29,5	5,0012	14,6766	15,4462
9500	93163,745	31	5,2790	15,4229	16,1925
10000	98067,1	32,5	5,5569	16,1692	16,9388
10500	102970,455	35,5	5,8347	17,6617	18,4313
11000	107873,81	37,5	6,1126	18,6567	19,4263
11500	112777,165	39	6,3904	19,4030	20,1726
12000	117680,52	40,5	6,6682	20,1493	20,9189
12500	122583,875	42,5	6,9461	21,1443	21,9139
13000	127487,23	44,5	7,2239	22,1393	22,9089
13500	132390,585	47	7,5018	23,3831	24,1527
14000	137293,94	49,5	7,7796	24,6269	25,3965



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

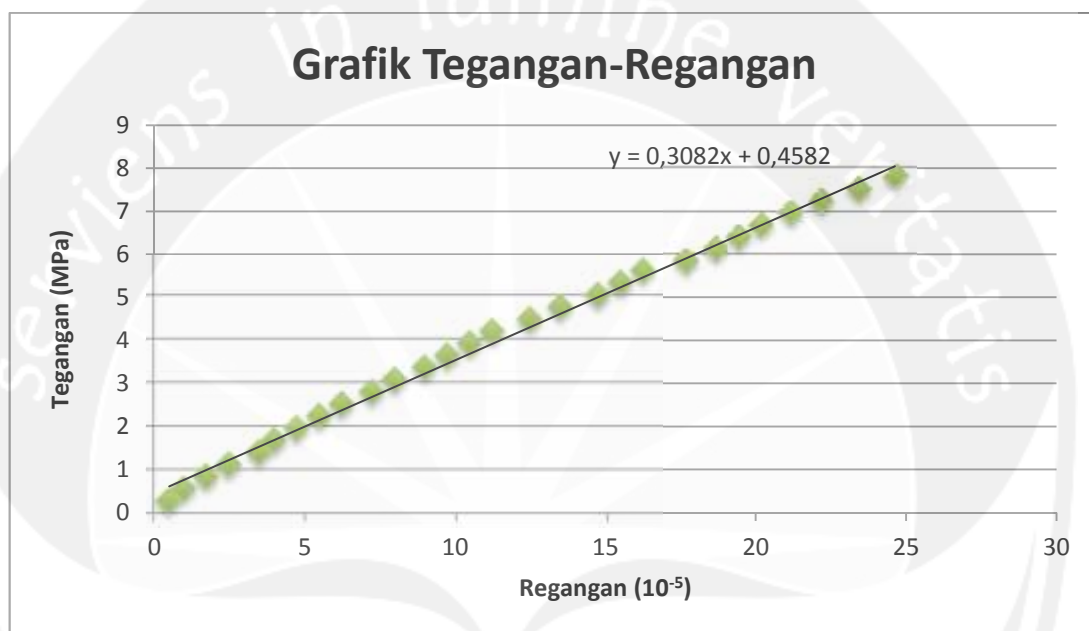
Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
 Telp: (0274) 487711 Fax: (0274) 487748
 Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

Diameter = 149,9 mm

Luas = 17662,6099 mm²

Po = 201 mm

Modulus Elastisitas = 30632,6475 MPa



Pengujian kuat tekan Beton BG 1,5 %

Keterangan	Ukuran/Dimensi		Berat (kg)	Kuat Desak (kN)	Kuat Desak (MPa)
	Tinggi (cm)	Diameter (cm)			
SG 01	30,47	14,96	12,75	645	36,7136
SG 02	29,96	15,05	12,732	770	43,3060
SG 03	30,28	14,99	12,878	640	36,2833
Rata-rata				685	38,7676



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

LAMPIRAN V

**DATA HASIL PENGUJIAN BALOK BETON BERTULANG DENGAN
PENAMBAHAN GLENIUM ACE 8590**

1. Balok BN-01

No	Load Cell (kg)	LVDT1 (mm)	LVDT2 (mm)	LVDT3 (mm)	Beban (P) (kN)	Lendutan (δ) (mm)	Kelengkungan (Δ) (1/m)
0	34,3957	-0,0085	0,0003	-0,0173	0,34	0,0003	0,0026
1	46,9909	-0,0066	0,0007	-0,0171	0,46	0,0007	0,0025
2	87,4924	0,0011	0,0008	-0,0161	0,86	0,0008	0,0017
3	128,8892	0,0109	0,0008	-0,0093	1,26	0,0008	0,0000
4	149,8119	0,0169	0,0016	-0,0058	1,47	0,0016	0,0008
5	146,4563	0,0171	0,0019	-0,0055	1,44	0,0019	0,0008
6	144,3999	0,0169	0,0023	-0,0057	1,42	0,0023	0,0007
7	143,0835	0,0169	0,0027	-0,0057	1,40	0,0027	0,0006
8	144,1370	0,0171	0,0016	-0,0057	1,41	0,0016	0,0008
9	171,6889	0,0233	0,0031	-0,0016	1,68	0,0031	0,0015
10	205,2336	0,0330	0,0082	0,0058	2,01	0,0082	0,0022
11	231,5573	0,0428	0,0208	0,0139	2,27	0,0208	0,0015
12	254,7081	0,0537	0,0294	0,0233	2,50	0,0294	0,0018
13	275,8420	0,0668	0,0405	0,0346	2,71	0,0405	0,0020
14	297,3788	0,0834	0,0655	0,0491	2,92	0,0655	0,0001
15	302,6966	0,0916	0,0754	0,0567	2,97	0,0754	0,0002
16	298,3420	0,0914	0,0758	0,0563	2,93	0,0758	0,0004
17	295,6672	0,0911	0,0760	0,0560	2,90	0,0760	0,0005
18	293,0848	0,0905	0,0760	0,0557	2,87	0,0760	0,0006
19	306,3841	0,0979	0,0813	0,0624	3,00	0,0813	0,0002
20	361,2719	0,1357	0,1057	0,0977	3,54	0,1057	0,0022
21	413,9829	0,1787	0,1457	0,1360	4,06	0,1457	0,0023
22	461,5354	0,2231	0,1915	0,1749	4,53	0,1915	0,0015
23	487,9395	0,2510	0,2214	0,2007	4,79	0,2214	0,0009
24	490,4760	0,2609	0,2323	0,2075	4,81	0,2323	0,0004
25	484,5220	0,2609	0,2333	0,2056	4,75	0,2333	0,0000
26	480,0198	0,2609	0,2335	0,2047	4,71	0,2335	0,0001
27	474,6187	0,2607	0,2329	0,2026	4,65	0,2329	0,0003
28	500,2228	0,2765	0,2481	0,2233	4,91	0,2481	0,0004
29	560,2139	0,3312	0,3006	0,2772	5,49	0,3006	0,0007



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

30	618,6158	0,3962	0,3695	0,3420	6,07	0,3695	0,0001
31	676,2874	0,4709	0,4477	0,4083	6,63	0,4477	0,0016
32	688,7583	0,5054	0,4791	0,4306	6,75	0,4791	0,0022
33	678,6286	0,5067	0,4802	0,4308	6,66	0,4802	0,0023
34	671,9429	0,5067	0,4802	0,4309	6,59	0,4802	0,0023
35	676,7754	0,5236	0,4867	0,4363	6,64	0,4867	0,0013
36	742,2041	0,6022	0,5529	0,4927	7,28	0,5529	0,0011
37	788,2262	0,6669	0,6170	0,5479	7,73	0,6170	0,0019
38	829,1427	0,7327	0,6879	0,6063	8,13	0,6879	0,0037
39	860,8662	0,7935	0,7518	0,6579	8,44	0,7518	0,0052
40	881,8268	0,8430	0,7976	0,6980	8,65	0,7976	0,0054
41	872,9674	0,8527	0,8104	0,7057	8,56	0,8104	0,0063
42	864,5001	0,8528	0,8212	0,7059	8,48	0,8212	0,0084
43	856,5896	0,8529	0,8624	0,7060	8,40	0,8624	0,0166
44	856,2542	0,8570	0,8632	0,7073	8,40	0,8632	0,0162
45	911,4562	0,9195	0,9086	0,7583	8,94	0,9086	0,0139
46	960,5902	1,0009	0,9928	0,8304	9,42	0,9928	0,0154
47	1005,4895	1,0975	1,0894	0,9122	9,86	1,0894	0,0169
48	1036,9149	1,1750	1,1634	0,9799	10,17	1,1634	0,0172
49	1054,4048	1,2326	1,2173	1,0294	10,34	1,2173	0,0172
50	1056,9443	1,2569	1,2466	1,0513	10,37	1,2466	0,0185
51	1046,2728	1,2579	1,2489	1,0528	10,26	1,2489	0,0187
52	1038,5221	1,2581	1,2498	1,0528	10,18	1,2498	0,0189
53	1030,2283	1,2581	1,2484	1,0531	10,10	1,2484	0,0186
54	1021,6162	1,2578	1,2478	1,0529	10,02	1,2478	0,0185
55	1013,4821	1,2580	1,2497	1,0531	9,94	1,2497	0,0188
56	1015,1425	1,2620	1,2508	1,0538	9,96	1,2508	0,0186
57	1056,6293	1,3027	1,2818	1,0826	10,36	1,2818	0,0178
58	1086,8536	1,3468	1,3242	1,1228	10,66	1,3242	0,0179
59	1112,1638	1,3916	1,3745	1,1647	10,91	1,3745	0,0193
60	1125,9758	1,4277	1,4083	1,1997	11,04	1,4083	0,0189
61	1133,2031	1,4490	1,4324	1,2199	11,11	1,4324	0,0196
62	1141,4797	1,4714	1,4617	1,2407	11,19	1,4617	0,0211
63	1150,4506	1,4930	1,4813	1,2612	11,28	1,4813	0,0208
64	1154,3646	1,5081	1,4974	1,2763	11,32	1,4974	0,0210
65	1159,1409	1,5215	1,5148	1,2900	11,37	1,5148	0,0218
66	1163,4600	1,5360	1,5296	1,3034	11,41	1,5296	0,0220
67	1165,8862	1,5472	1,5408	1,3142	11,43	1,5408	0,0220
68	1153,2726	1,5502	1,5441	1,3181	11,31	1,5441	0,0220
69	1137,5237	1,5505	1,5419	1,3187	11,16	1,5419	0,0215



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

70	1128,5400	1,5508	1,5397	1,3188	11,07	1,5397	0,0210
71	1120,8635	1,5510	1,5370	1,3185	10,99	1,5370	0,0204
72	1112,3475	1,5514	1,5339	1,3181	10,91	1,5339	0,0198
73	1106,4163	1,5517	1,5322	1,3175	10,85	1,5322	0,0195
74	1120,0774	1,5563	1,5336	1,3184	10,98	1,5336	0,0192
75	1154,2563	1,5878	1,5515	1,3418	11,32	1,5515	0,0173
76	1190,5773	1,6398	1,6022	1,3895	11,68	1,6022	0,0175
77	1179,6299	1,6467	1,6077	1,3966	11,57	1,6077	0,0172
78	1166,1241	1,6467	1,6072	1,3969	11,44	1,6072	0,0171
79	1179,0557	1,6591	1,6133	1,4031	11,56	1,6133	0,0164
80	1208,6755	1,6909	1,6496	1,4306	11,85	1,6496	0,0178
81	1217,6466	1,7112	1,6769	1,4500	11,94	1,6769	0,0193
82	1219,7656	1,7240	1,6924	1,4618	11,96	1,6924	0,0199
83	1231,5552	1,7461	1,7056	1,4815	12,08	1,7056	0,0184
84	1233,7258	1,7580	1,7159	1,4933	12,10	1,7159	0,0181
85	1238,3995	1,7734	1,7315	1,5072	12,14	1,7315	0,0182
86	1228,9778	1,7746	1,7329	1,5085	12,05	1,7329	0,0183
87	1221,9042	1,7741	1,7328	1,5084	11,98	1,7328	0,0183
88	1214,6661	1,7739	1,7319	1,5090	11,91	1,7319	0,0181
89	1207,0741	1,7744	1,7309	1,5092	11,84	1,7309	0,0178
90	1218,4507	1,7813	1,7322	1,5097	11,95	1,7322	0,0173
91	1244,9622	1,8111	1,7605	1,5302	12,21	1,7605	0,0180
92	1272,9053	1,8512	1,7983	1,5681	12,48	1,7983	0,0177
93	1296,9597	1,8969	1,8403	1,6106	12,72	1,8403	0,0173
94	1312,2092	1,9362	1,8791	1,6468	12,87	1,8791	0,0175
95	1317,9308	1,9591	1,8987	1,6686	12,92	1,8987	0,0170
96	1327,2333	1,9828	1,9284	1,6918	13,02	1,9284	0,0182
97	1341,6869	2,0128	1,9588	1,7201	13,16	1,9588	0,0185
98	1347,7894	2,0336	1,9848	1,7403	13,22	1,9848	0,0196
99	1348,8413	2,0465	1,9987	1,7526	13,23	1,9987	0,0198
100	1362,7147	2,0709	2,0199	1,7753	13,36	2,0199	0,0194
101	1356,2791	2,0784	2,0274	1,7828	13,30	2,0274	0,0194
102	1347,2950	2,0791	2,0281	1,7829	13,21	2,0281	0,0194
103	1340,5199	2,0791	2,0275	1,7831	13,15	2,0275	0,0193
104	1332,3420	2,0794	2,0264	1,7837	13,07	2,0264	0,0190
105	1325,5924	2,0792	2,0265	1,7835	13,00	2,0265	0,0190
106	1357,8715	2,1070	2,0432	1,7991	13,32	2,0432	0,0180
107	1387,3141	2,1493	2,0878	1,8370	13,60	2,0878	0,0189
108	1412,5508	2,1948	2,1343	1,8798	13,85	2,1343	0,0194
109	1429,2644	2,2344	2,1740	1,9152	14,02	2,1740	0,0198



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

110	1435,4142	2,2586	2,2108	1,9391	14,08	2,2108	0,0224
111	1443,9720	2,2796	2,2327	1,9595	14,16	2,2327	0,0226
112	1462,7045	2,3155	2,2617	1,9932	14,34	2,2617	0,0215
113	1465,6941	2,3344	2,2788	2,0104	14,37	2,2788	0,0213
114	1471,4880	2,3501	2,2961	2,0253	14,43	2,2961	0,0217
115	1476,4862	2,3671	2,3163	2,0415	14,48	2,3163	0,0224
116	1467,5647	2,3705	2,3204	2,0442	14,39	2,3204	0,0226
117	1460,0500	2,3707	2,3198	2,0444	14,32	2,3198	0,0224
118	1453,9014	2,3708	2,3189	2,0447	14,26	2,3189	0,0222
119	1447,7859	2,3705	2,3188	2,0445	14,20	2,3188	0,0223
120	1459,9454	2,3797	2,3220	2,0464	14,32	2,3220	0,0218
121	1472,8344	2,3951	2,3382	2,0579	14,44	2,3382	0,0223
122	1487,2244	2,4169	2,3579	2,0770	14,58	2,3579	0,0222
123	1496,4197	2,4346	2,3715	2,0937	14,67	2,3715	0,0215
124	1504,1774	2,4505	2,3830	2,1073	14,75	2,3830	0,0208
125	1522,5847	2,4814	2,4131	2,1355	14,93	2,4131	0,0209
126	1544,7534	2,5228	2,4568	2,1744	15,15	2,4568	0,0216
127	1561,5320	2,5613	2,4916	2,2099	15,31	2,4916	0,0212
128	1570,1155	2,5886	2,5215	2,2351	15,40	2,5215	0,0219
129	1575,6981	2,6071	2,5461	2,2534	15,45	2,5461	0,0232
130	1584,4497	2,6281	2,5669	2,2724	15,54	2,5669	0,0233
131	1599,2625	2,6595	2,6022	2,3019	15,68	2,6022	0,0243
132	1588,5499	2,6647	2,6118	2,3071	15,58	2,6118	0,0252
133	1580,1044	2,6649	2,6124	2,3077	15,50	2,6124	0,0252
134	1574,0363	2,6648	2,6123	2,3077	15,44	2,6123	0,0252
135	1580,0870	2,6693	2,6137	2,3088	15,50	2,6137	0,0249
136	1610,2230	2,7049	2,6417	2,3378	15,79	2,6417	0,0241
137	1631,6299	2,7442	2,6785	2,3738	16,00	2,6785	0,0239
138	1650,8066	2,7817	2,7168	2,4088	16,19	2,7168	0,0243
139	1667,3953	2,8192	2,7613	2,4434	16,35	2,7613	0,0260
140	1677,5872	2,8468	2,7858	2,4689	16,45	2,7858	0,0256
141	1688,2686	2,8741	2,8134	2,4936	16,56	2,8134	0,0259
142	1703,8230	2,9083	2,8534	2,5264	16,71	2,8534	0,0272
143	1708,6729	2,9264	2,8699	2,5447	16,76	2,8699	0,0269
144	1713,9645	2,9421	2,8826	2,5609	16,81	2,8826	0,0262
145	1722,5972	2,9620	2,9022	2,5851	16,89	2,9022	0,0257
146	1724,8311	2,9784	2,9205	2,5948	16,91	2,9205	0,0268
147	1714,4365	2,9795	2,9202	2,5989	16,81	2,9202	0,0262
148	1707,4672	2,9796	2,9204	2,5989	16,74	2,9204	0,0262
149	1701,9622	2,9791	2,9207	2,5991	16,69	2,9207	0,0263



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

150	1715,2887	2,9906	2,9282	2,6040	16,82	2,9282	0,0262
151	1751,4946	3,0378	2,9812	2,6421	17,18	2,9812	0,0282
152	1764,8639	3,0668	3,0058	2,6696	17,31	3,0058	0,0275
153	1776,8682	3,0938	3,0258	2,6953	17,43	3,0258	0,0263
154	1780,0105	3,1089	3,0456	2,7102	17,46	3,0456	0,0272
155	1800,4105	3,1421	3,0827	2,7411	17,66	3,0827	0,0282
156	1823,1124	3,1931	3,1377	2,7887	17,88	3,1377	0,0293
157	1846,9885	3,2382	3,1752	2,8307	18,11	3,1752	0,0282
158	1872,5310	3,2946	3,2434	2,8838	18,36	3,2434	0,0308
159	1889,1888	3,3426	3,2853	2,9294	18,53	3,2853	0,0299
160	1880,4432	3,3547	3,2906	2,9401	18,44	3,2906	0,0286
161	1870,8171	3,3548	3,2908	2,9397	18,35	3,2908	0,0287
162	1863,8496	3,3551	3,2907	2,9399	18,28	3,2907	0,0286
163	1858,8473	3,3549	3,2903	2,9400	18,23	3,2903	0,0286
164	1878,2340	3,3735	3,3089	2,9546	18,42	3,3089	0,0290
165	1912,3810	3,4223	3,3598	2,9994	18,75	3,3598	0,0298
166	1920,6383	3,4455	3,3848	3,0215	18,84	3,3848	0,0303
167	1933,6931	3,4711	3,4221	3,0455	18,96	3,4221	0,0328
168	1951,8215	3,5090	3,4573	3,0798	19,14	3,4573	0,0326
169	1965,9003	3,5423	3,4959	3,1094	19,28	3,4959	0,0340
170	1982,6199	3,5790	3,5300	3,1433	19,44	3,5300	0,0338
171	2006,0673	3,6289	3,5771	3,1909	19,67	3,5771	0,0334
172	2031,3151	3,6797	3,6378	3,2378	19,92	3,6378	0,0358
173	2050,8865	3,7302	3,6831	3,2862	20,11	3,6831	0,0350
174	2039,8452	3,7379	3,6923	3,2938	20,00	3,6923	0,0353
175	2029,7887	3,7379	3,6936	3,2937	19,91	3,6936	0,0356
176	2022,8188	3,7382	3,6937	3,2939	19,84	3,6937	0,0355
177	2018,2598	3,7381	3,6932	3,2940	19,79	3,6932	0,0354
178	2037,2689	3,7562	3,7083	3,3058	19,98	3,7083	0,0355
179	2077,1038	3,8139	3,7648	3,3570	20,37	3,7648	0,0359
180	2120,8269	3,8948	3,8551	3,4324	20,80	3,8551	0,0383
181	2155,7678	3,9706	3,9249	3,5052	21,14	3,9249	0,0374
182	2175,3408	4,0166	3,9789	3,5503	21,33	3,9789	0,0391
183	2193,1182	4,0586	4,0344	3,5927	21,51	4,0344	0,0417
184	2202,5652	4,0834	4,0706	3,6185	21,60	4,0706	0,0439
185	2207,9170	4,0995	4,0952	3,6365	21,65	4,0952	0,0454
186	2207,5874	4,1108	4,1029	3,6477	21,65	4,1029	0,0447
187	2199,4463	4,1111	4,1025	3,6478	21,57	4,1025	0,0446
188	2193,4004	4,1111	4,1025	3,6478	21,51	4,1025	0,0446
189	2188,2454	4,1116	4,1029	3,6480	21,46	4,1029	0,0446



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

190	2200,7463	4,1248	4,1095	3,6588	21,58	4,1095	0,0436
191	2253,4478	4,2010	4,1831	3,7285	22,10	4,1831	0,0437
192	2283,2891	4,2583	4,2504	3,7833	22,39	4,2504	0,0459
193	2310,8083	4,3125	4,3266	3,8344	22,66	4,3266	0,0506
194	2344,7429	4,3829	4,3918	3,9022	22,99	4,3918	0,0499
195	2365,5342	4,4337	4,4413	3,9507	23,20	4,4413	0,0498
196	2389,3123	4,4861	4,4888	3,9995	23,43	4,4888	0,0492
197	2396,7607	4,5153	4,5228	4,0284	23,50	4,5228	0,0502
198	2386,4001	4,5180	4,5229	4,0312	23,40	4,5229	0,0496
199	2378,4526	4,5182	4,5214	4,0313	23,32	4,5214	0,0493
200	2372,4219	4,5183	4,5223	4,0312	23,27	4,5223	0,0495
201	2373,1040	4,5194	4,5246	4,0325	23,27	4,5246	0,0497
202	2415,2686	4,5716	4,5952	4,0791	23,69	4,5952	0,0540
203	2463,7893	4,6622	4,6747	4,1637	24,16	4,6747	0,0524
204	2498,3447	4,7308	4,7482	4,2292	24,50	4,7482	0,0536
205	2531,3679	4,7997	4,8284	4,2974	24,82	4,8284	0,0560
206	2554,4524	4,8548	4,9081	4,3517	25,05	4,9081	0,0610
207	2574,6816	4,9018	4,9563	4,3964	25,25	4,9563	0,0614
208	2576,6160	4,9327	4,9760	4,4238	25,27	4,9760	0,0596
209	2564,8306	4,9325	4,9743	4,4238	25,15	4,9743	0,0592
210	2557,3552	4,9322	4,9734	4,4237	25,08	4,9734	0,0591
211	2551,7219	4,9325	4,9729	4,4236	25,02	4,9729	0,0590
212	2585,6667	4,9735	5,0173	4,4582	25,36	5,0173	0,0603
213	2636,4248	5,0597	5,0940	4,5391	25,85	5,0940	0,0589
214	2665,0581	5,1269	5,1662	4,6038	26,14	5,1662	0,0602
215	2690,5615	5,1806	5,2182	4,6530	26,39	5,2182	0,0603
216	2710,6499	5,2297	5,2779	4,6976	26,58	5,2779	0,0629
217	2740,0862	5,2925	5,3463	4,7576	26,87	5,3463	0,0642
218	2752,6702	5,3356	5,3896	4,7993	26,99	5,3896	0,0644
219	2739,1768	5,3553	5,3913	4,8029	26,86	5,3913	0,0624
220	2729,7646	5,4123	5,3906	4,8024	26,77	5,3906	0,0566
221	2722,9968	5,4123	5,3903	4,8023	26,70	5,3903	0,0566
222	2718,1123	5,4124	5,3906	4,8020	26,66	5,3906	0,0567
223	2731,2649	5,4232	5,4020	4,8125	26,78	5,4020	0,0568
224	2752,4104	5,4494	5,4327	4,8385	26,99	5,4327	0,0577
225	2778,8745	5,4951	5,4707	4,8808	27,25	5,4707	0,0566
226	2797,9866	5,5341	5,5146	4,9179	27,44	5,5146	0,0577
227	2812,1460	5,5668	5,5603	4,9485	27,58	5,5603	0,0605
228	2831,1970	5,6076	5,6005	4,9855	27,76	5,6005	0,0608
229	2855,9321	5,6603	5,6369	5,0348	28,01	5,6369	0,0579



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

230	2883,1648	5,7209	5,6936	5,0929	28,27	5,6936	0,0573
231	2894,0637	5,7602	5,7363	5,1306	28,38	5,7363	0,0582
232	2896,9861	5,7852	5,7707	5,1533	28,41	5,7707	0,0603
233	2884,1292	5,7853	5,7714	5,1536	28,28	5,7714	0,0604
234	2875,6951	5,7859	5,7710	5,1536	28,20	5,7710	0,0603
235	2869,5266	5,7856	5,7711	5,1536	28,14	5,7711	0,0603
236	2885,1865	5,8062	5,7862	5,1684	28,29	5,7862	0,0598
237	2939,4639	5,8954	5,8686	5,2501	28,83	5,8686	0,0592
238	2986,7327	6,0091	5,9991	5,3557	29,29	5,9991	0,0633
239	3007,7869	6,0832	6,0726	5,4287	29,50	6,0726	0,0633
240	3035,4702	6,1719	6,1673	5,5144	29,77	6,1673	0,0648
256	3066,9412	7,4545	7,5685	6,7774	30,08	7,5685	0,0905
257	3068,5544	7,5814	7,7148	6,9071	30,09	7,7148	0,0941
258	3068,8645	7,6785	7,8269	7,0108	30,10	7,8269	0,0965
259	3069,9275	7,7489	7,8964	7,0809	30,11	7,8964	0,0963
260	3076,1150	7,8139	7,9706	7,1453	30,17	7,9706	0,0982
270	3104,2507	8,2803	8,4873	7,6005	30,44	8,4873	0,1094
271	3102,1555	8,3513	8,5654	7,6804	30,42	8,5654	0,1099
291	3118,3088	9,5864	9,7872	8,8187	30,58	9,7872	0,1169
292	3120,1963	9,6926	9,8961	8,9170	30,60	9,8961	0,1183
293	3124,1646	9,7875	9,9935	9,0259	30,64	9,9935	0,1173
294	3131,3442	9,9095	10,1133	9,1453	30,71	10,1133	0,1172
295	3134,1311	10,0145	10,2168	9,2558	30,74	10,2168	0,1163
296	3129,3469	10,1062	10,3115	9,3441	30,69	10,3115	0,1173
301	3148,7971	10,3555	10,5497	9,5636	30,88	10,5497	0,1180
302	3167,5325	10,5265	10,7156	9,7268	31,06	10,7156	0,1178
303	3171,6086	10,6814	10,8633	9,8706	31,10	10,8633	0,1174
304	3169,9221	10,8075	10,9794	10,0063	31,09	10,9794	0,1145
310	3192,7964	11,1197	11,2736	10,2834	31,31	11,2736	0,1144
311	3198,7087	11,2975	11,4430	10,4738	31,37	11,4430	0,1115
312	3192,4038	11,4192	11,5591	10,5913	31,31	11,5591	0,1108
313	3193,8748	11,5291	11,6699	10,6983	31,32	11,6699	0,1112
320	3207,5811	11,8604	12,0050	11,0033	31,46	12,0050	0,1146
321	3216,8896	12,0089	12,1598	11,1437	31,55	12,1598	0,1167
322	3224,4214	12,1408	12,3016	11,2698	31,62	12,3016	0,1193
323	3216,8306	12,2431	12,4196	11,3759	31,55	12,4196	0,1220
330	3214,6152	12,6446	12,8488	11,7879	31,52	12,8488	0,1265
331	3208,7402	12,7570	12,9672	11,9060	31,47	12,9672	0,1271
332	3211,9946	12,8595	13,0749	12,0052	31,50	13,0749	0,1285
333	3212,8635	12,9420	13,1744	12,0877	31,51	13,1744	0,1319



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

356	3212,0225	14,1325	14,4986	13,3856	31,50	14,4986	0,1479
357	3220,5999	14,2165	14,5958	13,4740	31,58	14,5958	0,1501
358	3219,5166	14,2867	14,6629	13,5460	31,57	14,6629	0,1493
364	3250,3867	14,4957	14,8810	13,7492	31,88	14,8810	0,1517
365	3260,0542	14,5937	14,9820	13,8400	31,97	14,9820	0,1530
366	3268,7856	14,6949	15,0873	13,9321	32,06	15,0873	0,1548
367	3277,8369	14,8077	15,2026	14,0336	32,14	15,2026	0,1564
368	3273,4336	14,8928	15,2957	14,1121	32,10	15,2957	0,1586
374	3290,5195	15,1255	15,5260	14,3266	32,27	15,5260	0,1600
375	3305,2014	15,2444	15,6452	14,4298	32,41	15,6452	0,1616
376	3311,5813	15,3545	15,7557	14,5333	32,48	15,7557	0,1624
377	3308,4253	15,4543	15,8537	14,6251	32,44	15,8537	0,1628
378	3309,1267	15,5512	15,9559	14,7183	32,45	15,9559	0,1642
384	3332,3105	15,8445	16,2644	14,9975	32,68	16,2644	0,1687
385	3333,2952	15,9651	16,3928	15,1101	32,69	16,3928	0,1710
386	3329,2346	16,0629	16,4997	15,2079	32,65	16,4997	0,1728
387	3319,5762	16,1661	16,6088	15,3154	32,55	16,6088	0,1736
395	3303,1538	16,7112	17,2187	15,9056	32,39	17,2187	0,1821
396	3317,2349	16,8238	17,3363	16,0195	32,53	17,3363	0,1829
397	3325,7612	16,9220	17,4417	16,1199	32,61	17,4417	0,1841
402	3343,8394	17,2599	17,8057	16,4649	32,79	17,8057	0,1887
403	3338,0454	17,3879	17,9441	16,6007	32,74	17,9441	0,1900
404	3339,6147	17,5090	18,0605	16,7119	32,75	18,0605	0,1900
405	3350,3970	17,6269	18,1674	16,8234	32,86	18,1674	0,1884
412	3352,9668	18,0233	18,5942	17,2466	32,88	18,5942	0,1919
413	3369,0447	18,1281	18,6982	17,3537	33,04	18,6982	0,1915
414	3378,5310	18,2452	18,8219	17,4709	33,13	18,8219	0,1928
415	3369,2908	18,3215	19,0403	17,5525	33,04	19,0403	0,2207
422	3360,5112	18,7550	19,7950	18,0180	32,96	19,7950	0,2817
423	3364,0352	18,8249	19,8617	18,0885	32,99	19,8617	0,2810
424	3364,1577	18,8818	19,9243	18,1482	32,99	19,9243	0,2819
425	3362,6030	18,9320	19,9784	18,2005	32,98	19,9784	0,2824
426	3363,2676	18,9760	20,0327	18,2487	32,98	20,0327	0,2841
427	3363,1533	19,0162	20,0784	18,2913	32,98	20,0784	0,2849
434	3394,1643	19,2821	20,3752	18,5572	33,29	20,3752	0,2911
435	3395,3271	19,3626	20,4589	18,6389	33,30	20,4589	0,2916
436	3402,3396	19,4601	20,5594	18,7352	33,37	20,5594	0,2924
437	3403,8438	19,6039	20,7170	18,8803	33,38	20,7170	0,2950
455	3427,8328	20,7489	21,9016	20,0168	33,62	21,9016	0,3038
456	3431,5347	20,9072	22,0632	20,1707	33,65	22,0632	0,3048



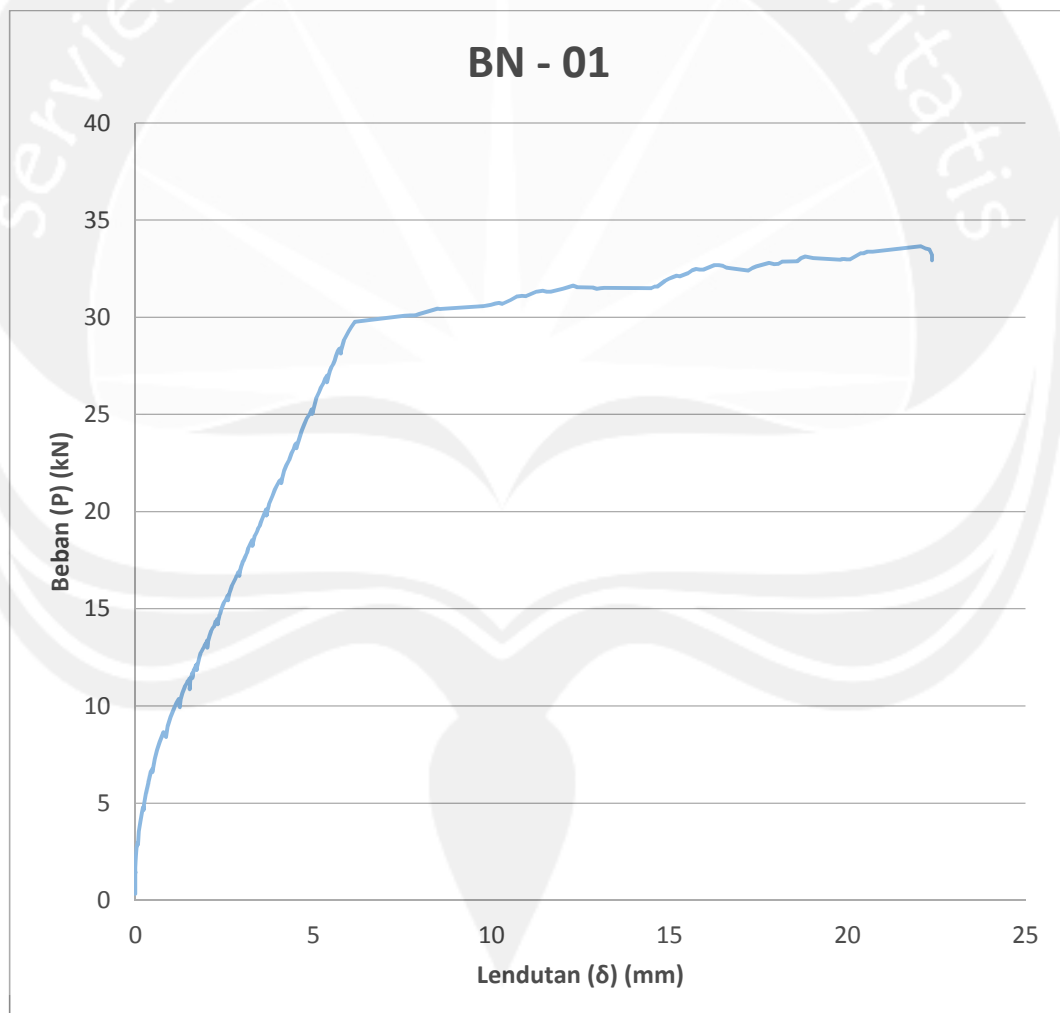
UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

457	3419,9751	21,0409	22,1986	20,2973	33,54	22,1986	0,3059
458	3415,3511	21,1563	22,3090	20,3997	33,49	22,3090	0,3062
459	3385,7920	21,2160	22,3768	20,4516	33,20	22,3768	0,3086
460	3357,8696	21,2247	22,3813	20,4591	32,93	22,3813	0,3079

Keterangan :

-  = Data Pada Beban Retak Pertama
-  = Data Pada Beban Maksimum





UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

2. Balok BN-02

No.	Load Cell (kg)	LVDT1 (mm)	LVDT2 (mm)	LVDT3 (mm)	Beban (P) (kN)	Lendutan (δ) (mm)	Kelengkungan (Δ) (1/m)
0	1,6533	0,1421	-1,1135	0,1821	0,02	-1,1135	0,2551
1	68,6024	0,1891	-1,0965	0,2294	0,67	-1,0965	0,2611
2	164,3187	0,2668	-1,0297	0,3063	1,61	-1,0297	0,2633
3	251,6822	0,3554	-0,9434	0,3925	2,47	-0,9434	0,2635
4	313,1735	0,4379	-0,8605	0,4754	3,07	-0,8605	0,2634
5	340,6318	0,4897	-0,8108	0,5266	3,34	-0,8108	0,2638
6	331,6503	0,4968	-0,8041	0,5330	3,25	-0,8041	0,2638
7	322,5331	0,4970	-0,8043	0,5333	3,16	-0,8043	0,2639
8	338,5041	0,5117	-0,7874	0,5495	3,32	-0,7874	0,2636
9	397,8756	0,5811	-0,7176	0,6182	3,90	-0,7176	0,2635
10	442,4030	0,6745	-0,6153	0,7120	4,34	-0,6153	0,2617
11	480,6097	0,7960	-0,4830	0,8329	4,71	-0,4830	0,2595
12	500,5878	0,9210	-0,3700	0,9388	4,91	-0,3700	0,2600
13	531,9413	0,9881	-0,2992	1,0022	5,22	-0,2992	0,2589
14	529,4920	1,0091	-0,2749	1,0233	5,19	-0,2749	0,2582
15	517,5565	1,0092	-0,2749	1,0234	5,08	-0,2749	0,2582
16	509,2197	1,0096	-0,2752	1,0234	4,99	-0,2752	0,2584
17	536,2777	1,0363	-0,2562	1,0465	5,26	-0,2562	0,2595
18	581,8722	1,1010	-0,1919	1,1087	5,71	-0,1919	0,2593
19	627,1820	1,1981	-0,0914	1,2016	6,15	-0,0914	0,2583
20	648,5081	1,3104	0,0229	1,3029	6,36	0,0229	0,2567
21	673,6504	1,3779	0,0859	1,3652	6,61	0,0859	0,2571
22	699,0557	1,4410	0,1460	1,4231	6,86	0,1460	0,2572
23	715,0505	1,4863	0,1923	1,4680	7,01	0,1923	0,2570
24	722,3029	1,5166	0,2291	1,4987	7,08	0,2291	0,2557
25	709,4795	1,5184	0,2300	1,5010	6,96	0,2300	0,2559
26	699,0781	1,5186	0,2301	1,5010	6,86	0,2301	0,2559
27	719,2665	1,5391	0,2435	1,5241	7,05	0,2435	0,2576
28	760,4958	1,5985	0,3035	1,5806	7,46	0,3035	0,2572
29	797,0224	1,6709	0,3761	1,6479	7,82	0,3761	0,2567
30	834,7498	1,7510	0,4624	1,7235	8,19	0,4624	0,2550
31	870,3467	1,8311	0,5436	1,8057	8,54	0,5436	0,2550
32	908,0506	1,9122	0,6279	1,8871	8,90	0,6279	0,2543
33	936,4290	1,9857	0,7017	1,9602	9,18	0,7017	0,2542
34	933,6691	2,0069	0,7246	1,9845	9,16	0,7246	0,2542
35	921,0378	2,0071	0,7254	1,9846	9,03	0,7254	0,2541



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

36	910,5781	2,0070	0,7251	1,9844	8,93	0,7251	0,2541
37	941,4462	2,0375	0,7486	2,0174	9,23	0,7486	0,2558
38	1006,0063	2,1366	0,8465	2,1104	9,87	0,8465	0,2554
39	1066,8981	2,2796	0,9761	2,2305	10,46	0,9761	0,2558
40	1120,1285	2,4312	1,1107	2,3493	10,98	1,1107	0,2559
41	1160,4243	2,5254	1,2049	2,4477	11,38	1,2049	0,2563
42	1160,2074	2,5539	1,2328	2,4826	11,38	1,2328	0,2571
43	1148,9042	2,5544	1,2322	2,4824	11,27	1,2322	0,2572
44	1137,2506	2,5546	1,2327	2,4820	11,15	1,2327	0,2571
45	1167,5958	2,5893	1,2619	2,5154	11,45	1,2619	0,2581
46	1243,6378	2,7084	1,3794	2,6293	12,20	1,3794	0,2579
47	1306,8812	2,8378	1,5151	2,7515	12,82	1,5151	0,2559
48	1360,8458	2,9550	1,6330	2,8703	13,35	1,6330	0,2559
49	1386,3606	3,0179	1,7095	2,9392	13,60	1,7095	0,2538
50	1388,3110	3,0773	1,7284	2,9656	13,61	1,7284	0,2586
51	1374,3682	3,2045	1,7286	2,9663	13,48	1,7286	0,2713
52	1364,7155	3,2045	1,7285	2,9664	13,38	1,7285	0,2714
53	1421,1011	3,2598	1,7932	3,0327	13,94	1,7932	0,2706
54	1484,4331	3,3720	1,9063	3,1397	14,56	1,9063	0,2699
55	1549,8824	3,5036	2,0397	3,2631	15,20	2,0397	0,2687
56	1598,0209	3,6231	2,1604	3,3751	15,67	2,1604	0,2677
57	1609,3820	3,6816	2,2196	3,4317	15,78	2,2196	0,2674
58	1603,1405	3,6944	2,2306	3,4446	15,72	2,2306	0,2678
59	1589,9435	3,6948	2,2400	3,4443	15,59	2,2400	0,2659
60	1578,5135	3,6951	2,2878	3,4443	15,48	2,2878	0,2564
61	1574,3597	3,6959	2,2909	3,4464	15,44	2,2909	0,2561
62	1626,0497	3,7480	2,3551	3,5023	15,95	2,3551	0,2540
63	1658,6271	3,8034	2,4146	3,5557	16,27	2,4146	0,2530
64	1701,6001	3,8820	2,4876	3,6296	16,69	2,4876	0,2536
65	1737,5991	3,9558	2,5721	3,7006	17,04	2,5721	0,2512
66	1764,9227	4,0167	2,6328	3,7581	17,31	2,6328	0,2509
67	1786,6654	4,0670	2,6889	3,8053	17,52	2,6889	0,2494
68	1805,0358	4,1095	2,7312	3,8469	17,70	2,7312	0,2494
69	1810,4604	4,1330	2,7659	3,8707	17,75	2,7659	0,2472
70	1800,0802	4,1362	2,7683	3,8737	17,65	2,7683	0,2473
71	1788,4246	4,1361	2,7673	3,8732	17,54	2,7673	0,2475
72	1783,0120	4,1372	2,7691	3,8756	17,49	2,7691	0,2475
73	1841,9050	4,2065	2,8398	3,9467	18,06	2,8398	0,2474
74	1894,5175	4,3017	2,9260	4,0390	18,58	2,9260	0,2489
75	1929,0406	4,3752	3,0221	4,1106	18,92	3,0221	0,2442



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

76	1953,4628	4,4300	3,0848	4,1640	19,16	3,0848	0,2424
77	1982,7856	4,4929	3,1512	4,2268	19,44	3,1512	0,2417
78	1992,2178	4,5281	3,1745	4,2647	19,54	3,1745	0,2444
79	1980,2435	4,5310	3,1745	4,2694	19,42	3,1745	0,2451
80	1968,2651	4,5308	3,1751	4,2694	19,30	3,1751	0,2450
81	1962,6902	4,5308	3,1759	4,2719	19,25	3,1759	0,2451
82	2037,5159	4,6257	3,2722	4,3648	19,98	3,2722	0,2446
83	2124,9287	4,7918	3,4581	4,5252	20,84	3,4581	0,2401
84	2183,5789	4,9270	3,5945	4,6548	21,41	3,5945	0,2393
85	2207,4517	4,9914	3,6567	4,7153	21,65	3,6567	0,2393
86	2217,8691	5,0287	3,7027	4,7503	21,75	3,7027	0,2374
87	2207,1201	5,0326	3,7013	4,7534	21,64	3,7013	0,2384
88	2195,3525	5,0328	3,7003	4,7530	21,53	3,7003	0,2385
89	2216,3105	5,0594	3,7251	4,7820	21,73	3,7251	0,2391
90	2307,2805	5,2072	3,8908	4,9254	22,63	3,8908	0,2351
91	2377,2073	5,3551	4,0376	5,0668	23,31	4,0376	0,2347
92	2422,8835	5,4634	4,1428	5,1722	23,76	4,1428	0,2350
93	2445,0061	5,5281	4,2070	5,2349	23,98	4,2070	0,2349
94	2438,0925	5,5449	4,2229	5,2511	23,91	4,2229	0,2350
95	2426,1602	5,5450	4,2226	5,2507	23,79	4,2226	0,2350
96	2423,9346	5,5503	4,2285	5,2578	23,77	4,2285	0,2351
97	2482,9653	5,6353	4,3144	5,3411	24,35	4,3144	0,2348
98	2525,0005	5,7210	4,4015	5,4251	24,76	4,4015	0,2343
99	2573,3071	5,8232	4,5238	5,5257	25,24	4,5238	0,2301
100	2610,9353	5,9145	4,6014	5,6140	25,60	4,6014	0,2326
101	2636,9478	5,9829	4,6653	5,6829	25,86	4,6653	0,2335
102	2655,3440	6,0337	4,7259	5,7395	26,04	4,7259	0,2321
103	2649,0562	6,0484	4,7369	5,7563	25,98	4,7369	0,2331
104	2638,6025	6,0484	4,7365	5,7565	25,88	4,7365	0,2332
105	2631,9063	6,0498	4,7390	5,7587	25,81	4,7390	0,2331
106	2688,3657	6,1311	4,8148	5,8361	26,36	4,8148	0,2338
107	2739,8445	6,2341	4,9338	5,9368	26,87	4,9338	0,2303
108	2791,8601	6,3577	5,0651	6,0568	27,38	5,0651	0,2284
109	2822,0779	6,5043	5,1537	6,1391	27,68	5,1537	0,2336
110	2848,6067	6,6157	5,2412	6,2132	27,94	5,2412	0,2346
111	2854,9807	6,6612	5,2908	6,2566	28,00	5,2908	0,2336
112	2840,0728	6,6654	5,2948	6,2612	27,85	5,2948	0,2337
113	2828,5313	6,6657	5,2944	6,2661	27,74	5,2944	0,2343
114	2848,5825	6,6930	5,3203	6,2992	27,94	5,3203	0,2352
115	2899,2546	6,7832	5,4009	6,3866	28,43	5,4009	0,2368



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

116	2935,6021	6,8811	5,5080	6,4817	28,79	5,5080	0,2347
117	2976,9807	6,9920	5,6153	6,5880	29,19	5,6153	0,2349
118	3009,0354	7,1089	5,7336	6,7018	29,51	5,7336	0,2344
124	2963,7805	7,5015	6,1562	7,1441	29,06	6,1562	0,2333
125	2960,5215	7,6297	6,3492	7,2945	29,03	6,3492	0,2226
126	2958,3186	7,7279	6,4365	7,4146	29,01	6,4365	0,2269
133	3046,2930	8,2183	7,0057	7,9545	29,87	7,0057	0,2161
134	3050,7771	8,4235	7,1311	8,0887	29,92	7,1311	0,2250
141	3084,6941	8,8429	7,5691	8,5370	30,25	7,5691	0,2242
142	3107,4753	8,9477	7,6724	8,6544	30,47	7,6724	0,2257
143	3119,1648	9,0331	7,7651	8,7547	30,59	7,7651	0,2258
149	3173,8010	9,3407	8,0880	9,1017	31,12	8,0880	0,2267
150	3184,8787	9,5252	8,3051	9,3424	31,23	8,3051	0,2257
151	3143,6052	9,6901	8,5011	9,6297	30,83	8,5011	0,2318
156	3097,2600	10,0803	8,9633	10,1441	30,37	8,9633	0,2298
157	3085,8054	10,2761	9,1842	10,3882	30,26	9,1842	0,2296
163	3133,7312	10,8233	9,7946	11,0846	30,73	9,7946	0,2319
164	3130,0090	10,9771	9,9659	11,2945	30,70	9,9659	0,2340
165	3126,9866	11,0689	10,0641	11,4041	30,67	10,0641	0,2345
171	3144,9468	11,4501	10,4874	11,8437	30,84	10,4874	0,2319
172	3160,4878	11,5727	10,6237	11,9835	30,99	10,6237	0,2309
173	3160,7354	11,6659	10,7250	12,0922	31,00	10,7250	0,2308
181	3172,5447	12,1004	11,1969	12,5706	31,11	11,1969	0,2277
182	3175,2402	12,2098	11,3171	12,6908	31,14	11,3171	0,2266
183	3180,2207	12,3121	11,4236	12,7969	31,19	11,4236	0,2262
190	3175,5310	12,7709	11,9101	13,3010	31,14	11,9101	0,2252
191	3183,8069	12,9043	12,0440	13,4444	31,22	12,0440	0,2261
197	3228,4016	13,3925	12,5549	13,9587	31,66	12,5549	0,2241
198	3240,9204	13,5522	12,7148	14,1199	31,78	12,7148	0,2242
205	3234,9260	14,2055	13,3854	14,8014	31,72	13,3854	0,2236
213	3247,5208	14,9303	14,1733	15,6157	31,85	14,1733	0,2199
214	3251,5437	15,0715	14,3209	15,7616	31,89	14,3209	0,2191
220	3207,8420	15,7582	14,9887	16,3753	31,46	14,9887	0,2156
221	3137,3167	16,0948	15,2839	16,6383	30,77	15,2839	0,2165
227	3156,6724	16,9464	16,0778	17,3331	30,96	16,0778	0,2124
228	3158,5408	17,1722	16,2877	17,5269	30,97	16,2877	0,2124
234	3178,5974	17,8437	16,9354	18,1051	31,17	16,9354	0,2078
235	3188,0552	18,0472	17,1242	18,2827	31,26	17,1242	0,2082
236	3180,2507	18,2058	17,2746	18,4211	31,19	17,2746	0,2078
241	3191,2026	18,7785	17,8154	18,9050	31,30	17,8154	0,2053



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

242	3199,8091	19,0314	18,0562	19,1220	31,38	18,0562	0,2041
247	3241,8286	19,8145	18,7713	19,7654	31,79	18,7713	0,2037
248	3226,4883	20,1310	19,0249	19,9945	31,64	19,0249	0,2076
253	3237,6575	20,8389	19,7037	20,6119	31,75	19,7037	0,2043
254	3246,8022	21,1008	19,9632	20,8438	31,84	19,9632	0,2018
259	3233,3608	21,6860	20,5426	21,3844	31,71	20,5426	0,1985
260	3213,6973	21,8072	20,6621	21,4919	31,52	20,6621	0,1975
261	3207,3088	21,9440	20,7920	21,6108	31,45	20,7920	0,1971
262	3206,7373	22,0900	20,9331	21,7365	31,45	20,9331	0,1960
268	3237,5479	22,6339	21,4614	22,2150	31,75	21,4614	0,1926
269	3249,8472	22,8248	21,6481	22,3867	31,87	21,6481	0,1915
270	3245,1504	22,9538	21,7728	22,5047	31,82	21,7728	0,1913
276	3275,3086	23,6196	22,4159	23,0977	32,12	22,4159	0,1885
277	3277,8008	23,7973	22,5860	23,2586	32,14	22,5860	0,1884
282	3292,1829	24,2692	23,0532	23,6841	32,29	23,0532	0,1847
283	3296,6589	24,5062	23,2849	23,9063	32,33	23,2849	0,1843
284	3258,8303	24,6297	23,4032	24,0280	31,96	23,4032	0,1851
285	3261,7405	24,7607	23,5473	24,1565	31,99	23,5473	0,1823
290	3263,6882	25,1840	23,9778	24,5694	32,01	23,9778	0,1798
291	3237,8223	25,3459	24,1457	24,7334	31,75	24,1457	0,1788
292	3222,3064	25,4817	24,2975	24,8732	31,60	24,2975	0,1760
293	3206,0693	25,6516	24,4749	25,0526	31,44	24,4749	0,1754
298	3190,0100	26,0486	24,8862	25,4595	31,28	24,8862	0,1736
299	3203,7617	26,2187	25,0710	25,6342	31,42	25,0710	0,1711
300	3206,6887	26,3776	25,2488	25,8018	31,45	25,2488	0,1682
301	3205,0847	26,5018	25,3783	25,9311	31,43	25,3783	0,1676
305	3226,5908	26,7386	25,6275	26,1635	31,64	25,6275	0,1647
306	3252,8628	26,9286	25,8208	26,3546	31,90	25,8208	0,1642
307	3238,6096	27,1147	26,0198	26,5572	31,76	26,0198	0,1632
308	3230,6035	27,2707	26,1815	26,7179	31,68	26,1815	0,1626
312	3248,9155	27,5933	26,5076	27,0434	31,86	26,5076	0,1621
313	3267,2415	27,8003	26,7142	27,2532	32,04	26,7142	0,1625
314	3282,5276	28,0043	26,9216	27,4557	32,19	26,9216	0,1617
319	3294,8352	28,5218	27,4481	27,9777	32,31	27,4481	0,1603
320	3301,1265	28,8282	27,7614	28,2880	32,37	27,7614	0,1593
321	3277,9570	29,0670	28,0075	28,5250	32,15	28,0075	0,1577
322	3232,7124	29,1559	28,1003	28,6178	31,70	28,1003	0,1573
323	3216,0193	29,1792	28,1434	28,6625	31,54	28,1434	0,1555
324	2887,7383	29,0957	28,6042	28,7864	28,32	28,6042	0,0674
325	2838,6545	29,3804	28,9118	29,0749	27,84	28,9118	0,0632



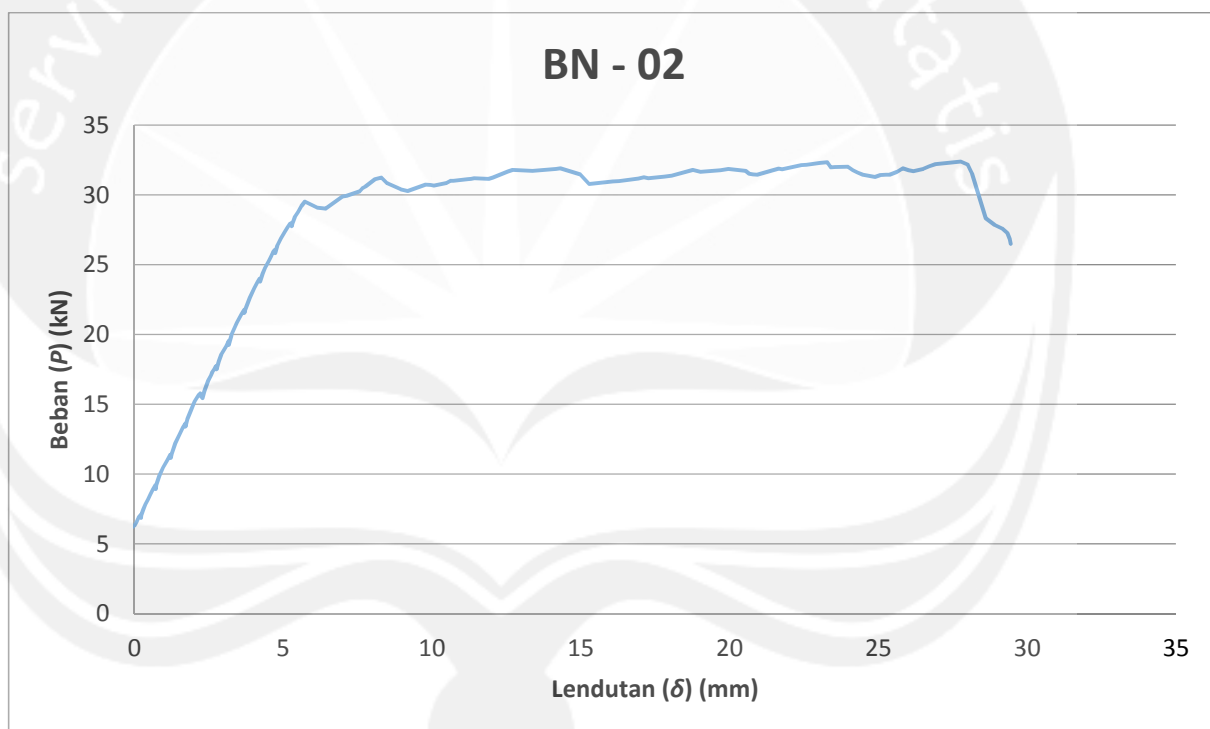
UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
 Telp: (0274) 487711 Fax: (0274) 487748
 Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

326	2812,1318	29,6006	29,1609	29,3137	27,58	29,1609	0,0592
327	2777,9343	29,7580	29,3442	29,4969	27,24	29,3442	0,0567
328	2735,6882	29,8217	29,4179	29,5684	26,83	29,4179	0,0554
329	2713,4890	29,8327	29,4398	29,5801	26,61	29,4398	0,0533
330	2701,3716	29,8389	29,4484	29,5930	26,49	29,4484	0,0535

Keterangan :

- = Data Pada Beban Retak Pertama
- = Data Pada Beban Maksimum





UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

3. Balok BG 1,2 % - 01

No.	Load Cell (kg)	LVDT1 (mm)	LVDT2 (mm)	LVDT3 (mm)	Beban (P) (kN)	Lendutan (δ) (mm)	Kelengkungan (Δ) (1/m)
0	3,2705	-0,0132	0,0116	-0,0039	0,03	0,0116	0,0040
1	24,8972	-0,0067	0,0168	0,0007	0,24	0,0168	0,0040
2	122,0599	0,0461	0,0658	0,0509	1,20	0,0658	0,0035
3	126,4790	0,0535	0,0742	0,0590	1,24	0,0742	0,0036
4	145,7557	0,0684	0,0932	0,0740	1,43	0,0932	0,0044
5	220,9390	0,1371	0,1681	0,1437	2,17	0,1681	0,0055
6	216,9599	0,1361	0,1690	0,1437	2,13	0,1690	0,0058
7	221,8401	0,1388	0,1707	0,1458	2,18	0,1707	0,0057
8	292,7112	0,2019	0,2287	0,2143	2,87	0,2287	0,0041
9	295,4312	0,2103	0,2389	0,2259	2,90	0,2389	0,0042
10	292,2851	0,2086	0,2386	0,2241	2,87	0,2386	0,0044
11	298,0270	0,2127	0,2409	0,2273	2,92	0,2409	0,0042
12	422,9714	0,3150	0,3424	0,3332	4,15	0,3424	0,0036
13	485,1389	0,3789	0,4064	0,3994	4,76	0,4064	0,0035
14	478,3651	0,3789	0,4066	0,3994	4,69	0,4066	0,0035
15	471,8188	0,3770	0,4058	0,3989	4,63	0,4058	0,0036
16	470,9665	0,3752	0,4053	0,3976	4,62	0,4053	0,0038
17	543,9031	0,4282	0,4514	0,4500	5,33	0,4514	0,0025
18	611,1424	0,4916	0,5152	0,5154	5,99	0,5152	0,0023
19	667,0756	0,5496	0,5759	0,5755	6,54	0,5759	0,0027
20	671,0218	0,5661	0,5936	0,5933	6,58	0,5936	0,0028
21	661,5633	0,5664	0,5939	0,5934	6,49	0,5939	0,0028
22	652,9376	0,5669	0,5939	0,5937	6,40	0,5939	0,0027
23	644,7628	0,5672	0,5935	0,5939	6,32	0,5935	0,0026
24	637,8293	0,5664	0,5948	0,5922	6,26	0,5948	0,0031
25	656,8325	0,5722	0,6084	0,5987	6,44	0,6084	0,0046
26	724,1002	0,6251	0,6569	0,6539	7,10	0,6569	0,0035
27	769,1686	0,6780	0,7034	0,7076	7,54	0,7034	0,0021
28	793,3369	0,7164	0,7425	0,7472	7,78	0,7425	0,0022
29	807,2534	0,7469	0,7693	0,7814	7,92	0,7693	0,0010
30	821,7315	0,7754	0,7959	0,8130	8,06	0,7959	0,0003
31	845,2809	0,8133	0,8348	0,8532	8,29	0,8348	0,0003
32	865,7869	0,8641	0,8876	0,9065	8,49	0,8876	0,0005
33	858,9439	0,8761	0,9001	0,9207	8,42	0,9001	0,0003
34	847,2025	0,8759	0,9006	0,9221	8,31	0,9006	0,0003



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

35	836,5409	0,8770	0,9007	0,9221	8,20	0,9007	0,0002
36	828,2781	0,8772	0,8935	0,9224	8,12	0,8935	0,0013
37	842,5144	0,8855	0,8910	0,9304	8,26	0,8910	0,0034
38	874,5264	0,9146	0,9183	0,9633	8,58	0,9183	0,0041
39	906,0518	0,9554	0,9581	1,0070	8,89	0,9581	0,0046
40	931,0632	1,0012	1,0072	1,0442	9,13	1,0072	0,0031
41	938,0859	1,0263	1,0286	1,0587	9,20	1,0286	0,0028
42	941,1056	1,0436	1,0435	1,0752	9,23	1,0435	0,0032
43	942,1464	1,0544	1,0582	1,0864	9,24	1,0582	0,0025
44	953,3478	1,0741	1,0813	1,1065	9,35	1,0813	0,0018
45	978,3384	1,1123	1,1180	1,1449	9,59	1,1180	0,0021
46	997,8133	1,1527	1,1596	1,1857	9,79	1,1596	0,0019
47	1011,7510	1,1924	1,2000	1,2262	9,92	1,2000	0,0019
48	1007,5481	1,2199	1,2267	1,2381	9,88	1,2267	0,0004
49	992,9727	1,2188	1,2259	1,2207	9,74	1,2259	0,0012
50	984,6641	1,2191	1,2268	1,2209	9,66	1,2268	0,0014
51	974,6020	1,2197	1,2263	1,2210	9,56	1,2263	0,0012
52	966,3842	1,2201	1,2253	1,2213	9,48	1,2253	0,0009
53	975,3660	1,2194	1,2269	1,2224	9,57	1,2269	0,0012
54	1013,8701	1,2463	1,2625	1,2575	9,94	1,2625	0,0021
55	1034,7898	1,2781	1,2997	1,2905	10,15	1,2997	0,0031
56	1050,7007	1,3083	1,3295	1,3210	10,30	1,3295	0,0030
57	1065,5364	1,3439	1,3129	1,3568	10,45	1,3129	0,0075
58	1079,6230	1,3813	1,3559	1,3901	10,59	1,3559	0,0060
59	1093,6570	1,4172	1,3932	1,4088	10,73	1,3932	0,0040
60	1110,0477	1,4571	1,4302	1,4400	10,89	1,4302	0,0037
61	1117,1113	1,4843	1,4567	1,4612	10,96	1,4567	0,0032
62	1138,5630	1,5307	1,4914	1,5031	11,17	1,4914	0,0051
63	1123,8936	1,5409	1,4996	1,5129	11,02	1,4996	0,0055
64	1110,9904	1,5411	1,5017	1,5134	10,90	1,5017	0,0051
65	1141,4873	1,5705	1,5366	1,5423	11,19	1,5366	0,0040
66	1191,4253	1,6493	1,6211	1,6203	11,68	1,6211	0,0028
67	1196,1378	1,6855	1,6585	1,6551	11,73	1,6585	0,0024
68	1218,5884	1,7385	1,6941	1,7027	11,95	1,6941	0,0053
69	1236,4941	1,7907	1,7313	1,7524	12,13	1,7313	0,0080
70	1248,7053	1,8312	1,7727	1,7943	12,25	1,7727	0,0080
71	1265,3325	1,8724	1,8112	1,8334	12,41	1,8112	0,0083
72	1285,2025	1,9177	1,8505	1,8781	12,60	1,8505	0,0095
73	1279,1937	1,9365	1,8702	1,8955	12,54	1,8702	0,0092
74	1266,0143	1,9368	1,8706	1,8957	12,42	1,8706	0,0091



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

75	1257,3373	1,9370	1,8705	1,8953	12,33	1,8705	0,0091
76	1294,0675	1,9713	1,8975	1,9279	12,69	1,8975	0,0104
77	1339,2512	2,0215	1,9329	1,9979	13,13	1,9329	0,0154
78	1377,8020	2,0909	1,9993	2,0751	13,51	1,9993	0,0167
79	1410,2927	2,1735	2,0477	2,1558	13,83	2,0477	0,0234
80	1427,4307	2,2273	2,0950	2,2103	14,00	2,0950	0,0248
81	1431,8813	2,2630	2,1275	2,2450	14,04	2,1275	0,0253
82	1420,1714	2,2697	2,1321	2,2512	13,93	2,1321	0,0257
83	1406,6731	2,2696	2,1327	2,2508	13,79	2,1327	0,0255
84	1393,4430	2,2696	2,1324	2,2508	13,67	2,1324	0,0255
85	1382,8981	2,2701	2,1321	2,2512	13,56	2,1321	0,0257
86	1403,3551	2,2814	2,1501	2,2657	13,76	2,1501	0,0247
87	1428,5221	2,3107	2,1818	2,2996	14,01	2,1818	0,0247
88	1442,8235	2,3382	2,2071	2,3263	14,15	2,2071	0,0250
89	1452,6685	2,3582	2,2273	2,3509	14,25	2,2273	0,0254
90	1457,2505	2,3766	2,2505	2,3692	14,29	2,2505	0,0245
91	1462,8716	2,3931	2,2705	2,3877	14,35	2,2705	0,0240
92	1474,0375	2,4178	2,2890	2,4119	14,46	2,2890	0,0252
93	1486,8539	2,4430	2,3160	2,4404	14,58	2,3160	0,0251
94	1498,2457	2,4689	2,3193	2,4683	14,69	2,3193	0,0298
95	1509,2715	2,4952	2,3224	2,4973	14,80	2,3224	0,0348
96	1499,6669	2,5003	2,3213	2,5022	14,71	2,3213	0,0360
97	1488,5433	2,5007	2,3209	2,5025	14,60	2,3209	0,0361
98	1496,7804	2,5076	2,3217	2,5095	14,68	2,3217	0,0374
99	1526,3291	2,5420	2,3341	2,5487	14,97	2,3341	0,0422
100	1519,0640	2,5479	2,3388	2,5551	14,90	2,3388	0,0425
101	1508,2791	2,5487	2,3370	2,5555	14,79	2,3370	0,0430
102	1498,3866	2,5488	2,3370	2,5557	14,69	2,3370	0,0431
103	1489,0205	2,5462	2,3370	2,5561	14,60	2,3370	0,0428
104	1480,0920	2,5404	2,3359	2,5565	14,51	2,3359	0,0425
105	1471,7856	2,5325	2,3297	2,5568	14,43	2,3297	0,0430
106	1463,9934	2,5260	2,3224	2,5569	14,36	2,3224	0,0438
107	1455,4375	2,5187	2,3152	2,5575	14,27	2,3152	0,0446
108	1445,9114	2,5102	2,3046	2,5574	14,18	2,3046	0,0459
109	1450,5164	2,5083	2,3019	2,5545	14,22	2,3019	0,0459
110	1450,7813	2,5083	2,3029	2,5544	14,23	2,3029	0,0457
111	1443,5599	2,5079	2,3025	2,5550	14,16	2,3025	0,0458
112	1434,4818	2,5032	2,2983	2,5524	14,07	2,2983	0,0459
113	1427,2318	2,4957	2,2873	2,5428	14,00	2,2873	0,0464
114	1419,4377	2,4875	2,2753	2,5351	13,92	2,2753	0,0472



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

115	1409,8367	2,4794	2,2662	2,5287	13,83	2,2662	0,0476
116	1402,0524	2,4732	2,2547	2,5208	13,75	2,2547	0,0485
117	1397,6599	2,4667	2,2546	2,5125	13,71	2,2546	0,0470
118	1388,8866	2,4577	2,2451	2,5060	13,62	2,2451	0,0473
119	1385,2952	2,4519	2,2339	2,4998	13,59	2,2339	0,0484
120	1415,5869	2,4669	2,2492	2,4987	13,88	2,2492	0,0467
121	1431,9746	2,4812	2,2724	2,4986	14,04	2,2724	0,0435
122	1437,0024	2,4872	2,2968	2,4990	14,09	2,2968	0,0393
123	1432,8354	2,4877	2,2966	2,4993	14,05	2,2966	0,0394
124	1424,4860	2,4882	2,2955	2,4998	13,97	2,2955	0,0397
125	1416,4683	2,4858	2,2932	2,5002	13,89	2,2932	0,0400
126	1409,0853	2,4789	2,2871	2,5007	13,82	2,2871	0,0405
127	1412,8958	2,4752	2,2787	2,5005	13,86	2,2787	0,0418
128	1427,0668	2,4807	2,2829	2,4993	13,99	2,2829	0,0414
129	1441,6898	2,4935	2,3010	2,5007	14,14	2,3010	0,0392
130	1469,1877	2,5213	2,3225	2,5288	14,41	2,3225	0,0405
131	1496,8195	2,5517	2,3406	2,5577	14,68	2,3406	0,0428
132	1517,1327	2,5773	2,3656	2,5829	14,88	2,3656	0,0429
133	1534,1708	2,5993	2,3842	2,6075	15,05	2,3842	0,0438
134	1544,8804	2,6150	2,4021	2,6261	15,15	2,4021	0,0437
135	1557,5356	2,6355	2,4230	2,6460	15,27	2,4230	0,0436
136	1567,5000	2,6537	2,4433	2,6650	15,37	2,4433	0,0432
137	1571,4091	2,6652	2,4521	2,6766	15,41	2,4521	0,0438
138	1583,5229	2,6845	2,4695	2,6969	15,53	2,4695	0,0442
139	1599,0483	2,7093	2,4996	2,7232	15,68	2,4996	0,0433
140	1605,2023	2,7270	2,5207	2,7401	15,74	2,5207	0,0426
141	1620,7462	2,7515	2,5514	2,7671	15,89	2,5514	0,0416
142	1634,9500	2,7799	2,5750	2,7959	16,03	2,5750	0,0426
143	1633,0028	2,7910	2,5838	2,8071	16,01	2,5838	0,0430
144	1637,8618	2,8061	2,5973	2,8250	16,06	2,5973	0,0437
145	1630,1140	2,8092	2,6008	2,8287	15,99	2,6008	0,0436
146	1619,0255	2,8099	2,5978	2,8296	15,88	2,5978	0,0444
147	1609,1537	2,8101	2,5964	2,8299	15,78	2,5964	0,0447
148	1599,5417	2,8038	2,5933	2,8309	15,69	2,5933	0,0448
149	1590,3046	2,7967	2,5903	2,8313	15,60	2,5903	0,0447
150	1581,0980	2,7894	2,5874	2,8320	15,51	2,5874	0,0447
151	1572,0415	2,7816	2,5809	2,8329	15,42	2,5809	0,0453
152	1563,6384	2,7739	2,5689	2,8331	15,33	2,5689	0,0469
153	1555,1566	2,7658	2,5571	2,8298	15,25	2,5571	0,0481
154	1546,5400	2,7578	2,5474	2,8217	15,17	2,5474	0,0485



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

155	1537,5662	2,7495	2,5379	2,8135	15,08	2,5379	0,0487
156	1528,7820	2,7405	2,5295	2,8052	14,99	2,5295	0,0487
157	1520,9753	2,7318	2,5236	2,7981	14,92	2,5236	0,0483
158	1517,6749	2,7264	2,5164	2,7931	14,88	2,5164	0,0487
159	1548,5214	2,7414	2,5341	2,7906	15,19	2,5341	0,0464
160	1595,1215	2,7874	2,5851	2,8146	15,64	2,5851	0,0432
161	1599,4749	2,7948	2,5900	2,8205	15,69	2,5900	0,0435
162	1595,8346	2,7952	2,5869	2,8206	15,65	2,5869	0,0442
163	1614,5090	2,8132	2,6002	2,8345	15,83	2,6002	0,0447
164	1652,7793	2,8561	2,6481	2,8812	16,21	2,6481	0,0441
165	1674,9685	2,8885	2,6842	2,9177	16,43	2,6842	0,0438
166	1687,1735	2,9123	2,7105	2,9425	16,55	2,7105	0,0434
167	1697,6560	2,9348	2,7347	2,9655	16,65	2,7347	0,0431
168	1717,8241	2,9691	2,7699	3,0002	16,85	2,7699	0,0429
169	1745,8207	3,0256	2,8228	3,0442	17,12	2,8228	0,0424
170	1733,7694	3,0373	2,8358	3,0543	17,00	2,8358	0,0420
171	1719,4678	3,0380	2,8353	3,0548	16,86	2,8353	0,0422
172	1709,3859	3,0380	2,8338	3,0554	16,76	2,8338	0,0426
173	1744,3685	3,0704	2,8665	3,0848	17,11	2,8665	0,0422
174	1766,4084	3,1087	2,9003	3,1238	17,32	2,9003	0,0432
175	1779,9908	3,1375	2,9323	3,1551	17,46	2,9323	0,0428
176	1798,7129	3,1744	2,9651	3,1929	17,64	2,9651	0,0437
177	1809,6605	3,2026	2,9967	3,2212	17,75	2,9967	0,0430
178	1817,1886	3,2252	3,0227	3,2453	17,82	3,0227	0,0425
179	1819,3541	3,2402	3,0367	3,2607	17,84	3,0367	0,0427
180	1855,0708	3,2939	3,0979	3,3165	18,19	3,0979	0,0414
181	1855,2159	3,3162	3,1165	3,3412	18,19	3,1165	0,0424
182	1849,4419	3,3181	3,1197	3,3412	18,14	3,1197	0,0420
183	1866,4191	3,3442	3,1487	3,3684	18,30	3,1487	0,0415
184	1880,9056	3,3731	3,1767	3,3995	18,45	3,1767	0,0419
185	1870,7472	3,3764	3,1798	3,4036	18,35	3,1798	0,0420
186	1859,8875	3,3773	3,1798	3,4040	18,24	3,1798	0,0422
187	1860,6677	3,3783	3,1801	3,4038	18,25	3,1801	0,0422
188	1884,9318	3,3993	3,2015	3,4267	18,48	3,2015	0,0423
189	1901,3514	3,4264	3,2276	3,4544	18,65	3,2276	0,0426
190	1917,2461	3,4538	3,2585	3,4820	18,80	3,2585	0,0419
191	1937,2047	3,4902	3,2969	3,5202	19,00	3,2969	0,0417
192	1947,4384	3,5154	3,3285	3,5456	19,10	3,3285	0,0404
193	1962,3290	3,5459	3,3602	3,5740	19,24	3,3602	0,0400
194	1976,4451	3,5768	3,3806	3,6056	19,38	3,3806	0,0421



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

195	1982,2350	3,5977	3,4016	3,6261	19,44	3,4016	0,0421
196	1979,6552	3,6041	3,4082	3,6320	19,41	3,4082	0,0420
197	1985,8153	3,6177	3,4230	3,6475	19,47	3,4230	0,0419
198	1998,9746	3,6409	3,4423	3,6726	19,60	3,4423	0,0429
199	2009,7715	3,6661	3,4693	3,6996	19,71	3,4693	0,0427
200	1998,2527	3,6678	3,4718	3,7015	19,60	3,4718	0,0426
201	1987,8071	3,6685	3,4711	3,7021	19,49	3,4711	0,0428
202	1978,8010	3,6693	3,4706	3,7031	19,41	3,4706	0,0431
203	2014,3623	3,6883	3,5011	3,7220	19,75	3,5011	0,0408
204	2050,0073	3,7423	3,5556	3,7802	20,10	3,5556	0,0411
205	2063,7075	3,7714	3,5831	3,8144	20,24	3,5831	0,0420
206	2072,7896	3,7876	3,6067	3,8390	20,33	3,6067	0,0413
207	2083,1853	3,8142	3,6308	3,7731	20,43	3,6308	0,0326
208	2104,5159	3,8508	3,6675	3,7936	20,64	3,6675	0,0309
209	2120,8499	3,8856	3,6976	3,8298	20,80	3,6976	0,0320
210	2147,9617	3,9337	3,7517	3,8834	21,06	3,7517	0,0314
211	2149,0449	3,9584	3,7786	3,9124	21,08	3,7786	0,0314
212	2132,8115	3,9596	3,7793	3,9138	20,92	3,7793	0,0315
213	2121,1011	3,9572	3,7777	3,9139	20,80	3,7777	0,0316
214	2113,4595	3,9514	3,7742	3,9142	20,73	3,7742	0,0317
215	2159,9321	3,9999	3,8243	3,9555	21,18	3,8243	0,0307
216	2214,8171	4,0900	3,9250	4,0497	21,72	3,9250	0,0290
217	2249,7749	4,1689	3,9967	4,1313	22,06	3,9967	0,0307
218	2264,1201	4,2181	4,0453	4,1838	22,20	4,0453	0,0311
219	2277,9114	4,2581	4,0841	4,2284	22,34	4,0841	0,0318
220	2294,4707	4,3001	4,1282	4,2800	22,50	4,1282	0,0324
221	2291,4810	4,3129	4,1440	4,2995	22,47	4,1440	0,0324
222	2279,0527	4,3140	4,1445	4,2996	22,35	4,1445	0,0325
223	2268,7363	4,3127	4,1436	4,2996	22,25	4,1436	0,0325
224	2267,3406	4,3108	4,1407	4,3003	22,24	4,1407	0,0330
225	2344,4678	4,4121	4,2377	4,3825	22,99	4,2377	0,0319
226	2382,6316	4,4924	4,3180	4,4664	23,37	4,3180	0,0323
227	2397,0413	4,5343	4,3617	4,5104	23,51	4,3617	0,0321
228	2419,7991	4,5850	4,4261	4,5634	23,73	4,4261	0,0296
229	2451,5303	4,6472	4,4810	4,6279	24,04	4,4810	0,0313
230	2459,4468	4,6871	4,5233	4,6694	24,12	4,5233	0,0310
231	2442,7229	4,6885	4,5251	4,6717	23,96	4,5251	0,0310
232	2432,4790	4,6865	4,5250	4,6718	23,85	4,5250	0,0308
233	2433,4321	4,6876	4,5293	4,6755	23,86	4,5293	0,0305
234	2492,3293	4,7608	4,6033	4,7468	24,44	4,6033	0,0301



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

235	2508,9805	4,8048	4,6542	4,7939	24,60	4,6542	0,0290
236	2533,8145	4,8551	4,7008	4,8472	24,85	4,7008	0,0301
237	2558,2344	4,9101	4,7602	4,9051	25,09	4,7602	0,0295
238	2575,3572	4,9514	4,8015	4,9514	25,26	4,8015	0,0300
239	2588,8235	4,9853	4,8300	4,9902	25,39	4,8300	0,0316
240	2603,3972	5,0195	4,8600	5,0260	25,53	4,8600	0,0326
241	2604,0266	5,0426	4,8804	5,0490	25,54	4,8804	0,0331
242	2590,9939	5,0419	4,8812	5,0495	25,41	4,8812	0,0329
243	2582,5916	5,0388	4,8818	5,0497	25,33	4,8818	0,0325
244	2576,9446	5,0347	4,8818	5,0501	25,27	4,8818	0,0321
245	2601,1472	5,0580	4,9051	5,0680	25,51	4,9051	0,0316
246	2631,9216	5,1029	4,9592	5,1145	25,81	4,9592	0,0299
247	2679,7349	5,1855	5,0339	5,2008	26,28	5,0339	0,0318
248	2721,3230	5,2670	5,1179	5,2891	26,69	5,1179	0,0320
249	2745,5283	5,3309	5,1882	5,3583	26,92	5,1882	0,0313
250	2743,6321	5,3528	5,2153	5,3831	26,91	5,2153	0,0305
251	2731,7205	5,3596	5,2231	5,3932	26,79	5,2231	0,0307
252	2717,2268	5,3524	5,2261	5,3939	26,65	5,2261	0,0294
253	2708,7979	5,3478	5,2257	5,3938	26,56	5,2257	0,0290
254	2701,6130	5,3431	5,2202	5,3941	26,49	5,2202	0,0297
255	2702,1982	5,3425	5,2221	5,3934	26,50	5,2221	0,0292
256	2721,2942	5,3568	5,2335	5,3963	26,69	5,2335	0,0286
257	2751,7188	5,3979	5,2694	5,4365	26,99	5,2694	0,0296
258	2733,2434	5,4024	5,2777	5,4660	26,80	5,2777	0,0313
259	2721,9512	5,3845	5,2721	5,4669	26,69	5,2721	0,0307
260	2774,8691	5,4488	5,3089	5,4917	27,21	5,3089	0,0323
261	2818,6497	5,5262	5,3897	5,5669	27,64	5,3897	0,0314
262	2841,6038	5,5823	5,4364	5,6253	27,87	5,4364	0,0335
263	2829,2559	5,5857	5,4406	5,6291	27,75	5,4406	0,0334
264	2820,6047	5,5858	5,4410	5,6294	27,66	5,4410	0,0333
265	2829,9561	5,6001	5,4596	5,6417	27,75	5,4596	0,0323
266	2890,1394	5,6900	5,5536	5,7336	28,34	5,5536	0,0316
267	2920,8660	5,7593	5,6213	5,8032	28,64	5,6213	0,0320
268	2936,5449	5,8067	5,6769	5,8531	28,80	5,6769	0,0306
269	2965,2322	5,8673	5,7271	5,9139	29,08	5,7271	0,0327
270	2986,6196	5,9261	5,7846	5,9727	29,29	5,7846	0,0330
271	3017,8269	6,0045	5,8621	6,0499	29,59	5,8621	0,0330
272	3032,4246	6,0536	5,9192	6,1061	29,74	5,9192	0,0321
273	3027,7485	6,0788	5,9501	6,1310	29,69	5,9501	0,0310
274	3014,5886	6,0786	5,9501	6,1314	29,56	5,9501	0,0310



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

275	3005,8613	6,0786	5,9500	6,1310	29,48	5,9500	0,0309
276	2998,1953	6,0787	5,9501	6,1308	29,40	5,9501	0,0309
277	2990,3445	6,0787	5,9504	6,1310	29,33	5,9504	0,0309
278	3029,6260	6,1136	5,9914	6,1760	29,71	5,9914	0,0307
279	3095,4434	6,2281	6,1087	6,2943	30,36	6,1087	0,0305
280	3136,1318	6,3255	6,2057	6,4025	30,76	6,2057	0,0317
281	3140,9858	6,3744	6,2494	6,4500	30,80	6,2494	0,0326
282	3158,1064	6,4145	6,3053	6,5016	30,97	6,3053	0,0305
283	3192,9058	6,4968	6,3877	6,5893	31,31	6,3877	0,0311
284	3213,8213	6,5709	6,4693	6,6686	31,52	6,4693	0,0301
285	3193,9089	6,5778	6,4729	6,6758	31,32	6,4729	0,0308
286	3180,1040	6,5778	6,4733	6,6758	31,19	6,4733	0,0307
287	3170,2754	6,5776	6,4733	6,6756	31,09	6,4733	0,0307
288	3161,9448	6,5777	6,4736	6,6757	31,01	6,4736	0,0306
289	3205,2742	6,6392	6,5367	6,7389	31,43	6,5367	0,0305
290	3258,8442	6,7635	6,6619	6,8749	31,96	6,6619	0,0315
291	3270,2104	6,8839	6,7873	6,9973	32,07	6,7873	0,0307
292	3258,4656	6,9927	6,9089	7,1074	31,95	6,9089	0,0282
293	3238,6694	7,1290	7,0506	7,2485	31,76	7,0506	0,0276
294	3218,1389	7,2971	7,2394	7,4195	31,56	7,2394	0,0238
299	3228,9719	7,7530	7,7247	7,8734	31,67	7,7247	0,0177
300	3207,5674	7,9000	7,8757	8,0375	31,46	7,8757	0,0186
301	3193,9041	7,9491	7,9462	8,1031	31,32	7,9462	0,0160
302	3208,0107	8,0361	8,0394	8,1903	31,46	8,0394	0,0148
303	3196,6206	8,0841	8,0860	8,2378	31,35	8,0860	0,0150
304	3193,6274	8,1174	8,1221	8,2695	31,32	8,1221	0,0143
305	3213,9546	8,1680	8,1872	8,3309	31,52	8,1872	0,0125
311	3273,4304	8,4643	8,5041	8,6369	32,10	8,5041	0,0093
324	3256,8816	9,3401	9,4538	9,5276	31,94	9,4538	0,0040
325	3299,6675	9,5054	9,6276	9,4656	32,36	9,6276	0,0284
326	3315,9343	9,7088	9,8507	9,5915	32,52	9,8507	0,0401
327	3285,0408	9,8471	9,9997	9,7327	32,22	9,9997	0,0420
330	3270,7041	9,9534	10,1210	9,8424	32,07	10,1210	0,0446
331	3339,7664	10,1588	10,3367	10,0462	32,75	10,3367	0,0469
332	3365,7632	10,3859	10,5801	10,2631	33,01	10,5801	0,0511
333	3361,2085	10,5330	10,7317	10,3909	32,96	10,7317	0,0540
334	3369,5510	10,6712	10,8624	10,5134	33,04	10,8624	0,0540
338	3350,5342	10,8307	11,0304	10,6399	32,86	11,0304	0,0590
339	3400,1794	11,0035	11,1945	10,7709	33,34	11,1945	0,0615
340	3411,1848	11,2106	11,3975	10,9120	33,45	11,3975	0,0672



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

341	3402,3035	11,3174	11,5304	11,0243	33,37	11,5304	0,0719
342	3385,9829	11,4035	11,6157	11,1086	33,21	11,6157	0,0719
343	3379,9001	11,4798	11,7017	11,1923	33,15	11,7017	0,0731
344	3366,5081	11,5436	11,7766	11,2502	33,01	11,7766	0,0759
348	3371,4360	11,6611	11,9077	11,3526	33,06	11,9077	0,0802
349	3417,7478	11,8150	12,0734	11,4915	33,52	12,0734	0,0840
350	3413,3447	11,9507	12,2232	11,6330	33,47	12,2232	0,0863
351	3339,9602	12,1261	12,3667	11,7424	32,75	12,3667	0,0865
352	3323,4185	12,3205	12,5124	11,8522	32,59	12,5124	0,0852
359	3325,0354	12,8298	12,6262	12,2223	32,61	12,6262	0,0200
360	3338,3933	12,9358	12,6338	12,3108	32,74	12,6338	0,0021
361	3356,0242	13,0451	12,6451	12,4026	32,91	12,6451	0,0158
362	3343,7502	13,1440	12,6420	12,4802	32,79	12,6420	0,0340
398	3446,0298	16,3091	12,6411	15,0041	33,79	12,6411	0,6031
399	3426,9319	16,3175	12,6399	15,0028	33,61	12,6399	0,6041
400	3414,9739	16,3228	12,6405	15,0022	33,49	12,6405	0,6044
401	3424,3311	16,3492	12,6420	15,0336	33,58	12,6420	0,6099
403	3501,6621	16,6012	12,6395	15,2610	34,34	12,6395	0,6583
404	3490,4456	16,6787	12,6398	15,2749	34,23	12,6398	0,6674
405	3515,9402	16,8032	12,6414	15,3915	34,48	12,6414	0,6912
406	3517,3262	16,9810	12,6432	15,5535	34,49	12,6432	0,7248
407	3470,4702	17,0278	12,6406	15,5905	34,03	12,6406	0,7337
408	3447,2556	17,0407	12,6369	15,5976	33,81	12,6369	0,7365
409	3432,9412	17,0472	12,6365	15,6028	33,67	12,6365	0,7377
410	3445,7964	17,0804	12,6392	15,6367	33,79	12,6392	0,7439
411	3514,5986	17,2458	12,6381	15,8060	34,47	12,6381	0,7776
412	3526,0205	17,4553	12,6387	15,9916	34,58	12,6387	0,8170
413	3531,2327	17,6640	12,6362	16,1872	34,63	12,6362	0,8579
414	3532,3767	17,7969	12,6345	16,3086	34,64	12,6345	0,8837
415	3511,6479	17,8611	12,6333	16,3539	34,44	12,6333	0,8948
416	3490,0793	17,8702	12,6306	16,3637	34,23	12,6306	0,8973
417	3476,5200	17,8735	12,6323	16,3632	34,09	12,6323	0,8972
418	3468,9207	17,8782	12,6334	16,3637	34,02	12,6334	0,8975
420	3560,9910	18,1279	12,6336	16,6161	34,92	12,6336	0,9477
421	3552,8496	18,2158	12,6323	16,6919	34,84	12,6323	0,9643
422	3550,8923	18,2856	12,6317	16,7604	34,82	12,6317	0,9782
423	3568,4260	18,4309	12,6348	16,8878	34,99	12,6348	1,0049
433	3286,1455	19,4524	13,0116	17,8617	32,23	13,0116	1,1291

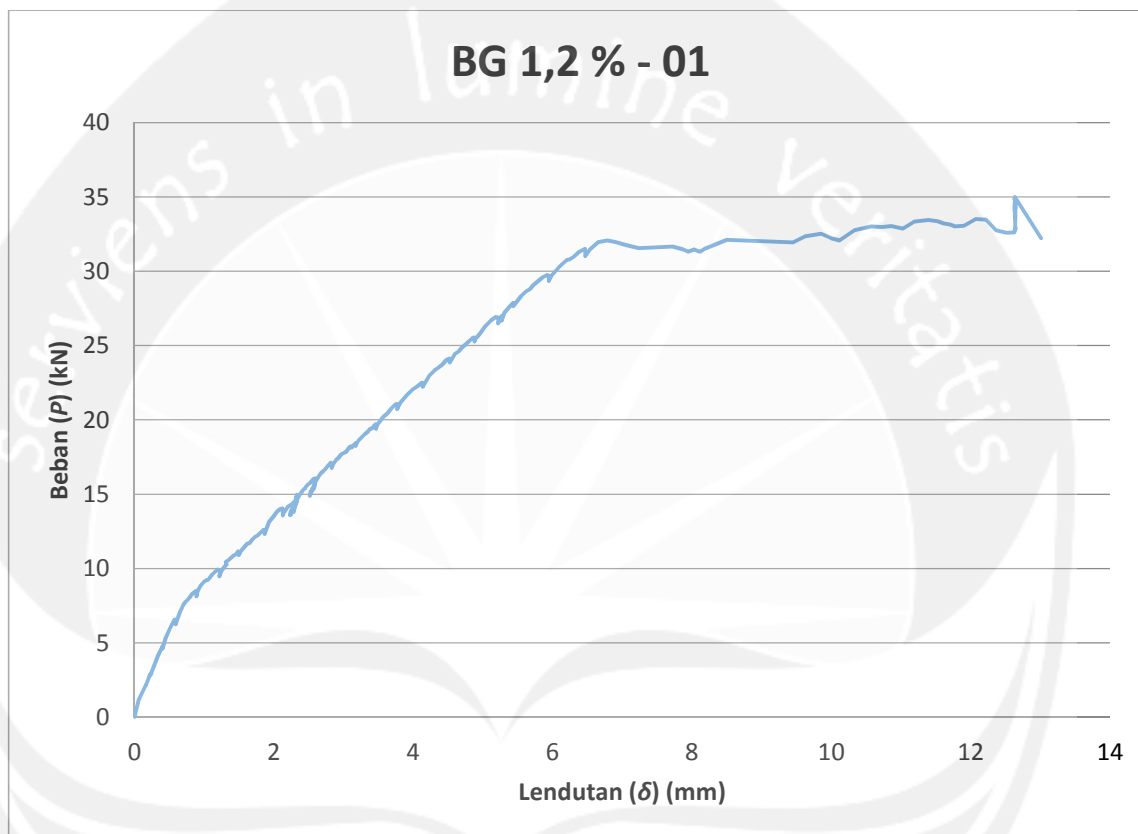


UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

Keterangan :

-  = Data Pada Beban Retak Pertama
-  = Data Pada Beban Maksimum





UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
 Telp: (0274) 487711 Fax: (0274) 487748
 Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

4. Balok BG 1,2 % - 02

No.	Load Cell (kg)	LVDT1 (mm)	LVDT2 (mm)	LVDT3 (mm)	Beban (P) (kN)	Lendutan (δ) (mm)	Kelengkungan (Δ) (1/m)
0	-0,3522	-0,0107	0,0314	0,0060	0,00	0,0314	0,0068
1	4,5353	-0,0094	0,0306	0,0076	0,04	0,0306	0,0063
2	178,4574	0,0989	0,1331	0,1097	1,75	0,1331	0,0058
3	248,9903	0,1588	0,1937	0,1641	2,44	0,1937	0,0065
4	246,2702	0,1609	0,1946	0,1665	2,42	0,1946	0,0062
5	254,1340	0,1667	0,2001	0,1720	2,49	0,2001	0,0062
6	337,4397	0,2290	0,2655	0,2337	3,31	0,2655	0,0068
7	430,7980	0,3054	0,3437	0,3103	4,22	0,3437	0,0072
8	513,8541	0,3752	0,4027	0,3802	5,04	0,4027	0,0050
9	531,1534	0,3983	0,4216	0,4021	5,21	0,4216	0,0043
10	524,1477	0,3985	0,4228	0,4021	5,14	0,4228	0,0045
11	519,7961	0,3989	0,4234	0,4025	5,10	0,4234	0,0045
12	565,4644	0,4265	0,4520	0,4303	5,55	0,4520	0,0047
13	681,4774	0,5205	0,5510	0,5227	6,68	0,5510	0,0059
14	756,7343	0,6002	0,6326	0,6010	7,42	0,6326	0,0064
15	825,7443	0,6742	0,7101	0,6709	8,10	0,7101	0,0075
16	838,8395	0,7070	0,7397	0,7026	8,23	0,7397	0,0070
17	827,2466	0,7070	0,7394	0,7031	8,11	0,7394	0,0069
18	841,1328	0,7201	0,7501	0,7150	8,25	0,7501	0,0065
19	957,0767	0,8215	0,8396	0,8131	9,39	0,8396	0,0045
20	1044,4111	0,9328	0,9563	0,9234	10,24	0,9563	0,0056
21	1113,8917	1,0368	1,0616	1,0275	10,92	1,0616	0,0059
22	1128,7162	1,0899	1,1110	1,0814	11,07	1,1110	0,0051
23	1111,0974	1,0928	1,1125	1,0847	10,90	1,1125	0,0047
24	1101,1259	1,0929	1,1128	1,0846	10,80	1,1128	0,0048
25	1114,2289	1,1062	1,1250	1,0973	10,93	1,1250	0,0047
26	1176,8049	1,1613	1,1785	1,1523	11,54	1,1785	0,0043
27	1238,0742	1,2386	1,2529	1,2300	12,14	1,2529	0,0037
28	1251,9935	1,2822	1,2963	1,2747	12,28	1,2963	0,0036
29	1294,0724	1,3388	1,3520	1,3320	12,69	1,3520	0,0033
30	1295,1382	1,3723	1,3916	1,3659	12,70	1,3916	0,0045
31	1278,5560	1,3744	1,3937	1,3675	12,54	1,3937	0,0046
32	1268,6954	1,3753	1,3952	1,3687	12,44	1,3952	0,0046
33	1304,6490	1,4067	1,4284	1,3999	12,79	1,4284	0,0050
34	1382,6892	1,4942	1,5129	1,4872	13,56	1,5129	0,0044
35	1472,5674	1,6428	1,6653	1,6358	14,44	1,6653	0,0052



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

36	1541,4634	1,7971	1,8238	1,7904	15,12	1,8238	0,0060
37	1535,4762	1,8532	1,8854	1,8474	15,06	1,8854	0,0070
38	1515,4617	1,8576	1,8890	1,8515	14,86	1,8890	0,0069
39	1510,2426	1,8638	1,8961	1,8570	14,81	1,8961	0,0071
40	1575,0210	1,9297	1,9630	1,9211	15,45	1,9630	0,0075
41	1665,0718	2,0692	2,1017	2,0600	16,33	2,1017	0,0074
42	1734,7861	2,2361	2,2633	2,2262	17,01	2,2633	0,0064
43	1779,3988	2,3641	2,3958	2,3539	17,45	2,3958	0,0074
44	1757,0165	2,3891	2,4294	2,3787	17,23	2,4294	0,0091
45	1742,1466	2,3912	2,4312	2,3802	17,08	2,4312	0,0091
46	1772,1353	2,4264	2,4654	2,4140	17,38	2,4654	0,0090
47	1859,7826	2,5488	2,5866	2,5337	18,24	2,5866	0,0091
48	1935,4957	2,6994	2,7366	2,6760	18,98	2,7366	0,0098
49	1990,6545	2,8392	2,8760	2,8172	19,52	2,8760	0,0096
50	2007,3435	2,9135	2,9444	2,8877	19,69	2,9444	0,0088
51	1987,0269	2,9189	2,9465	2,8931	19,49	2,9465	0,0081
52	1974,8010	2,9199	2,9495	2,8939	19,37	2,9495	0,0085
53	1964,6107	2,9199	2,9496	2,8944	19,27	2,9496	0,0085
54	1985,5923	2,9417	2,9724	2,9138	19,47	2,9724	0,0089
55	2006,4371	2,9718	2,9983	2,9420	19,68	2,9983	0,0083
56	2026,1865	3,0038	3,0362	2,9729	19,87	3,0362	0,0096
57	2044,8602	3,0377	3,0711	3,0049	20,05	3,0711	0,0100
58	2047,7454	3,0564	3,0857	3,0227	20,08	3,0857	0,0092
59	2039,1743	3,0596	3,0879	3,0258	20,00	3,0879	0,0090
60	2054,5261	3,0802	3,1067	3,0458	20,15	3,1067	0,0087
61	2077,7236	3,1146	3,1508	3,0797	20,38	3,1508	0,0107
62	2084,0144	3,1321	3,1640	3,0975	20,44	3,1640	0,0098
63	2094,5000	3,1527	3,1834	3,1180	20,54	3,1834	0,0096
64	2107,5891	3,1771	3,2086	3,1425	20,67	3,2086	0,0098
65	2124,0935	3,2077	3,2367	3,1728	20,83	3,2367	0,0093
66	2130,4143	3,2275	3,2600	3,1927	20,89	3,2600	0,0100
67	2136,6306	3,2447	3,2802	3,2094	20,95	3,2802	0,0106
68	2130,2690	3,2508	3,2863	3,2161	20,89	3,2863	0,0106
69	2122,1694	3,2510	3,2875	3,2163	20,81	3,2875	0,0108
70	2111,4163	3,2515	3,2878	3,2166	20,71	3,2878	0,0108
71	2103,3083	3,2521	3,2876	3,2144	20,63	3,2876	0,0109
72	2139,2107	3,2757	3,3164	3,2388	20,98	3,3164	0,0118
73	2183,7595	3,3316	3,3677	3,2927	21,42	3,3677	0,0111
74	2209,5193	3,3762	3,4084	3,3373	21,67	3,4084	0,0103
75	2221,0649	3,4073	3,4536	3,3686	21,78	3,4536	0,0131



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

76	2212,7778	3,4150	3,4614	3,3763	21,70	3,4614	0,0132
77	2211,6140	3,4234	3,4694	3,3842	21,69	3,4694	0,0131
78	2226,1616	3,4441	3,4832	3,4039	21,83	3,4832	0,0119
79	2260,1030	3,4901	3,5258	3,4494	22,16	3,5258	0,0112
80	2295,8696	3,5518	3,5943	3,5098	22,51	3,5943	0,0127
81	2317,5234	3,6019	3,6460	3,5612	22,73	3,6460	0,0129
82	2306,6306	3,6144	3,6607	3,5744	22,62	3,6607	0,0132
83	2294,9236	3,6157	3,6608	3,5755	22,51	3,6608	0,0130
84	2283,2224	3,6165	3,6601	3,5764	22,39	3,6601	0,0127
85	2271,2910	3,6164	3,6593	3,5770	22,27	3,6593	0,0125
86	2264,8018	3,6164	3,6593	3,5762	22,21	3,6593	0,0126
87	2294,6714	3,6335	3,6782	3,5922	22,50	3,6782	0,0131
88	2332,3042	3,6786	3,7198	3,6370	22,87	3,7198	0,0124
89	2351,3586	3,7133	3,7516	3,6707	23,06	3,7516	0,0119
90	2382,7126	3,7615	3,8037	3,7179	23,37	3,8037	0,0128
91	2424,5532	3,8365	3,8838	3,7923	23,78	3,8838	0,0139
92	2436,2683	3,8762	3,9283	3,8310	23,89	3,9283	0,0149
93	2472,3811	3,9419	3,9853	3,8955	24,25	3,9853	0,0133
94	2494,5005	4,0002	4,0328	3,9535	24,46	4,0328	0,0112
95	2510,6460	4,0441	4,0861	3,9966	24,62	4,0861	0,0131
96	2510,4031	4,0666	4,1090	4,0190	24,62	4,1090	0,0132
97	2498,0281	4,0675	4,1114	4,0196	24,50	4,1114	0,0136
98	2487,5266	4,0674	4,1116	4,0197	24,39	4,1116	0,0136
99	2476,9824	4,0679	4,1114	4,0199	24,29	4,1114	0,0135
100	2510,1741	4,0971	4,1400	4,0453	24,62	4,1400	0,0138
101	2566,5535	4,1756	4,2233	4,1070	25,17	4,2233	0,0164
102	2619,7202	4,2677	4,3135	4,2070	25,69	4,3135	0,0152
103	2644,1045	4,3361	4,3933	4,2826	25,93	4,3933	0,0168
104	2684,5066	4,4154	4,4646	4,3611	26,33	4,4646	0,0153
105	2723,2852	4,4992	4,5512	4,4443	26,71	4,5512	0,0159
106	2730,5803	4,5431	4,5863	4,4874	26,78	4,5863	0,0142
107	2717,3423	4,5462	4,5912	4,4910	26,65	4,5912	0,0145
108	2707,0569	4,5462	4,5924	4,4905	26,55	4,5924	0,0148
109	2695,3250	4,5468	4,5929	4,4906	26,43	4,5929	0,0148
110	2684,1323	4,5472	4,5927	4,4917	26,32	4,5927	0,0147
111	2682,3374	4,5467	4,5931	4,4919	26,30	4,5931	0,0148
112	2723,7627	4,5786	4,6219	4,5233	26,71	4,6219	0,0142
113	2765,5029	4,6372	4,6890	4,5817	27,12	4,6890	0,0159
114	2800,1880	4,6969	4,7638	4,6411	27,46	4,7638	0,0190
115	2826,4490	4,7493	4,8025	4,6929	27,72	4,8025	0,0163



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

116	2841,3728	4,7890	4,8428	4,7316	27,86	4,8428	0,0165
117	2865,8442	4,8354	4,8869	4,7772	28,10	4,8869	0,0161
118	2899,8423	4,8999	4,9497	4,8398	28,44	4,9497	0,0160
119	2909,9458	4,9378	4,9987	4,8765	28,54	4,9987	0,0183
120	2899,4517	4,9422	4,9994	4,8808	28,43	4,9994	0,0176
121	2892,4673	4,9449	5,0050	4,8842	28,37	5,0050	0,0181
122	2901,0234	4,9580	5,0169	4,8967	28,45	5,0169	0,0179
123	2901,1990	4,9656	5,0280	4,9041	28,45	5,0280	0,0186
124	2900,7334	4,9704	5,0335	4,9087	28,45	5,0335	0,0188
125	2897,6907	4,9727	5,0355	4,9108	28,42	5,0355	0,0188
126	2892,4648	4,9730	5,0343	4,9105	28,37	5,0343	0,0185
127	2884,4866	4,9734	5,0344	4,9109	28,29	5,0344	0,0184
128	2874,6013	4,9741	5,0350	4,9117	28,19	5,0350	0,0184
129	2865,2744	4,9741	5,0348	4,9123	28,10	5,0348	0,0183
130	2871,1389	4,9737	5,0346	4,9117	28,16	5,0346	0,0184
131	2905,8127	4,9991	5,0530	4,9367	28,50	5,0530	0,0170
132	2930,9775	5,0341	5,0894	4,9699	28,74	5,0894	0,0175
133	2946,1377	5,0602	5,1200	4,9966	28,89	5,1200	0,0183
134	2955,5674	5,0790	5,1341	5,0165	28,98	5,1341	0,0173
135	2969,0969	5,1027	5,1532	5,0403	29,12	5,1532	0,0163
136	2980,1072	5,1249	5,1732	5,0615	29,23	5,1732	0,0160
137	2996,2275	5,1538	5,2011	5,0893	29,38	5,2011	0,0159
138	3007,6929	5,1788	5,2320	5,1132	29,50	5,2320	0,0172
139	3019,0137	5,2025	5,2534	5,1374	29,61	5,2534	0,0167
140	3029,5591	5,2258	5,2719	5,1607	29,71	5,2719	0,0157
141	3062,5215	5,2785	5,3309	5,2120	30,03	5,3309	0,0171
142	3090,2188	5,3351	5,3801	5,2677	30,30	5,3801	0,0158
143	3107,8391	5,3819	5,4271	5,3126	30,48	5,4271	0,0160
144	3104,5503	5,3987	5,4482	5,3282	30,45	5,4482	0,0169
145	3093,8904	5,3993	5,4491	5,3282	30,34	5,4491	0,0171
146	3084,6965	5,3997	5,4504	5,3284	30,25	5,4504	0,0173
147	3074,1558	5,4000	5,4509	5,3289	30,15	5,4509	0,0173
148	3064,3728	5,4001	5,4509	5,3297	30,05	5,4509	0,0172
149	3069,0413	5,4004	5,4511	5,3301	30,10	5,4511	0,0172
150	3102,7908	5,4301	5,4808	5,3607	30,43	5,4808	0,0171
151	3133,5305	5,4759	5,5278	5,4057	30,73	5,5278	0,0174
152	3151,1743	5,5111	5,5640	5,4404	30,90	5,5640	0,0177
153	3156,0925	5,5296	5,5893	5,4593	30,95	5,5893	0,0190
154	3165,0698	5,5522	5,6088	5,4817	31,04	5,6088	0,0184
155	3174,9241	5,5752	5,6322	5,5039	31,14	5,6322	0,0185



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

156	3188,3726	5,6042	5,6756	5,5324	31,27	5,6756	0,0215
157	3203,4299	5,6351	5,6982	5,5619	31,42	5,6982	0,0199
158	3213,1851	5,6607	5,7175	5,5880	31,51	5,7175	0,0186
159	3222,1882	5,6875	5,7326	5,6143	31,60	5,7326	0,0163
160	3220,6516	5,6985	5,7413	5,6245	31,58	5,7413	0,0160
161	3230,8845	5,7198	5,7749	5,6442	31,68	5,7749	0,0186
162	3260,1733	5,7714	5,8252	5,6954	31,97	5,8252	0,0184
178	3298,4202	5,9521	6,0198	5,8679	32,35	6,0198	0,0220
179	3313,3711	5,9853	6,0475	5,9001	32,49	6,0475	0,0209
180	3310,4524	5,9997	6,0586	5,9119	32,46	6,0586	0,0206
181	3307,8665	6,0108	6,0665	5,9218	32,44	6,0665	0,0200
182	3304,1895	6,0183	6,0821	5,9287	32,40	6,0821	0,0217
183	3314,1230	6,0411	6,1128	5,9507	32,50	6,1128	0,0234
184	3331,6758	6,0806	6,1471	5,9887	32,67	6,1471	0,0225
185	3348,4954	6,1295	6,1924	6,0342	32,84	6,1924	0,0221
186	3358,3789	6,1872	6,2626	6,0876	32,93	6,2626	0,0250
187	3354,2295	6,2385	6,3185	6,1344	32,89	6,3185	0,0264
188	3351,6726	6,3037	6,3789	6,1923	32,87	6,3789	0,0262
189	3336,3550	6,3662	6,4491	6,2457	32,72	6,4491	0,0286
197	3305,7695	6,5885	6,7154	6,4624	32,42	6,7154	0,0380
198	3298,8135	6,6490	6,7812	6,5186	32,35	6,7812	0,0395
199	3291,3494	6,7004	6,8382	6,5662	32,28	6,8382	0,0410
200	3282,9675	6,7344	6,8753	6,5950	32,20	6,8753	0,0421
201	3292,0398	6,7868	6,9320	6,6417	32,28	6,9320	0,0436
202	3317,6277	6,8845	7,0357	6,7309	32,54	7,0357	0,0456
203	3305,6599	6,9590	7,1171	6,7986	32,42	7,1171	0,0477
204	3293,7327	7,0056	7,1700	6,8395	32,30	7,1700	0,0495
205	3286,2039	7,0403	7,2086	6,8702	32,23	7,2086	0,0507
206	3289,8757	7,0808	7,2483	6,9069	32,26	7,2483	0,0509
216	3295,5654	7,3328	7,5366	7,1383	32,32	7,5366	0,0602
217	3295,2341	7,3897	7,5990	7,1920	32,32	7,5990	0,0616
218	3300,8005	7,4708	7,6923	7,2665	32,37	7,6923	0,0647
219	3289,0732	7,5252	7,7552	7,3144	32,25	7,7552	0,0671
220	3287,2678	7,5759	7,8142	7,3585	32,24	7,8142	0,0694
221	3302,2715	7,6424	7,8853	7,4155	32,38	7,8853	0,0713
222	3312,0105	7,7172	7,9669	7,4848	32,48	7,9669	0,0732
223	3332,9524	7,8025	8,0621	7,5650	32,69	8,0621	0,0757
224	3335,1719	7,8809	8,1608	7,6417	32,71	8,1608	0,0799
229	3347,4153	7,9631	8,2855	7,7445	32,83	8,2855	0,0863
230	3365,1035	8,0387	8,3734	7,8172	33,00	8,3734	0,0891



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

231	3374,9624	8,1129	8,4594	7,8880	33,10	8,4594	0,0918
232	3393,4946	8,2017	8,5654	7,9780	33,28	8,5654	0,0951
233	3397,7100	8,3004	8,6785	8,0725	33,32	8,6785	0,0984
234	3394,5129	8,3577	8,7411	8,1265	33,29	8,7411	0,0998
235	3403,0396	8,4227	8,8110	8,1874	33,37	8,8110	0,1012
236	3424,5117	8,5119	8,9029	8,2709	33,58	8,9029	0,1023
244	3431,5649	8,6997	9,1079	8,4443	33,65	9,1079	0,1072
245	3437,6614	8,7438	9,1596	8,4856	33,71	9,1596	0,1090
246	3448,7046	8,7945	9,2129	8,5333	33,82	9,2129	0,1098
247	3448,5378	8,8385	9,2653	8,5750	33,82	9,2653	0,1117
248	3467,9924	8,9035	9,3367	8,6368	34,01	9,3367	0,1133
249	3477,1113	8,9815	9,4153	8,7106	34,10	9,4153	0,1138
250	3493,8333	9,0630	9,5053	8,7862	34,26	9,5053	0,1161
251	3499,9827	9,1551	9,6007	8,8725	34,32	9,6007	0,1174
257	3520,4731	9,3371	9,7953	9,0443	34,52	9,7953	0,1209
258	3534,2712	9,4275	9,8895	9,1320	34,66	9,8895	0,1219
259	3545,0300	9,5235	9,9864	9,2220	34,77	9,9864	0,1227
260	3550,7344	9,6196	10,0940	9,3121	34,82	10,0940	0,1256
261	3557,9287	9,7235	10,1986	9,4057	34,89	10,1986	0,1268
273	3533,6787	10,1012	10,5610	9,7288	34,65	10,5610	0,1292
274	3533,3125	10,1962	10,6528	9,7896	34,65	10,6528	0,1320
275	3512,3008	10,2669	10,7109	9,8450	34,44	10,7109	0,1310
276	3504,6804	10,3360	10,7756	9,9000	34,37	10,7756	0,1315
277	3504,8206	10,4237	10,8558	9,9713	34,37	10,8558	0,1317
278	3496,1824	10,5036	10,9312	10,0385	34,29	10,9312	0,1320
279	3492,1165	10,5861	11,0026	10,1098	34,25	11,0026	0,1309
280	3484,5439	10,6637	11,0794	10,1757	34,17	11,0794	0,1319
287	3508,9355	11,0343	11,4213	10,4866	34,41	11,4213	0,1322
288	3507,1680	11,1205	11,4943	10,5536	34,39	11,4943	0,1315
289	3510,1973	11,2074	11,5701	10,6240	34,42	11,5701	0,1309
302	3537,6445	11,7178	12,0287	11,0329	34,69	12,0287	0,1307
303	3549,4409	11,7979	12,1034	11,1009	34,81	12,1034	0,1308
304	3565,3008	11,8844	12,1842	11,1756	34,96	12,1842	0,1308
305	3567,9675	11,9639	12,2666	11,2435	34,99	12,2666	0,1326
310	3596,7632	12,1421	12,4383	11,3975	35,27	12,4383	0,1337
311	3596,0989	12,2170	12,5048	11,4613	35,27	12,5048	0,1331
320	3634,6194	12,5820	12,8567	11,7754	35,64	12,8567	0,1356
322	3634,9578	12,7281	12,9947	11,8998	35,65	12,9947	0,1362
323	3646,3164	12,8905	13,1459	12,0390	35,76	13,1459	0,1362
329	3655,6580	13,1519	13,3849	12,2512	35,85	13,3849	0,1367



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

330	3678,0757	13,3214	13,5411	12,3870	36,07	13,5411	0,1374
331	3645,3740	13,3913	13,5751	12,4230	35,75	13,5751	0,1336
333	3703,5752	13,5820	13,7608	12,5949	36,32	13,7608	0,1345
339	3740,6501	13,9647	14,1294	12,9322	36,68	14,1294	0,1362
340	3730,3896	14,1934	14,3502	13,1314	36,58	14,3502	0,1376
341	3732,5039	14,3571	14,5186	13,2786	36,60	14,5186	0,1401
342	3719,3962	14,4715	14,6308	13,3831	36,48	14,6308	0,1407
349	3731,6694	14,9773	15,1551	13,8395	36,60	15,1551	0,1493
350	3722,2122	15,0631	15,2457	13,9251	36,50	15,2457	0,1503
351	3731,1877	15,1543	15,3374	14,0009	36,59	15,3374	0,1520
352	3731,7659	15,2348	15,4179	14,0762	36,60	15,4179	0,1525
359	3782,5496	15,7617	15,9563	14,5571	37,09	15,9563	0,1594
360	3792,1494	15,8815	16,0906	14,6677	37,19	16,0906	0,1632
361	3805,7375	16,0057	16,2170	14,7824	37,32	16,2170	0,1646
362	3814,7371	16,1136	16,3308	14,8835	37,41	16,3308	0,1664
368	3841,6738	16,6483	16,8704	15,3742	37,67	16,8704	0,1718
369	3842,8064	16,8344	17,0715	15,5508	37,69	17,0715	0,1758
370	3838,5664	16,9657	17,2130	15,6779	37,64	17,2130	0,1782
371	3839,1838	17,0571	17,3174	15,7632	37,65	17,3174	0,1814
379	3886,5544	17,6470	17,9156	16,2972	38,11	17,9156	0,1887
380	3866,2551	17,7982	18,0565	16,4269	37,92	18,0565	0,1888
502	3907,6838	26,7574	26,5663	24,1766	38,32	26,5663	0,2199
503	3907,5313	26,9459	26,7556	24,3584	38,32	26,7556	0,2207
504	3887,3826	27,0886	26,8925	24,4807	38,12	26,8925	0,2216
510	3888,7124	27,4703	27,2394	24,8261	38,14	27,2394	0,2182
511	3906,6887	27,6435	27,4089	24,9947	38,31	27,4089	0,2180
512	3922,1887	27,8565	27,6093	25,2005	38,46	27,6093	0,2162
518	3926,9324	28,3222	28,0748	25,6104	38,51	28,0748	0,2217
519	3919,7273	28,4759	28,2268	25,7572	38,44	28,2268	0,2221
520	3916,6614	28,6082	28,3538	25,8753	38,41	28,3538	0,2224
521	3895,3779	28,7244	28,4863	25,9869	38,20	28,4863	0,2261
530	3889,3887	29,3957	29,2217	26,6568	38,14	29,2217	0,2391
536	3904,4177	29,7671	29,5965	27,0096	38,29	29,5965	0,2416
537	3908,9668	29,9044	29,7512	27,1632	38,33	29,7512	0,2435
538	3909,8076	30,0240	29,8753	27,2836	38,34	29,8753	0,2443
539	3912,9705	30,1411	29,9958	27,3958	38,37	29,9958	0,2455
540	3915,0391	30,2638	30,1192	27,5099	38,39	30,1192	0,2465
547	3911,0286	30,6193	30,4843	27,8466	38,35	30,4843	0,2503
548	3935,0352	30,7957	30,6677	28,0256	38,59	30,6677	0,2514
549	3941,5513	30,9895	30,8644	28,2178	38,65	30,8644	0,2521



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

550	3921,2175	31,1131	30,9873	28,3376	38,45	30,9873	0,2524
557	3939,2222	31,4942	31,3804	28,6931	38,63	31,3804	0,2573
558	3952,5205	31,6906	31,6010	28,9054	38,76	31,6010	0,2606
559	3945,3005	31,8787	31,7930	29,0893	38,69	31,7930	0,2618
560	3940,5759	32,0224	31,9410	29,2216	38,64	31,9410	0,2638
566	3937,3345	32,5797	32,5170	29,7434	38,61	32,5170	0,2711
567	3939,5137	32,7531	32,7089	29,9271	38,63	32,7089	0,2738
568	3938,2290	32,8862	32,8505	30,0574	38,62	32,8505	0,2757
569	3906,7532	32,9694	32,9567	30,1297	38,31	32,9567	0,2814
575	3899,8125	33,2470	33,2639	30,3877	38,24	33,2639	0,2893
576	3910,8750	33,3566	33,3842	30,5039	38,35	33,3842	0,2908
577	3890,9688	33,4083	33,4447	30,5545	38,16	33,4447	0,2927
578	3889,9771	33,4508	33,4876	30,5975	38,15	33,4876	0,2927
579	3912,6421	33,5366	33,5706	30,6819	38,37	33,5706	0,2923
580	3929,2703	33,6481	33,6861	30,7901	38,53	33,6861	0,2934
581	3937,5203	33,7547	33,7982	30,8965	38,61	33,7982	0,2945
587	3958,6592	34,1040	34,1595	31,2458	38,82	34,1595	0,2969
588	3966,3889	34,2973	34,3658	31,4399	38,90	34,3658	0,2994
589	3986,9880	34,5161	34,6062	31,6694	39,10	34,6062	0,3027
596	3980,6238	34,9403	35,0523	32,0587	39,04	35,0523	0,3106
597	3972,0125	35,2014	35,3214	32,3338	38,95	35,3214	0,3108
612	3975,0044	36,6239	36,8519	33,7406	38,98	36,8519	0,3339
613	3997,2673	36,8027	37,0298	33,9206	39,20	37,0298	0,3336
614	3998,4233	36,9546	37,1897	34,0773	39,21	37,1897	0,3348
615	3996,4192	37,0906	37,3379	34,2184	39,19	37,3379	0,3367
621	3978,4263	37,3949	37,6581	34,5240	39,02	37,6581	0,3397
622	3961,7014	37,5309	37,7883	34,6763	38,85	37,7883	0,3369
623	3947,2485	37,7157	37,9976	34,8865	38,71	37,9976	0,3393

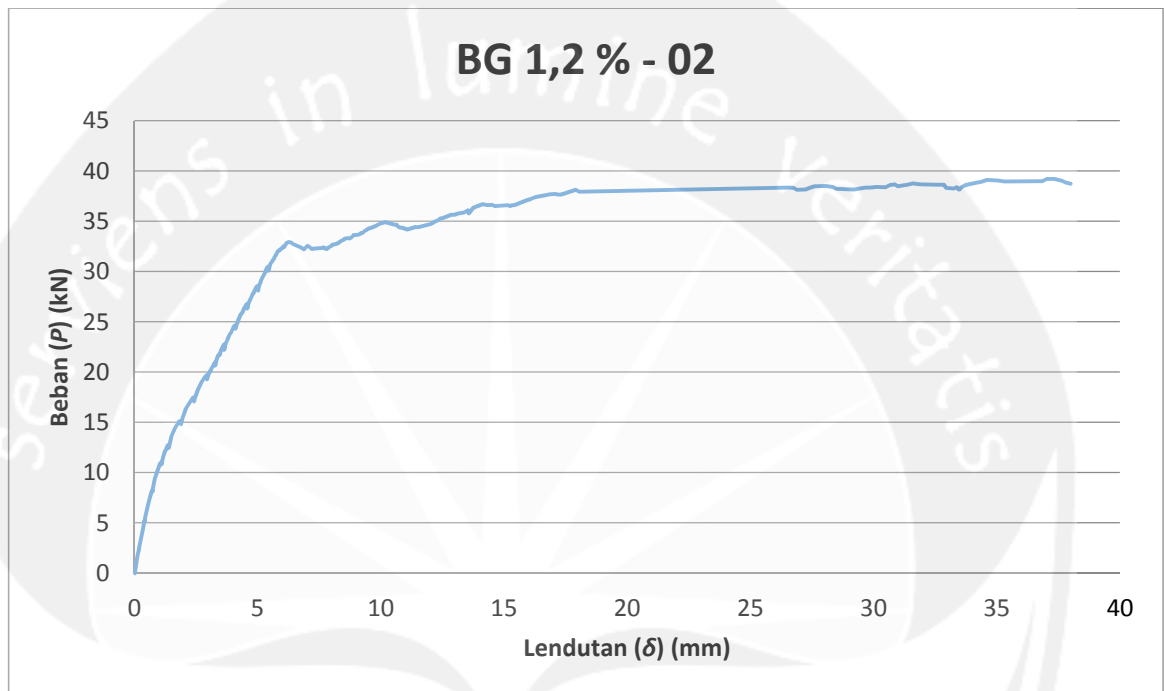


UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

Keterangan :

-  = Data Pada Beban Retak Pertama
-  = Data Pada Beban Maksimum





UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

5. Balok BG 1,5 % - 01

No.	Load Cell (kg)	LVDT1 (mm)	LVDT2 (mm)	LVDT3 (mm)	Beban (P) (kN)	Lendutan (δ) (mm)	Kelengkungan ($\square$) (1/m)
0	-1,8139	-0,0409	-0,0019	-0,0110	-0,02	-0,0019	0,0048
1	-1,7982	-0,0431	-0,0018	-0,0202	-0,02	-0,0018	0,0060
2	-1,7997	-0,0434	-0,0020	-0,0203	-0,02	-0,0020	0,0060
3	-1,7993	-0,0436	-0,0021	-0,0202	-0,02	-0,0021	0,0059
4	33,3707	-0,0404	0,0000	-0,0153	0,33	0,0000	0,0056
5	245,6949	-0,0181	0,0300	0,0395	2,41	0,0300	0,0039
6	300,2889	-0,0144	0,0275	0,0553	2,94	0,0275	0,0014
7	296,2482	-0,0142	0,0261	0,0556	2,91	0,0261	0,0011
8	304,8819	-0,0141	0,0287	0,0547	2,99	0,0287	0,0017
9	449,2534	0,0704	0,1175	0,1402	4,41	0,1175	0,0024
10	553,1647	0,1460	0,1952	0,2193	5,42	0,1952	0,0025
11	552,5003	0,1529	0,2060	0,2280	5,42	0,2060	0,0031
12	544,9872	0,1533	0,2059	0,2293	5,34	0,2059	0,0029
13	618,3250	0,1930	0,2416	0,2700	6,06	0,2416	0,0020
14	840,4620	0,3483	0,3990	0,4342	8,24	0,3990	0,0015
15	891,2232	0,4099	0,4686	0,4996	8,74	0,4686	0,0028
16	876,3657	0,4100	0,4688	0,5004	8,59	0,4688	0,0027
17	865,4371	0,4102	0,4688	0,5008	8,49	0,4688	0,0027
18	982,6094	0,4943	0,5498	0,5833	9,64	0,5498	0,0022
19	1175,5447	0,7140	0,7768	0,8053	11,53	0,7768	0,0034
20	1179,7657	0,7656	0,8279	0,8560	11,57	0,8279	0,0034
21	1163,8577	0,7664	0,8270	0,8565	11,41	0,8270	0,0031
22	1191,1638	0,7883	0,8499	0,8796	11,68	0,8499	0,0032
23	1395,7980	1,0421	1,1048	1,0817	13,69	1,1048	0,0086
24	1427,6195	1,1645	1,2169	1,2091	14,00	1,2169	0,0060
25	1406,3173	1,1647	1,2164	1,2054	13,79	1,2164	0,0063
26	1398,1831	1,1678	1,2192	1,2094	13,71	1,2192	0,0061
27	1541,0770	1,3410	1,4056	1,3789	15,11	1,4056	0,0091
28	1661,7504	1,6140	1,6845	1,6506	16,30	1,6845	0,0104
29	1636,2782	1,6443	1,7126	1,6802	16,05	1,7126	0,0101
30	1618,6521	1,6447	1,7127	1,6807	15,87	1,7127	0,0100
31	1604,4744	1,6450	1,7121	1,6798	15,73	1,7121	0,0100
32	1592,8361	1,6448	1,7120	1,6749	15,62	1,7120	0,0104
33	1657,3479	1,6994	1,7692	1,7397	16,25	1,7692	0,0099
34	1761,0538	1,8612	1,9439	1,9152	17,27	1,9439	0,0111
35	1828,7817	2,0653	2,1491	2,1056	17,93	2,1491	0,0127



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

36	1831,5972	2,1758	2,2603	2,2100	17,96	2,2603	0,0135
37	1809,2090	2,1786	2,2605	2,2094	17,74	2,2605	0,0133
38	1794,0060	2,1789	2,2604	2,2102	17,59	2,2604	0,0132
39	1781,3591	2,1794	2,2594	2,2106	17,47	2,2594	0,0129
40	1798,4259	2,1934	2,2727	2,2227	17,64	2,2727	0,0129
41	1878,1624	2,2825	2,3734	2,3181	18,42	2,3734	0,0146
42	1937,2079	2,3932	2,4874	2,4337	19,00	2,4874	0,0148
43	1964,0083	2,4739	2,5769	2,4974	19,26	2,5769	0,0183
44	1971,5493	2,5228	2,6272	2,5318	19,33	2,6272	0,0200
45	1994,1998	2,5710	2,6698	2,5806	19,56	2,6698	0,0188
46	2027,0813	2,6516	2,7481	2,6647	19,88	2,7481	0,0180
47	2007,4454	2,6564	2,7540	2,6701	19,69	2,7540	0,0181
48	1992,6110	2,6568	2,7543	2,6703	19,54	2,7543	0,0181
49	1979,9127	2,6551	2,7544	2,6710	19,42	2,7544	0,0183
50	1968,5273	2,6359	2,7447	2,6716	19,30	2,7447	0,0182
51	1958,1500	2,6307	2,7231	2,6725	19,20	2,7231	0,0143
52	1995,9518	2,6602	2,7432	2,6943	19,57	2,7432	0,0132
53	2102,6563	2,8040	2,8815	2,8366	20,62	2,8815	0,0123
54	2180,6187	2,9693	3,0524	3,0073	21,38	3,0524	0,0128
55	2224,8691	3,1018	3,1962	3,1508	21,82	3,1962	0,0140
56	2206,7644	3,1220	3,2200	3,1700	21,64	3,2200	0,0148
57	2190,9021	3,1222	3,2185	3,1731	21,49	3,2185	0,0142
58	2177,3098	3,1232	3,2183	3,1741	21,35	3,2183	0,0139
59	2165,7236	3,1234	3,2185	3,1721	21,24	3,2185	0,0141
60	2204,5195	3,1547	3,2493	3,1991	21,62	3,2493	0,0145
61	2285,1392	3,2655	3,3709	3,3413	22,41	3,3709	0,0135
62	2349,9365	3,3981	3,5047	3,4794	23,05	3,5047	0,0132
63	2414,3914	3,5551	3,6679	3,6543	23,68	3,6679	0,0126
64	2398,3364	3,5911	3,7035	3,6951	23,52	3,7035	0,0121
65	2382,5593	3,5909	3,7034	3,6933	23,37	3,7034	0,0123
66	2369,0310	3,5915	3,7016	3,6938	23,23	3,7016	0,0118
67	2405,8208	3,6284	3,7362	3,7287	23,59	3,7362	0,0115
68	2519,6460	3,7936	3,9315	3,8704	24,71	3,9315	0,0199
69	2607,0916	3,9914	4,1288	4,0609	25,57	4,1288	0,0205
70	2615,1333	4,0699	4,2110	4,1528	25,65	4,2110	0,0199
71	2595,0073	4,0702	4,2095	4,1519	25,45	4,2095	0,0197
72	2580,5200	4,0694	4,2084	4,1525	25,31	4,2084	0,0195
73	2567,8442	4,0639	4,2029	4,1531	25,18	4,2029	0,0189
74	2579,2788	4,0730	4,2106	4,1612	25,29	4,2106	0,0187
75	2678,1631	4,2029	4,3299	4,2855	26,26	4,3299	0,0172



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

76	2727,2993	4,3140	4,4391	4,4015	26,75	4,4391	0,0163
77	2734,5405	4,3577	4,4827	4,4461	26,82	4,4827	0,0162
78	2772,4377	4,4200	4,5616	4,5234	27,19	4,5616	0,0180
79	2807,4087	4,5045	4,6540	4,6151	27,53	4,6540	0,0189
80	2789,7268	4,5188	4,6764	4,6306	27,36	4,6764	0,0203
81	2774,7944	4,5187	4,6764	4,6303	27,21	4,6764	0,0204
82	2761,1760	4,5166	4,6768	4,6307	27,08	4,6768	0,0206
83	2750,2178	4,5099	4,6746	4,6310	26,97	4,6746	0,0208
84	2740,9753	4,5032	4,6739	4,6315	26,88	4,6739	0,0213
85	2792,9812	4,5483	4,6974	4,6606	27,39	4,6974	0,0186
86	2870,5012	4,6635	4,8124	4,7795	28,15	4,8124	0,0182
87	2930,6521	4,7799	4,9389	4,9075	28,74	4,9389	0,0190
88	2969,8838	4,8788	5,0399	5,0081	29,12	5,0399	0,0193
89	2968,9470	4,9200	5,0906	5,0480	29,12	5,0906	0,0213
90	2948,9670	4,9209	5,0925	5,0482	28,92	5,0925	0,0216
91	2935,6167	4,9211	5,0916	5,0488	28,79	5,0916	0,0213
92	2923,0471	4,9192	5,0902	5,0499	28,67	5,0902	0,0211
93	2915,5278	4,9134	5,0775	5,0498	28,59	5,0775	0,0192
94	2928,9817	4,9166	5,0790	5,0474	28,72	5,0790	0,0194
95	2938,9258	4,9328	5,0819	5,0486	28,82	5,0819	0,0182
96	2933,5049	4,9340	5,0813	5,0426	28,77	5,0813	0,0186
97	2927,9592	4,9341	5,0826	5,0459	28,71	5,0826	0,0185
98	2920,4312	4,9347	5,0818	5,0506	28,64	5,0818	0,0178
99	2911,1965	4,9347	5,0829	5,0480	28,55	5,0829	0,0183
100	2904,4446	4,9305	5,0831	5,0487	28,48	5,0831	0,0187
101	2933,3127	4,9463	5,0946	5,0567	28,77	5,0946	0,0186
102	2979,6790	5,0029	5,1436	5,1193	29,22	5,1436	0,0165
103	3033,2095	5,0777	5,2356	5,2074	29,75	5,2356	0,0186
104	3089,9573	5,1916	5,3514	5,3247	30,30	5,3514	0,0186
105	3116,2803	5,2698	5,4343	5,3829	30,56	5,4343	0,0216
106	3101,2607	5,2878	5,4503	5,3821	30,41	5,4503	0,0231
107	3086,9133	5,2832	5,4505	5,3815	30,27	5,4505	0,0236
108	3074,9009	5,2635	5,4500	5,3825	30,15	5,4500	0,0254
109	3081,8862	5,2696	5,4548	5,3851	30,22	5,4548	0,0255
110	3153,5601	5,3656	5,5491	5,4682	30,93	5,5491	0,0265
111	3229,5874	5,5097	5,6971	5,6143	31,67	5,6971	0,0270
112	3242,6272	5,6062	5,8025	5,7168	31,80	5,8025	0,0282
113	3213,0977	5,5980	5,7815	5,7187	31,51	5,7815	0,0246
114	3201,5596	5,5928	5,7787	5,7186	31,40	5,7787	0,0246
115	3269,4307	5,6643	5,8378	5,7741	32,06	5,8378	0,0237



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

116	3250,8374	5,6896	5,8799	5,8265	31,88	5,8799	0,0244
117	3070,8562	5,4927	5,6766	5,5832	30,11	5,6766	0,0277
118	3084,0706	5,5043	5,6792	5,5866	30,24	5,6792	0,0268
119	3078,7820	5,5046	5,6771	5,5869	30,19	5,6771	0,0263
120	3111,3044	5,5317	5,7080	5,6135	30,51	5,7080	0,0271
121	3253,6248	5,6835	5,8662	5,7680	31,91	5,8662	0,0281
122	3392,9043	5,9143	6,1065	6,0105	33,27	6,1065	0,0288
123	3411,2893	6,0397	6,2415	6,1438	33,45	6,2415	0,0300
124	3387,1152	6,0459	6,2476	6,1448	33,22	6,2476	0,0304
125	3422,8950	6,1070	6,3090	6,2066	33,57	6,3090	0,0304
126	3526,5608	6,3307	6,5501	6,4466	34,58	6,5501	0,0323
127	3549,1633	6,5677	6,8065	6,7100	34,81	6,8065	0,0335
157	3669,4749	9,7047	10,2464	10,4203	35,99	10,2464	0,0368
158	3683,8896	9,9388	10,4997	10,6709	36,13	10,4997	0,0390
168	3672,2363	11,5064	12,0011	12,0835	36,01	12,0011	0,0412
173	3691,7463	12,0056	12,4705	12,5465	36,20	12,4705	0,0389
174	3695,6333	12,2468	12,7235	12,7711	36,24	12,7235	0,0429
193	3739,5508	14,7463	15,1869	15,1117	36,67	15,1869	0,0516
199	3763,0928	15,7225	16,1192	16,1010	36,90	16,1192	0,0415
200	3747,3625	15,9255	16,3309	16,3142	36,75	16,3309	0,0422
212	3734,7646	18,5383	18,7516	18,4775	36,63	18,7516	0,0488
226	3750,7405	21,4631	21,4378	20,9312	36,78	21,4378	0,0481
239	3810,1985	23,4373	23,5461	23,0504	37,37	23,5461	0,0604
240	3778,5984	23,8633	23,9898	23,4356	37,06	23,9898	0,0681
247	3641,8301	25,5989	25,9458	25,0786	35,71	25,9458	0,1214
254	3678,9512	27,2821	27,8481	26,6911	36,08	27,8481	0,1723
258	3769,9958	28,4740	29,1545	27,8470	36,97	29,1545	0,1988
259	3711,9756	28,7706	29,4794	28,1410	36,40	29,4794	0,2047
262	3713,5298	29,4786	30,1869	28,8012	36,42	30,1869	0,2094
265	3750,9067	29,9886	30,7513	29,3182	36,78	30,7513	0,2196
266	3718,4778	30,2341	31,0274	29,5802	36,47	31,0274	0,2241
267	3685,4902	30,2570	31,0537	29,6073	36,14	31,0537	0,2243
268	3748,9480	30,4307	31,2443	29,7806	36,76	31,2443	0,2277
269	3800,8665	30,8276	31,6879	30,1718	37,27	31,6879	0,2376
273	3805,3975	31,3476	32,2604	30,6623	37,32	32,2604	0,2511
274	3824,6470	31,8076	32,7907	31,1737	37,51	32,7907	0,2600
282	3851,0854	33,0293	34,0353	32,4852	37,77	34,0353	0,2556
283	3895,2781	33,4198	34,4850	32,9038	38,20	34,4850	0,2646
284	3714,5500	33,7321	34,7580	33,1519	36,43	34,7580	0,2632
288	3713,9612	34,2653	35,2914	33,6703	36,42	35,2914	0,2647



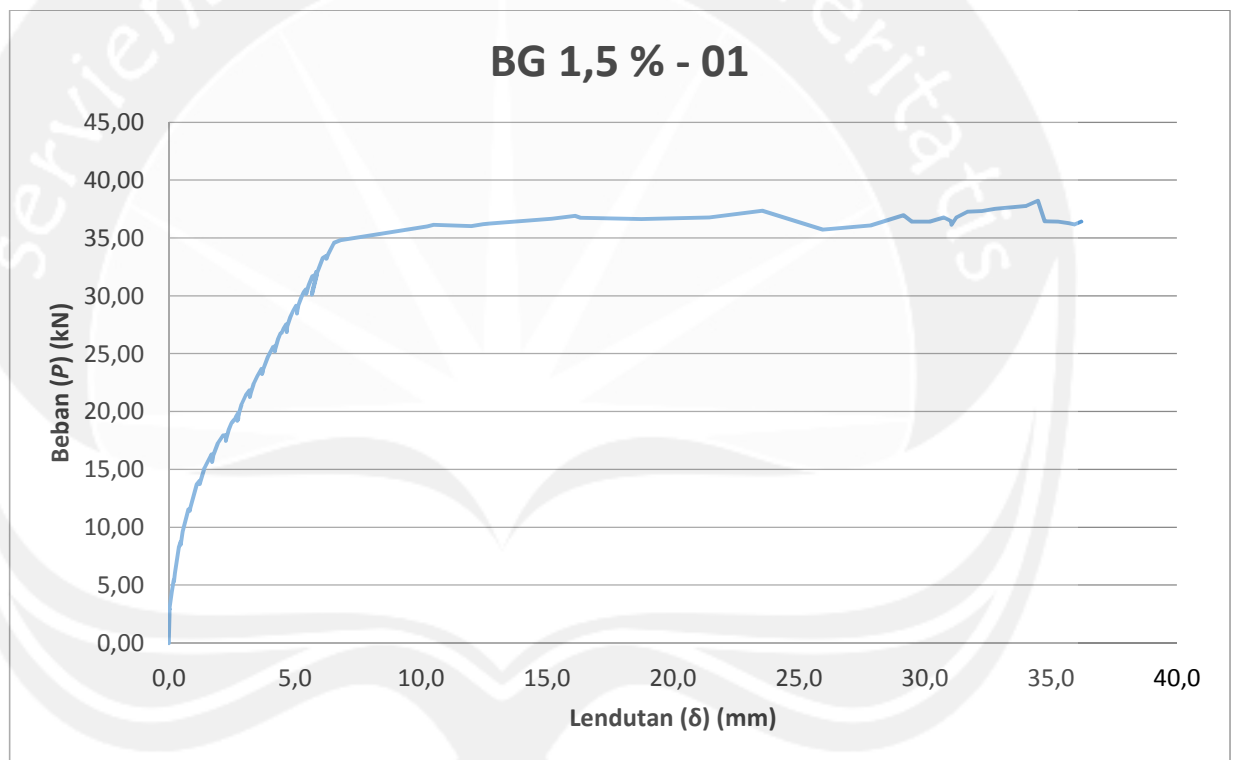
UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

289	3697,8059	34,6709	35,7181	34,0833	36,26	35,7181	0,2682
292	3686,5847	34,9211	35,9447	34,2696	36,15	35,9447	0,2699
293	3712,3142	35,1782	36,2148	34,5188	36,41	36,2148	0,2733

Keterangan :

-  = Data Pada Beban Retak Pertama
 = Data Pada Beban Maksimum





UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

6. Balok BG 1,5 % - 02

No.	Load Cell (kg)	LVDT1 (mm)	LVDT2 (mm)	LVDT3 (mm)	Beban (P) (kN)	Lendutan (δ) (mm)	Kelengkungan (Δ) (1/m)
0	12,1317	-0,0090	-0,0004	0,0049	0,12	-0,0004	0,0003
1	11,8352	-0,0089	-0,0009	0,0054	0,12	-0,0009	0,0002
2	12,3795	-0,0090	-0,0013	0,0077	0,12	-0,0013	0,0001
3	23,5222	-0,0031	0,0049	0,0144	0,23	0,0049	0,0002
4	251,5217	0,1472	0,1475	0,1686	2,47	0,1475	0,0021
5	454,5255	0,2780	0,2634	0,3116	4,46	0,2634	0,0063
6	457,5004	0,2885	0,2733	0,3221	4,49	0,2733	0,0064
7	449,1789	0,2883	0,2713	0,3213	4,40	0,2713	0,0067
8	495,1343	0,3064	0,2908	0,3378	4,86	0,2908	0,0063
9	652,3797	0,4037	0,3837	0,4316	6,40	0,3837	0,0068
10	829,8840	0,5270	0,4973	0,5540	8,14	0,4973	0,0086
11	892,4125	0,5844	0,5572	0,6110	8,75	0,5572	0,0081
12	902,1712	0,6042	0,5738	0,6318	8,85	0,5738	0,0088
13	888,8127	0,6043	0,5740	0,6323	8,72	0,5740	0,0089
14	878,1691	0,6045	0,5622	0,6322	8,61	0,5622	0,0112
15	876,5516	0,6046	0,5652	0,6323	8,60	0,5652	0,0106
16	954,8268	0,6473	0,6142	0,6734	9,36	0,6142	0,0092
17	1038,5667	0,7195	0,6841	0,7434	10,18	0,6841	0,0095
18	1084,2925	0,7733	0,7396	0,7940	10,63	0,7396	0,0088
19	1198,1843	0,8896	0,8639	0,9042	11,75	0,8639	0,0066
20	1268,7096	0,9949	0,9618	1,0063	12,44	0,9618	0,0078
21	1261,5242	1,0140	0,9809	1,0253	12,37	0,9809	0,0078
22	1244,7949	1,0146	0,9820	1,0287	12,21	0,9820	0,0079
23	1232,0374	1,0151	0,9786	1,0285	12,08	0,9786	0,0086
24	1220,7306	1,0153	0,9806	1,0245	11,97	0,9806	0,0079
25	1211,7660	1,0155	0,9774	1,0210	11,88	0,9774	0,0082
26	1297,9634	1,0661	1,0373	1,0792	12,73	1,0373	0,0071
27	1362,9196	1,1440	1,1133	1,1574	13,37	1,1133	0,0075
28	1502,6382	1,3636	1,3314	1,3801	14,74	1,3314	0,0081
29	1541,6356	1,5186	1,4937	1,5352	15,12	1,4937	0,0066
30	1517,0206	1,5210	1,4972	1,5367	14,88	1,4972	0,0063
31	1501,5330	1,5213	1,4973	1,5379	14,73	1,4973	0,0065
32	1532,7299	1,5538	1,5258	1,5708	15,03	1,5258	0,0073
33	1672,4708	1,7490	1,7152	1,7683	16,40	1,7152	0,0087
34	1712,6772	1,8860	1,8494	1,9054	16,80	1,8494	0,0093
35	1751,1598	1,9729	1,9418	1,9896	17,17	1,9418	0,0079



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

36	1785,8217	2,0627	2,0360	2,0764	17,51	2,0360	0,0067
37	1771,6598	2,0805	2,0582	2,0965	17,37	2,0582	0,0061
38	1754,5507	2,0809	2,0585	2,0994	17,21	2,0585	0,0063
39	1748,7697	2,0834	2,0599	2,1000	17,15	2,0599	0,0064
40	1769,0908	2,1033	2,0746	2,1165	17,35	2,0746	0,0071
41	1810,0409	2,1544	2,1185	2,1654	17,75	2,1185	0,0083
42	1853,0417	2,2218	2,1938	2,2302	18,17	2,1938	0,0064
43	1883,5626	2,3001	2,2793	2,3064	18,47	2,2793	0,0048
44	1901,3409	2,3486	2,3279	2,3548	18,65	2,3279	0,0048
45	1942,9987	2,4279	2,4009	2,4338	19,05	2,4009	0,0060
46	1976,8218	2,5259	2,5044	2,5329	19,39	2,5044	0,0050
47	1952,1003	2,5296	2,5123	2,5348	19,14	2,5123	0,0040
48	1936,9880	2,5302	2,5116	2,5366	19,00	2,5116	0,0044
49	1924,4470	2,5306	2,5100	2,5374	18,87	2,5100	0,0048
50	1919,4584	2,5308	2,5095	2,5367	18,82	2,5095	0,0049
51	1958,3733	2,5590	2,5427	2,5634	19,21	2,5427	0,0037
52	2001,0515	2,6184	2,5928	2,6203	19,62	2,5928	0,0053
53	2042,3894	2,6864	2,6622	2,6875	20,03	2,6622	0,0050
54	2059,5298	2,7374	2,7186	2,7418	20,20	2,7186	0,0042
55	2064,0173	2,7598	2,7412	2,7630	20,24	2,7412	0,0040
56	2084,8818	2,8026	2,7849	2,8041	20,45	2,7849	0,0037
57	2101,0078	2,8377	2,8177	2,8383	20,60	2,8177	0,0041
58	2136,0122	2,8983	2,8732	2,8760	20,95	2,8732	0,0028
59	2179,2058	2,9814	2,9606	2,9377	21,37	2,9606	0,0002
60	2183,7617	3,0247	3,0095	2,9806	21,42	3,0095	0,0014
61	2165,0964	3,0254	3,0105	2,9808	21,23	3,0105	0,0015
62	2151,3481	3,0249	3,0100	2,9812	21,10	3,0100	0,0014
63	2141,8015	3,0238	3,0101	2,9814	21,00	3,0101	0,0015
64	2164,0518	3,0350	3,0206	2,9906	21,22	3,0206	0,0016
65	2200,1799	3,0803	3,0595	3,0350	21,58	3,0595	0,0004
66	2235,6667	3,1332	3,1127	3,0859	21,92	3,1127	0,0006
67	2266,5369	3,1965	3,1720	3,1470	22,23	3,1720	0,0000
68	2310,9214	3,2747	3,2512	3,2236	22,66	3,2512	0,0004
69	2345,6912	3,3538	3,3320	3,3013	23,00	3,3320	0,0009
70	2343,9395	3,3901	3,3698	3,3369	22,99	3,3698	0,0013
71	2353,3059	3,4121	3,3910	3,3595	23,08	3,3910	0,0010
72	2375,1772	3,4551	3,4313	3,4035	23,29	3,4313	0,0004
73	2359,6763	3,4618	3,4389	3,4077	23,14	3,4389	0,0008
74	2347,1526	3,4623	3,4390	3,4077	23,02	3,4390	0,0008
75	2371,4333	3,4815	3,4610	3,4270	23,26	3,4610	0,0013



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

76	2394,8291	3,5169	3,4924	3,4613	23,49	3,4924	0,0007
77	2426,4824	3,5709	3,5507	3,5157	23,80	3,5507	0,0015
78	2436,1848	3,6012	3,5806	3,5458	23,89	3,5806	0,0014
79	2457,0015	3,6434	3,6189	3,5851	24,10	3,6189	0,0009
80	2470,9924	3,6789	3,6515	3,6216	24,23	3,6515	0,0002
81	2494,9331	3,7237	3,6995	3,6639	24,47	3,6995	0,0011
82	2528,2539	3,7939	3,7734	3,7268	24,79	3,7734	0,0026
83	2509,9629	3,8054	3,7863	3,7407	24,61	3,7863	0,0026
84	2465,7610	3,7828	3,7780	3,7346	24,18	3,7780	0,0039
85	2483,7251	3,7880	3,7805	3,7314	24,36	3,7805	0,0042
86	2513,2991	3,8180	3,7996	3,7557	24,65	3,7996	0,0026
87	2556,3867	3,8782	3,8575	3,8152	25,07	3,8575	0,0022
88	2574,0933	3,9203	3,9015	3,8563	25,24	3,9015	0,0026
89	2585,2012	3,9495	3,9336	3,8849	25,35	3,9336	0,0033
90	2600,4209	3,9854	3,9696	3,9187	25,50	3,9696	0,0035
91	2611,5493	4,0134	3,9979	3,9463	25,61	3,9979	0,0036
92	2635,0122	4,0567	4,0357	3,9895	25,84	4,0357	0,0025
93	2645,4604	4,0889	4,0656	4,0212	25,94	4,0656	0,0021
94	2650,2231	4,1106	4,0886	4,0421	25,99	4,0886	0,0024
95	2639,1521	4,1159	4,0946	4,0470	25,88	4,0946	0,0026
96	2628,3762	4,1160	4,0938	4,0471	25,78	4,0938	0,0025
97	2635,6594	4,1203	4,0984	4,0506	25,85	4,0984	0,0026
98	2649,1023	4,1369	4,1147	4,0676	25,98	4,1147	0,0025
99	2658,3857	4,1544	4,1292	4,0854	26,07	4,1292	0,0019
100	2671,2434	4,1756	4,1511	4,1054	26,20	4,1511	0,0021
101	2694,6670	4,2122	4,1906	4,1404	26,43	4,1906	0,0029
102	2718,5979	4,2572	4,2355	4,1833	26,66	4,2355	0,0030
103	2733,3486	4,2921	4,2673	4,2171	26,81	4,2673	0,0025
104	2760,1619	4,3402	4,3171	4,2635	27,07	4,3171	0,0031
105	2796,0811	4,4138	4,3872	4,3345	27,42	4,3872	0,0026
106	2806,7966	4,4525	4,4307	4,3719	27,53	4,4307	0,0037
107	2827,3545	4,4970	4,4699	4,4150	27,73	4,4699	0,0028
108	2828,3828	4,5221	4,4937	4,4390	27,74	4,4937	0,0026
109	2812,5266	4,5231	4,4647	4,4393	27,58	4,4647	0,0033
110	2800,0151	4,5234	4,4196	4,4399	27,46	4,4196	0,0124
111	2812,3755	4,5317	4,4263	4,4481	27,58	4,4263	0,0127
112	2835,6755	4,5594	4,4484	4,4751	27,81	4,4484	0,0138
113	2875,5627	4,6213	4,5105	4,5351	28,20	4,5105	0,0135
114	2903,5396	4,6746	4,5671	4,5855	28,47	4,5671	0,0126
115	2961,6787	4,7824	4,6765	4,6879	29,04	4,6765	0,0117



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

116	2991,3652	4,8594	4,7514	4,7619	29,34	4,7514	0,0119
117	3004,2695	4,9052	4,7951	4,8067	29,46	4,7951	0,0122
118	3010,5544	4,9324	4,8215	4,8330	29,52	4,8215	0,0123
119	2998,6458	4,9390	4,8294	4,8388	29,41	4,8294	0,0119
120	2984,7671	4,9400	4,8302	4,8391	29,27	4,8302	0,0119
121	2973,1997	4,9405	4,8289	4,8399	29,16	4,8289	0,0123
122	3011,2874	4,9652	4,8573	4,8642	29,53	4,8573	0,0115
123	3066,4426	5,0480	4,9382	4,9444	30,07	4,9382	0,0116
124	3068,1387	5,0703	4,9611	4,9656	30,09	4,9611	0,0114
125	3099,4041	5,1223	5,0129	5,0152	30,39	5,0129	0,0112
126	3118,4746	5,1684	5,0559	5,0594	30,58	5,0559	0,0116
127	3154,5215	5,2365	5,1251	5,1154	30,94	5,1251	0,0102
128	3183,1040	5,2965	5,1819	5,1436	31,22	5,1819	0,0076
129	3209,8137	5,3585	5,2434	5,2044	31,48	5,2434	0,0076
130	3230,8489	5,4090	5,2933	5,2545	31,68	5,2933	0,0077
131	3233,2693	5,4373	5,3262	5,2819	31,71	5,3262	0,0067
132	3218,1128	5,4381	5,3281	5,2827	31,56	5,3281	0,0065
133	3240,6064	5,4702	5,3561	5,3134	31,78	5,3561	0,0072
134	3313,0110	5,5860	5,4737	5,4262	32,49	5,4737	0,0065
135	3356,2087	5,6822	5,5713	5,5210	32,91	5,5713	0,0061
136	3377,8181	5,7518	5,6427	5,5876	33,13	5,6427	0,0054
137	3394,3989	5,8065	5,6951	5,6398	33,29	5,6951	0,0056
138	3404,0571	5,8442	5,7317	5,6754	33,38	5,7317	0,0056
139	3416,2878	5,8789	5,7660	5,7087	33,50	5,7660	0,0056
140	3425,3564	5,9119	5,7981	5,7401	33,59	5,7981	0,0056
141	3410,2512	5,9124	5,8012	5,7407	33,44	5,8012	0,0051
142	3402,1177	5,9144	5,8029	5,7427	33,36	5,8029	0,0051
143	3438,8518	5,9570	5,8434	5,7836	33,72	5,8434	0,0054
144	3453,4580	5,9910	5,8758	5,8173	33,87	5,8758	0,0057
145	3465,9736	6,0208	5,9075	5,8455	33,99	5,9075	0,0051
146	3488,4268	6,0668	5,9485	5,8879	34,21	5,9485	0,0058
147	3499,6750	6,1012	5,9806	5,9214	34,32	5,9806	0,0061
148	3506,8350	6,1297	6,0159	5,9480	34,39	6,0159	0,0046
149	3506,9929	6,1478	6,0372	5,9649	34,39	6,0372	0,0038
150	3533,5444	6,1985	6,0842	6,0126	34,65	6,0842	0,0043
151	3563,4919	6,2741	6,1622	6,0834	34,95	6,1622	0,0033
178	3497,6143	8,5674	8,7819	8,3308	34,30	8,7819	0,0665
181	3474,4358	9,0580	9,3180	8,8292	34,07	9,3180	0,0749
185	3489,6416	9,3243	9,6249	9,0956	34,22	9,6249	0,0830
189	3515,3848	9,7746	10,1370	9,5513	34,47	10,1370	0,0948



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086

Telp: (0274) 487711 Fax: (0274) 487748

Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

193	3537,5667	10,1848	10,5715	9,9354	34,69	10,5715	0,1023
194	3562,0051	10,3254	10,7435	10,0821	34,93	10,7435	0,1080
195	3584,4724	10,4660	10,9210	10,2401	35,15	10,9210	0,1136
199	3583,3196	10,7144	11,1901	10,4819	35,14	11,1901	0,1184
204	3583,4414	11,4570	11,9138	11,2626	35,14	11,9138	0,1108
211	3608,1948	12,1265	12,6805	11,9457	35,38	12,6805	0,1289
217	3662,0398	12,8512	13,4563	12,6652	35,91	13,4563	0,1396
218	3669,4529	13,0131	13,6157	12,8220	35,99	13,6157	0,1396
219	3681,9868	13,1634	13,7943	12,9866	36,11	13,7943	0,1439
223	3692,6345	13,4622	14,1105	13,2673	36,21	14,1105	0,1492
224	3713,2212	13,6824	14,3424	13,4749	36,41	14,3424	0,1527
225	3715,5266	13,7882	14,4922	13,6083	36,44	14,4922	0,1588
226	3733,5061	13,9520	14,6846	13,7768	36,61	14,6846	0,1640
241	3764,8752	14,9620	15,6880	14,7605	36,92	15,6880	0,1654
255	3749,3213	16,4547	16,8168	16,1565	36,77	16,8168	0,1022
256	3765,6931	16,7459	17,1094	16,4256	36,93	17,1094	0,1047
257	3718,5144	16,9749	17,3265	16,6295	36,47	17,3265	0,1049
261	3704,6943	17,2419	17,5712	16,8440	36,33	17,5712	0,1056
264	3714,8828	17,8223	18,0944	17,3198	36,43	18,0944	0,1047
278	3745,0725	18,9117	19,1087	18,2585	36,73	19,1087	0,1047
280	3794,4448	19,3697	19,5461	18,6647	37,21	19,5461	0,1058
284	3781,4058	19,6696	19,8269	18,9238	37,08	19,8269	0,1060
296	3750,4233	21,1577	20,4295	20,2959	36,78	20,4295	0,0595
301	3743,1213	21,4917	20,7642	20,5822	36,71	20,7642	0,0546
302	3750,3088	21,5862	20,8613	20,6657	36,78	20,8613	0,0529
303	3773,8025	21,7241	20,9964	20,7874	37,01	20,9964	0,0519
304	3777,7839	21,8528	21,1257	20,8990	37,05	21,1257	0,0500
305	3800,5393	22,0356	21,3070	21,0602	37,27	21,3070	0,0482
308	3803,7275	22,3625	21,6433	21,3457	37,30	21,6433	0,0422
309	3779,2039	22,7089	22,0125	21,6543	37,06	22,0125	0,0338
339	3780,6838	26,0532	25,3063	24,7317	37,08	25,3063	0,0172
340	3842,5894	26,4784	25,7079	25,1153	37,68	25,7079	0,0178
341	3832,3989	26,7686	26,0265	25,3907	37,58	26,0265	0,0106
344	3824,3352	27,0573	26,3413	25,6559	37,50	26,3413	0,0031
346	3826,4463	27,7730	27,1356	26,3210	37,52	27,1356	0,0177
350	3841,7786	28,1642	27,5652	26,6871	37,68	27,5652	0,0279
351	3873,5537	28,3874	27,8059	26,8825	37,99	27,8059	0,0342
352	3880,1570	28,6266	28,0784	27,1060	38,05	28,0784	0,0424
353	3828,6885	28,7705	28,2533	27,2488	37,55	28,2533	0,0487
354	3801,7854	28,8546	28,3442	27,3234	37,28	28,3442	0,0510



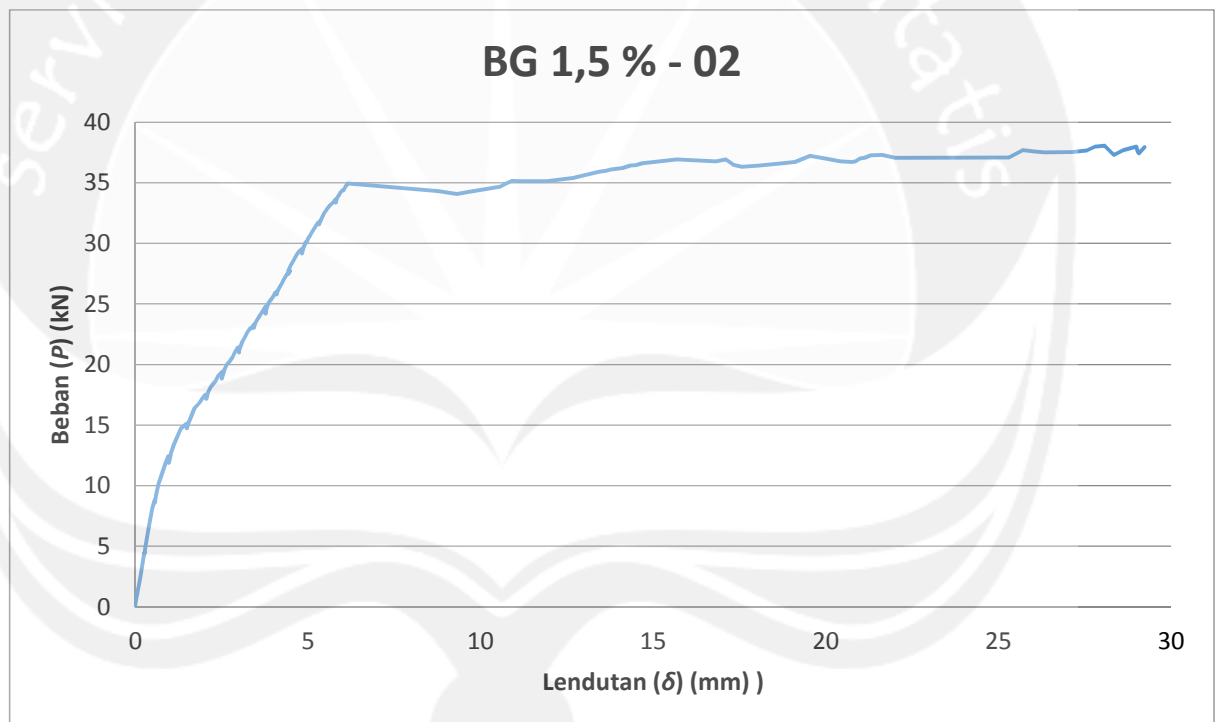
UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

355	3844,8188	29,1610	28,6191	27,5955	37,71	28,6191	0,0482
357	3872,4375	29,6786	28,9915	28,0582	37,98	28,9915	0,0246
358	3830,3015	29,7248	29,0425	28,0937	37,56	29,0425	0,0266
359	3815,6755	29,7558	29,0759	28,1187	37,42	29,0759	0,0277
360	3868,7532	29,8794	29,2325	28,2633	37,94	29,2325	0,0322

Keterangan :

-  = Data Pada Beban Retak Pertama
 = Data Pada Beban Maksimum





LAMPIRAN VI

PERHITUNGAN PERENCANAAN TULANGAN BALOK

A. Perencanaan Tulangan Balok

1. Diketahui :

a. Dimensi Balok :

- 1) Tinggi Balok = 200 mm
- 2) Lebar Balok = 100 mm
- 3) Panjang Balok (l_u) = 1800 mm
- 4) Selimut Beton = 15 mm
- 5) f_c' = 20 MPa

b. Dimensi Profil baja :

- 1) Diameter Tul. Longitudinal = 10 mm
- 2) Diameter Tul. Geser = 6 mm
- 3) f_y Tul. Longitudinal = 343,9045 MPa
- 4) f_y Tul. Geser = 287,4044 MPa

2. Penyelesaian :

$$\begin{aligned}h_{\min} &= \frac{l_u}{16} \times \left(0,4 + \frac{f_y}{700} \right) \\&= \frac{1800}{16} \times \left(0,4 + \frac{343,9045}{700} \right) \\&= 100,2704\end{aligned}$$



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

Digunakan $h = 200 \text{ mm}$

$$\begin{aligned}b &= \frac{1}{2} \times h \\&= \frac{1}{2} \times 200 \\&= 100 \text{ mm} \\b &= \frac{2}{3} \times h \\&= \frac{2}{3} \times 200 \\&= 133,3333 \text{ mm}\end{aligned}$$

Digunakan $b = 100 \text{ mm}$

Mencari d_s ,

$$d_s = 15 + 6 + \left(\frac{1}{2} \times 10 \right) = 26$$

Mencari d ,

$$\begin{aligned}d &= h - d_s \\&= 200 - 26 \\&= 174 \text{ mm}\end{aligned}$$

Dipakai tulangan 2 D 10

$$\begin{aligned}A_s &= 2 \times \left(\frac{1}{4} \times p \times D^2 \right) \\&= 2 \times \left(\frac{1}{4} \times p \times 10^2 \right) \\&= 157,0796 \text{ mm}^2\end{aligned}$$



$$A_{s_{min}} = \frac{1,4}{f_y} \times b \times d$$

$$= \frac{1,4}{343,9045} \times 100 \times 174$$

$$= 70,8336 \text{ mm}^2$$

$$A_{s_{max}} = 0,75 \times \left(0,85 \times \frac{f_c'}{f_y} \times b_1 \times \frac{600}{600 + f_y} \times b \times d \right)$$

$$= 0,75 \times \left(0,85 \times \frac{20}{343,9045} \times 0,85 \times \frac{600}{600 + 343,9045} \times 100 \times 174 \right)$$

$$= 348,5489 \text{ mm}^2$$

$$A_{s_{min}} \leq A_s \leq A_{s_{max}} \dots \dots \dots \text{Ok}$$

B. Analisis Balok Beton Bertulang

Berdasarkan rumus kesetimbangan gaya :

$$\sum H = 0$$

$$C_c = T_s$$

$$0,85 \cdot a \cdot b \cdot f_c' = A_s \cdot f_y$$

$$0,85 \cdot a \cdot 100 \cdot 20 = 157,0796 \cdot 343,9045$$

$$a = 31,7767 \text{ mm}$$

$$M_n = C_c \cdot z$$

$$= 0,85 \cdot a \cdot b \cdot f_c' \cdot \left(d - \frac{a}{2} \right)$$



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

$$= 0,85 \cdot 31,7767 \cdot 100 \cdot 20 \cdot \left(174 - \frac{31,7767}{2} \right)$$

$$= 8541254,4 \text{ N mm}$$

$$= 8,5413 \text{ kN m}$$

$$M_u = M_n$$

$$= 8,5413 \text{ kN m}$$

$$M_u = \frac{1}{6} \cdot P \cdot L$$

$$\frac{1}{6} \cdot P \cdot L = 8,5413 \text{ kN m}$$

$$P = \frac{6 \times M_u}{L}$$

$$P = 28,4708 \text{ kN}$$

$$= 2,8471 \text{ ton}$$

Tulangan Geser digunakan 2 P-6 :

$$V_{u_{\max}} = \frac{1}{2} \times P$$

$$= \frac{1}{2} \times 28,4708$$

$$= 14,2354 \text{ kN}$$



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

$$\begin{aligned}V_c &= \frac{\sqrt{f_c'}}{6} \times b \times d \\&= \frac{\sqrt{20}}{6} \times 100 \times 124 \\&= 12,9692 \text{ kN}\end{aligned}$$

Karena $V_u > V_c$, maka diperlukan tulangan geser.

Digunakan tulangan geser P – 6

$$\begin{aligned}A_v &= 2 \times \frac{1}{4} \times p \times D^2 \\&= 56,5487 \text{ mm}^2 \\S_{\max} &= \frac{d}{2} \\&= \frac{174}{2} \\&= 87 \text{ mm} \approx 100 \text{ mm}\end{aligned}$$

$$\begin{aligned}V_s &= \frac{A_v \times f_{ys} \times d}{s} \\&= \frac{56,5487 \times 287,6257 \times 174}{100} \\&= 28,3008 \text{ kN}\end{aligned}$$

$$V_u < V_n$$

$$V_u < V_c + V_s$$

$$14,2354 < 12,9692 + 28,3008$$

14,2354 < 41,2700Balok Aman dari kegagalan geser.



LAMPIRAN VII

PERHITUNGAN ANALISIS TEORITIS BEBAN MAKSIMUM DAN BEBAN SAAT RETAK PERTAMA

A. Balok BN

1. Diketahui :

a. Dimensi Balok :

- | | |
|----------------------------|---------------|
| 1) Tinggi Balok | = 200 mm |
| 2) Lebar Balok | = 100 mm |
| 3) Panjang Balok (l_u) | = 1800 mm |
| 4) Selimut Beton | = 15 mm |
| 5) f_c' | = 21,4074 MPa |

b. Dimensi Profil baja :

- | | |
|-------------------------------|----------------|
| 1) Diameter Tul. Longitudinal | = 10 mm |
| 2) Diameter Tul. Geser | = 6 mm |
| 3) f_y Tul. Longitudinal | = 343,9045 MPa |
| 4) f_y Tul. Geser | = 287,6257 MPa |

2. Penyelesaian :

Dipakai tulangan 2 D 10

$$A_s = 2 \times \left(\frac{1}{4} \times \rho \times D^2 \right)$$



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

$$= 2 \times \left(\frac{1}{4} \times p \times 10^2 \right)$$

$$= 157,0796 \text{ mm}^2$$

$$\sum H = 0$$

$$C_c = T_s$$

$$0,85 \cdot a \cdot b \cdot f_c' = A_s \cdot f_y$$

$$0,85 \cdot a \cdot 100 \cdot 21,4074 = 157,0796 \cdot 343,9045$$

$$a = 29,6876 \text{ mm}$$

$$M_n = C_c \cdot z$$

$$= 0,85 \cdot a \cdot b \cdot f_c' \cdot \left(d - \frac{a}{2} \right)$$

$$= 0,85 \cdot 29,6876 \cdot 100 \cdot 21,4074 \cdot \left(174 - \frac{29,6876}{2} \right)$$

$$= 8597684,435 \text{ N mm}$$

$$= 8,5977 \text{ kN m}$$

$$M_u = M_n$$

$$= 8,5977 \text{ kN m}$$

$$M_u = \frac{1}{6} \cdot P \cdot L$$

$$\frac{1}{6} \cdot P \cdot L = 8,5977 \text{ kN m}$$

$$P = \frac{6 \times M_u}{L}$$

$$P = 28,6589 \text{ kN}$$



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

$$= 2,8659 \text{ ton}$$

Momen Inersia (I) :

$$\begin{aligned} I &= \frac{1}{12} \times b \times h^3 \\ &= \frac{1}{12} \times 100 \times 200^3 \\ &= 66666666,67 \text{ mm}^4 \end{aligned}$$

Pada Saat Retak Pertama

Modulus retak (fr)

$$\begin{aligned} fr &= 0,7 \times \sqrt{f'_c} \\ &= 0,7 \times \sqrt{21,4074} \\ &= 3,2387 \text{ MPa} \end{aligned}$$

Momen dan beban teoritis :

$$\begin{aligned} M_{cr} &= \frac{fr \times I}{y} \\ &= \frac{3,2387 \times 66666666,67}{100} \\ &= 2159159,30 \text{ N mm} = 2,1592 \text{ kN m} \end{aligned}$$

$$\begin{aligned} P_{cr} &= \frac{M \times 6}{L} \\ &= 7,1972 \text{ kN} \end{aligned}$$



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

B. Balok BG 1,2 %

1. Diketahui :

a. Dimensi Balok :

- 1) Tinggi Balok = 200 mm
- 2) Lebar Balok = 100 mm
- 3) Panjang Balok (*lu*) = 1800 mm
- 4) Selimut Beton = 15 mm
- 5) f_c' = 25,8153 MPa

b. Dimensi Profil baja :

- 6) Diameter Tul. Longitudinal = 10 mm
- 7) Diameter Tul. Geser = 6 mm
- 8) f_y Tul. Longitudinal = 343,9045 MPa
- 9) f_y Tul. Geser = 287,6257 MPa

2. Penyelesaian :

Dipakai tulangan 2 D 10

$$\begin{aligned} A_s &= 2 \times \left(\frac{1}{4} \times p \times D^2 \right) \\ &= 2 \times \left(\frac{1}{4} \times p \times 10^2 \right) \\ &= 157,0796 \text{ mm}^2 \end{aligned}$$



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

$$\sum H = 0$$

$$C_c = T_s$$

$$0,85 \cdot a \cdot b \cdot f_c' = A_s \cdot f_y$$

$$0,85 \cdot a \cdot 100 \cdot 25,8153 = 157,0796 \cdot 343,9045$$

$$a = 24,6185 \text{ mm}$$

$$M_n = C_c \cdot z$$

$$= 0,85 \cdot a \cdot b \cdot f_c' \cdot \left(d - \frac{a}{2}\right)$$

$$= 0,85 \cdot 24,6185 \cdot 100 \cdot 25,8153 \cdot \left(174 - \frac{24,6185}{2}\right)$$

$$= 8734596,867 \text{ N mm}$$

$$= 8,7346 \text{ kN m}$$

$$M_u = M_n$$

$$= 8,7346 \text{ kN m}$$

$$M_u = \frac{1}{6} \cdot P \cdot L$$

$$\frac{1}{6} \cdot P \cdot L = 8,7346 \text{ kN m}$$

$$P = \frac{6 \times M_u}{L}$$

$$P = 29,1153 \text{ kN}$$

$$= 2,9115 \text{ ton}$$

Momen Inersia (I) :

$$I = \frac{1}{12} \times b \times h^3$$



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

$$= \frac{1}{12} \times 100 \times 200^3$$
$$= 66666666,67 \text{ mm}^4$$

Pada Saat Retak Pertama

Modulus retak (f_r)

$$f_r = 0,7 \times \sqrt{f_c'}$$
$$= 0,7 \times \sqrt{25,8153}$$
$$= 3,5566 \text{ MPa}$$

Momen dan beban teoritis :

$$M_{cr} = \frac{f_r \times I}{y}$$
$$= \frac{3,5566 \times 66666666,67}{100}$$
$$= 2371061,65 \text{ N mm} = 2,3711 \text{ kN m}$$

$$P_{cr} = \frac{M \times 6}{L}$$
$$= 7,9035 \text{ kN}$$



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

C. Balok BG 1,5 %

1. Diketahui :

a. Dimensi Balok :

- 1) Tinggi Balok = 200 mm
- 2) Lebar Balok = 100 mm
- 3) Panjang Balok (*lu*) = 1800 mm
- 4) Selimut Beton = 15 mm
- 5) f_c' = 38,7676 MPa

b. Dimensi Profil baja :

- 6) Diameter Tul. Longitudinal = 10 mm
- 7) Diameter Tul. Geser = 6 mm
- 8) f_y Tul. Longitudinal = 343,9045 MPa
- 9) f_y Tul. Geser = 287,6257 MPa

2. Penyelesaian :

Dipakai tulangan 2 D 10

$$\begin{aligned} A_s &= 2 \times \left(\frac{1}{4} \times p \times D^2 \right) \\ &= 2 \times \left(\frac{1}{4} \times p \times 10^2 \right) \\ &= 157,0796 \text{ mm}^2 \end{aligned}$$



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

$$\sum H = 0$$

$$C_c = T_s$$

$$0,85 \cdot a \cdot b \cdot f_c' = A_s \cdot f_y$$

$$0,85 \cdot a \cdot 100 \cdot 38,7676 = 157,0796 \cdot 343,9045$$

$$a = 16,3934 \text{ mm}$$

$$M_n = C_c \cdot z$$

$$= 0,85 \cdot a \cdot b \cdot f_c' \cdot \left(d - \frac{a}{2}\right)$$

$$= 0,85 \cdot 16,3934 \cdot 100 \cdot 38,7676 \cdot \left(174 - \frac{16,3934}{2}\right)$$

$$= 8956741,649 \text{ N mm}$$

$$= 8,9568 \text{ kN m}$$

$$M_u = M_n$$

$$= 8,9568 \text{ kN m}$$

$$M_u = \frac{1}{6} \cdot P \cdot L$$

$$\frac{1}{6} \cdot P \cdot L = 8,9568 \text{ kN m}$$

$$P = \frac{6 \times M_u}{L}$$

$$P = 29,8559 \text{ kN}$$

$$= 2,9856 \text{ ton}$$

Momen Inersia (I) :

$$I = \frac{1}{12} \times b \times h^3$$



UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik Program Studi Teknik Sipil
Laboratorium Struktur dan Bahan Bangunan

Jl. Babarsari No.44 Yogyakarta 55281 Indonesia Kotak Pos 1086
Telp: (0274) 487711 Fax: (0274) 487748
Website: www.ujy.ac.id Email: fteknik@mail.uajy.ac.id

$$= \frac{1}{12} \times 100 \times 200^3$$
$$= 66666666,67 \text{ mm}^4$$

Pada Saat Retak Pertama

Modulus retak (f_r)

$$f_r = 0,7 \times \sqrt{f_c'}$$
$$= 0,7 \times \sqrt{38,7676}$$
$$= 4,3585 \text{ MPa}$$

Momen dan beban teoritis :

$$M_{cr} = \frac{f_r \times I}{y}$$
$$= \frac{4,3585 \times 66666666,67}{100}$$
$$= 2905651,20 \text{ N mm} = 2,9057 \text{ kN m}$$
$$P_{cr} = \frac{M \times 6}{L}$$
$$= 9,6855 \text{ kN}$$