BAB VI

KESIMPULAN DAN SARAN

6.1 Kesimpulan

Berdasarkan hasil pengujian yang dilakukan terhadap beton normal dan beton ESP pada umur beton 7, 14 dan 28 hari dengan variasi kadar ESP sebesar 0%, 5%, 10%, 12,5%,15% dan 20%, diperoleh kesimpulan sebagai berikut:

1. Kuat tekan rerata beton ESP variasi 5% mendekati kuat tekan rerata beton normal pada umur 7, 14 dan 28 hari, dimana pada beton ESP variasi 5% pada umur 7, 14 dan 28 hari masing – masing memiliki kuat tekan rerata sebesar 15,82 MPa, 17,11 MPa dan 23,46 MPa. Sementara untuk beton normal (0% ESP) kuat tekan rerata pada umur 7, 14 dan 28 hari sebesar 16,00MPa, 18,19 MPa dan 23,86 MPa.
2. Semakin tinggi kadar ESP, semakin turun kuat tekan beton. Penambahan kadar ESP menyebabkan penurunan kuat tekan beton. Dimana, penurunan kuat tekan beton yang signifikan terjadi pada beton dengan variasi 20% ESP.
3. Modulus Elastisitas rerata beton normal pada umur 7, 14 dan 28 hari masing – masing sebesar 19242,3248 MPa, 20613,6818 MP dan 22005,8513 MPa.

4. Pada beton ESP 7 dan 28 hari, nilai modulus elastisitas rerata tertinggi terjadi pada beton ESP dengan variasi ESP sebesar 10% yaitu 19179,6340 MPa dan 21623,2611 MPa. Pada beton ESP umur 14 hari, nilai modulus elastisitas rerata tertinggi terjadi pada beton ESP dengan variasi ESP12,5% yaitu sebesar 20607,5923 MPa.
5. Pada umur 7 hari, nilai penyusutan rerata terjadi pada beton ESP dengan variasi ESP 5% yaitu sebesar 0,1511%. Sementara pada umur 14 dan 28 hari, nilai penyusutan tertinggi terjadi pada beton normal (variasi ESP 0%) yaitu masing – sebesar 0,1170 % dan 0,1841%.
6. Nilai penyerapan air rerata pada beton ESP umur 7, 14 dan 28 hari lebih rendah dibandingkan dengan nilai penyerapan air rerata pada beton normal pada umur 7, 14 dan 28 hari.
7. Nilai densitas rerata beton ESP variasi 5% pada umur 7 hari lebih tinggi dibandingkan dengan variasi lainnya, yaitu sebesar 2,1845 gr/cm^3.
8. Pada umur 14 hari, beton ESP variasi 10% memiliki nilai densitas rerata lebih tinggi yaitu sebesar 2,0849 gr/cm^3. Sedangkan pada umur 28 hari, nilai densitas rerata tertinggi terjadi pada beton ESP variasi 5% ESP.
9. Dari hasil pengujian didapatkan bahwa pada kadar variasi 5% -10% ESP, dapat digunakan sebagai pengganti semen ditinjau dari sudut pandang ekonomis dan ramah lingkungan.

6.2 Saran

Berdasarkan penelitian ini, saran yang diberikan penulis adalah sebagai berikut:

1. Pada penelitian lebih lanjut, perlu digunakan bahan tambah untuk meningkatkan kuat tekan pada beton ESP.
2. Perlu dilakukan penelitian lebih lanjut untuk mengetahui perilaku dan karakteristik lainnya pada beton, dengan ESP sebagai bahan pengganti semen.
3. Pada penelitian lebih lanjut, dapat digunakan ESP yang dibakar terlebih dahulu.
4. Perlu diperhatikan metode pengadukan beton agar didapatkan hasil yang homogen dengan memperhatikan urutan - urutan dan jumlah yang dimasukkan ke dalam molen pengaduk.

DAFTAR PUSTAKA

ACI Committee 211.1 – 91, 1993, *Standard Practice For Selecting Proportions For Normal Heavy Weight And Mass Concrete*. Detroit: ACI.

ACI Committee 363R – 92, 1997, *State of the Art Report on High Strength Concrete*. Detroitt: ACI.

Ansari, M.M., Kumar, D.M., Charles, M.J., Vani, G. 2016, *Properties of concrete with eggshell powder as cement replacement*, SSRG International Journal of Civil Engineering (SSRG-IJCE) www.internationaljournalssrg.org. Pdf. 24/08/2016. 09.35.

ASTM C 134 - 95, 1995, *Standard Test Methods for size, Dimensional Measurement and Bulk density of refractory Brick and Insulting Firebrick. ASTM. USA.*

ASTM C 20 - 00, 2000, *Standard Test Methods for apparent porosity, water absorption, Apparent Specific Gravity and Bulk Density of Burned refractory Brick and Shapes by Boiling Water*. ASTM. USA.

ASTM C 39/C 39M - 01, 2001, *Standard Test Methods for Compressive Strength and Modulus of Cylindrical Concrete Speciment.* ASTM. USA.

Butcher, G.D., Miles, R., 1990, *Concepts of Eggshell Quality*, http://poultryinfo.co.za/articles/Old/egg_shell_quality.pdf. 23/08/2016. 21.30.

Schierhorn, C., 2008, *Producing Structural lightweight Concrete Block.*

Gowsika, D., Sarankokila, S., Sargunan, K., 2014, *Experimental investigation of eggshel lpowder as partial replacement with cement in concrete*, International Journal of Engineering Trends and Technology (IJETT). Pdf. 26/08/2016. 01.30.

Hunton, P., 2005, *Research On Eggshell Structure and Quality*: An Historical Overview. Brazilian Journal of Poultry Science, http://www.scielo.br.pdf 23/08/2016. 22.05.

Maryam, S., 2006, Pengaruh Serbuk Cangkang Kerang sebagai Filler terhadap Sifat-Sifat dari Mortar. Skripsi. FMIPA. USU.

Mulyono, T., 2004, *Teknologi Beton*, penerbit Andi, Yogyakarta.

Nugraha, P., Antoni., 2007, *Teknologi Beton*, penerbit Andi, Surabaya.

SNI 15-2049-2004, *Semen Portland*, Badan Standadisasi Nasional, Jakarta.

SNI 2847:2013, *Persyaratan Beton Struktural Untuk Bangunan Gedung*, Badan Standardisasi Nasional.

Tjokrodimuljo, K., 2007, *Teknologi Beton*, KMTS Fakultas Teknik Universitas Gadjah Mada, Yogyakarta.

Wuryati, S., Candra, R., 2001, *Teknologi Beton*, Kanisius, Yogyakarta.

Yerramala, A., 2014, Replacement of Cement using Eggshell Powder, *The Indian Concrete Journal*. Pdf. 25/08/2016. 21.15.

Lampiran A

1. PEMERIKSAAN GRADASI BESAR BUTIRAN AGREGAT HALUS

Bahan : Pasir

Asal : Kali Progo

Diperiksa : 6 Oktober 2016

Lubang Ayakan	Berat Ayakan (gr)	Berat Ayakan + Pasir (gr)	Berat Pasir Tertahan (%)	Persentase Tertahan (%)	Persentase Komulatif Tertahan (%)	Persentase Lolos (%)
3/4"	493,06	493,06	0	0	0	100
3/8"	529,2	529,2	0	0	0	100
4	467,39	467,39	0	0	0	100
16	328,71	328,71	0	0	0	100
30	415,67	712,37	296,7	24	24	76
50	286,73	866,13	579,4	47	72	28
100	291,35	504,75	213,4	17	89	11
200	339,03	460,53	121,5	10	99	1
Pan	377,39	391,69	14,3	1,17	100	0
Jumlah			1225,3	100		

Modulus Halus Butir = $\frac{283,4652}{100} = 2,8346$

Kesimpulan MHB pasir $2,3 \leq 2,8346 \leq 3,1$ (Syarat Terpenuhi)

Lampiran A

2. PEMERIKSAAN KADAR AIR PADA PASIR

Bahan : Pasir

Asal : Kali Progo

Diperiksa : 6 Oktober 2016

No.	Pemeriksaan	Hasil
1.	Cawan (gr)	71
2.	Cawan + berat *split* basah (gr)	1388
3.	Cawan + berat *split* kering (gr)	1323
4.	Berat air = (2)-(3)	65
5.	Berat contoh kering = (3)-(1)	1252
6.	Kadar Air (w) = $\frac{(4)}{(5)} x100\%$	5,19 %

Lampiran A

3. PEMERIKSAAN BERAT JENIS DAN PENYERAPAN PASIR

Bahan : Pasir
Asal : Kali Progo
Diperiksa : 6 Oktober 2016

	Pemeriksaan	Hasil
A	Berat Contoh Kering Udara (gr) (S)	500
B	Berat Contoh Kering Oven (SSD) (gr) (A)	486,1
C	Berat Piknometer berisi Air (gr) (B)	827,3
D	Berat Piknometer berisi benda uji dan Air (gr) (C)	1126,7
	Berat Jenis *Bulk* $= \frac{A}{(B+S-C)}$	2,4232
E	BJ Jenuh Kering Permukaan (SSD) $= \frac{S}{(B+S-C)}$	2,4925
F	Berat Jenis Semu (*Apparent)* $= \frac{A}{(B+A-C)}$	2,6036
G	Penyerapan *(Absorption)* $= \frac{S-A}{A} x100\%$	2,8594

Rata-rata Berat Jenis *Bulk* = 2,4232 gr/cm^3
Rata-rata BJ Jenuh Kering Permukaan (*SSD)* = 2,4925 gr/cm^3
Rata-rata Berat Jenis Semu (*Apparent)* = 2,6036 gr/cm^3
Rata-rata Penyerapan (*Absorption)* = 2,8594 %

Lampiran A

4. PEMERIKSAAN KANDUNGAN ZAT ORGANIK DALAM PASIR

I. Waktu Pemeriksaan : 6 Oktober 2016

II. Bahan

a. Pasir Kering, Asal Kali Progo, Volume 120 gram

b. Larutan NaOH 3%

III. Alat

Gelas Ukur 250 cc

IV. Hasil

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

V. Kesimpulan

Sebelum digunakan, pasir dicuci terelebih dahulu.

Lampiran A

5. PEMERIKSAAN KANDUNGAN LUMPUR DALAM PASIR

I. Waktu pemeriksaan : 6 Oktober 2016

II. Bahan

a. Pasir asal : Kali Progo, berat : 100 gr
b. Air jernih asal : LSBB Prode TS FT-UAJY

III. Alat

a. Pan
b. Timbangan
c. *Oven* dengan suhu 105-110^{0}C
d. Air tetap jernih setelah pencucian sebanyak 8 kali

IV. Hasil

a. Berat Pasir Awal (A) = 100 gr
b. Berat Pasir Kering Oven = 99,58 gr
c. Kandungan Lumpur $= \frac{100 - 99{,}58}{100} x100\% = 0{,}42\%$

V. Kesimpulan

Kandungan lumpur 0,42% ≤ 1%, maka pasir baik untuk digunakan.

Lampiran B

1. ANALISIS SARINGAN AGREGAT KASAR

Bahan : Batu Pecah (*Split*)
Asal : Kali Clereng
Diperiksa : 11 Oktober 2016

Lubang Saringan	Berat Saringan (gr)	Berat saringan+pasir (gr)	Berat pasir tertahan (gr)	Sisa Ayakan (%)	JumlahSisa Ayakan (%)	Jumlah yang Melalui ayakan (%)
50	481,92	481,92	0	0	0	100
37,5	562,31	562,31	0	0	0	100
25	514,6	514,6	0	0	0	100
19	547,68	671,13	123,45	12,0497	12,0497	87,9503
12,5	461,26	782,73	321,47	31,3779	43,4276	56,5724
9,5	459,15	771,64	312,49	30,5014	73,9290	26,0710
4,75	531,19	724,15	192,96	18,8344	92,7634	7,2366
2,36	473,28	547,42	74,14	7,2366	100	0
1,18	329,37	329,37	0	0	100	0
0,6	398,84	0	0	0	100	0
0,3	302,07	0	0	0	100	0
0,15	2946,62	0	0	0	100	0
0,075	346,14	0	0	0	100	0
Pan	368,88	0	0	0	100	0
Jumlah			1024,51		722,1696	

$$\text{Modulus Halus Butir} = \frac{722,1696}{100}$$

$$= 7,2217$$

Kesimpulan $= 5,0 \leq 7,2217 \leq 8,0$ (Syarat Terpenuhi)

Lampiran B

2. PEMERIKSAAN BERAT JENIS DAN PENYERAPAN *SPLIT*

Bahan : Batu pecah (*Split)*
Asal : Kali Clereng
Diperiksa : 11 Oktober 2016

	Pemeriksaan	Hasil
A	Berat Contoh Kering (gr) (A)	1131
B	Berat Contoh Kering Permukaan (SSD) (gr) (B)	1152
C	Berat Contoh Dalam Air (gr) (C)	674
D	Berat Jenis *Bulk* $= \frac{(A)}{(B)-(C)}$	2,36
E	BJ Jenuh Kering Permukaan (SSD) $= \frac{(B)}{(B)-(C)}$	2,41
F	Berat Jenis Semu (*Apparent)* $= \frac{(A)}{(A)-(C)}$	2.475
G	Penyerapan *(Absorption)* $= \frac{(B)-(A)}{(A)} x100\%$	1,86

Berat Jenis *Bulk* = 2,36 gr/cm^3
BJ Jenuh Kering Permukaan (*SSD)* = 2,41 gr/cm^3
Berat Jenis Semu (*Apparent)* = 2,475 gr/cm^3
Penyerapan (*Absorption)* = 1,86 %

Lampiran B

3. PEMERIKSAAN KANDUNGAN LUMPUR DALAM *SPLIT*

I. Waktu pemeriksaan : 11 Oktober 2016

II. Bahan

c. *Split* asal : Kali Clereng, berat : 500 gr
d. Air jernih asal : LSBB Prode TS FT-UAJY

III. Alat

e. Pan
f. Timbangan
g. *Oven* dengan suhu 105-110^{0}C
h. Air tetap jernih setelah pencucian sebanyak 8 kali

IV. Hasil

d. Berat *Split* Awal (A) = 500 gr
e. Berat *Split* Kering Oven = 492,15 gr
f. Kandungan Lumpur $= \frac{500 - 494{,}28}{500} x100\% = 1{,}14\%$

V. Kesimpulan

Kandungan lumpur ≥ 1%, maka sebaiknya dicuci terlebih dahulu.

Lampiran B

4. PEMERIKSAAN KADAR AIR PADA *SPLIT*

Bahan : Batu Pecah (*Split)*

Asal : Kali Clereng

Diperiksa : 11 Oktober 2016

No.	Pemeriksaan	Hasil
1.	Cawan (gr)	61
2.	Cawan + berat *split* basah (gr)	1021
3.	Cawan + berat *split* kering (gr)	1009
4.	Berat air = (2)-(3)	12
5.	Berat contoh kering = (3)-(1)	948
6.	Kadar Air (w) = $\frac{(4)}{(5)} x100\%$	1,26 %

Lampiran C

HASIL PENGUJIAN KANDUNGAN KIMIA SERBUK CANGKANG TELUR

Jenis Sampel : Padatan (Serbuk Cangkang Telur)
Tanggal Analisis : 20 November 2016
Lokasi : Laboratorium Kimia Analitik UGM, Yogyakarta

No.	SAMPEL	PARAMETER	HASIL PENGUKURAN (%)			METODE
			I	II	III	
1.	Cangkang Telur	CaCO3	80,7906	81,6410	80,7906	Atomic Absorption Spect.
2.		Cu	0,0014	0,0014	0,0014	Atomic Absorption Spect.
3.		Fe	0,0086	0,0086	0,0098	Atomic Absorption Spect.
4.		Mg	0,7042	0,7042	0,7086	Atomic Absorption Spect.
5.		Mn	0,0006	0,0006	0,0011	Atomic Absorption Spect.
6.		Na	0,1197	0,1197	0,1273	Atomic Absorption Spect.
7.		K	0,0468	0,0468	0,0475	Atomic Absorption Spect.
8.		Zn	0,0062	0,0062	0,0059	Atomic Absorption Spect.
9.		P	0,0576	0,0576	0,0576	UV-Vis. Spect.

Lampiran D

PERENCANAAN ADUKAN UNTUK BETON NORMAL (ACI 211.1 - 1991)

A. Data Bahan

1. Bahan Agregat halus (pasir) : Kali Progo, Yogyakarta.
2. Bahan Agregat kasar : Clereng, Yogyakarta.
3. Jenis semen : Holcim (Tipe 1)
4. Berat Jenis semen : 3,15
5. Berat Jenis Agregat Halus : 2,73
6. Berat Jenis Agregat Kasar : 2,36
7. MHB pasir halus : 2,84
8. Berat/Volume padat Agregat kasar :1505 Kg/m^3
9. Penyerapan Agregat Kasar : 1,86%
10. Penyerapan Agregat Halus : 2,86%
11. Kadar air Agregat Kasar : 1,26%
12. Kadar air Agregat Halus : 5,19%

B. Hitungan

1. Nilai *slump* 75 - 150 mm (Tabel 2.1)
2. Ukuran agregat maksimum 19 mm, dan beton tanpa AEA
3. Berdasarkan tabel 2.2 didapat perkiraan kadar air 205 kg/m^3 dan kadar udara 2%

4. Atas dasar kekuatan tekan rata-rata beton pada umur 28 hari yang akan dicapai sebesar 25 MPa, maka dari tabel 2.3 atau gambar 2.1, didapat nilai fas 0,61
5. Kadar semen *portland* ditentukan sebagai berikut:

$$\frac{205}{0,61} = 336,065 kg/m^3$$

6. Kadar agregat kasar yang dibutuhkan dapat diperkirakan dengan menggunakan tabel 2.5. Untuk MHB agregat halus 2,84 dan ukuran agregat kasar maksimum 19 mm, dari tabel 2.5 diperkirakan volume padat agregat kasar sebesar 0,61 m^3, sehingga berat keringnya adalah : 0,61 x 1505 = 918,05 kg
7. Perkiraan agregat halus atas dasar berat

   Atas dasar ukuran nominal maksimum agregat sebesar 19 mm dan beton tanpa AEA dari tabel 2.6 didapat perkiraan berat volume padat beton sebesar 2345 kg/m^3, sehingga berat keringnya sebagai berikut :

   = 2345 – (205 + 336,07 + 918,05)

   = 885,88
8. Koreksi proporsi campuran (agregat dan air) oleh akibat kadar air agregat sebenarnya, meliputi :
   a. Koreksi terhadap berat agregat

Akibat kadar air yang sesungguhnya dari agregat kasar dan agregat halus adalah sebesar 1,26% dan 5,19%, maka komposisi berat dari kedua agregat tersebut terkoreksi menjadi :

Agregat kasar = 918,05 x 1,0126 = 929,617 Kg

Agregat halus = 885,88 x 1,0519 = 931,857 Kg

b. Koreksi terhadap air

Komposisi berat air terkoreksi :

= 205 – 918,05(0,0126 – 0,0186) – 885,88(0,0519 – 0,0286)

= 189,8673 Kg

Jadi, perkiraan komposisi berat campuran :

No.	Jenis Bahan	Berat bahan (Kg)
		Volume 1 m3
1.	Semen *Portland*	336,07
2.	Agregat kasar	918,05
3.	Agregat halus	885,88
4.	Air	189,87

Lampiran E

HASIL PENGUJIAN KUAT TEKAN BETON ESP UMUR 7, 14 DAN 28 HARI

Hasil Pengujian Kuat Tekan Beton ESP umur 7 hari

Kode	Dibuat Tanggal	Diuji Tanggal	% ESP	Fas	Slump (cm)	Diameter (cm)	Luas (cm^2)	Gaya Tekan Maks (KN)	Kuat Tekan (MPa)	Rata – rata Kuat Tekan (Mpa)
A71	15/11/2016	23/11/2016	0	0,61	11,2	15,0433	177,6462	310	16,9093	16,0002
A72	15/11/2016	23/11/2016	0	0,61	11,2	15,1167	179,3840	290	15,8184	
A73	15/11/2016	23/11/2016	0	0,61	11,2	15,1333	179,7782	280	15,2729	
B71	16/11/2016	24/11/2016	5	0,61	10,9	15,1667	180,5726	285	15,5457	15,8184
B72	16/11/2016	24/11/2016	5	0,61	10,9	15,1800	180,8894	290	15,8184	
B73	16/11/2016	24/11/2016	5	0,61	10,9	15,2033	181,4452	295	16,0911	
C71	23/11/2016	01/12/2016	10	0,61	10,7	15,0167	177,0185	240	13,0911	13,1820
C72	23/11/2016	01/12/2016	10	0,61	10,7	15,0933	178,8290	260	14,1820	
C73	23/11/2016	01/12/2016	10	0,61	10,7	15,1200	179,4623	225	12,2729	
D71	23/11/2016	01/12/2016	12,5	0,61	11,3	15,0467	177,7265	245	13,3638	12,2729
D72	23/11/2016	01/12/2016	12,5	0,61	11,3	15,0333	177,4101	195	10,6365	
D73	23/11/2016	01/12/2016	12,5	0,61	11,3	15,0333	177,4101	235	12,8184	
E71	23/11/2016	01/12/2016	15	0,61	11,5	15,0167	177,0185	250	13,6365	10,7274
E72	23/11/2016	01/12/2016	15	0,61	11,5	15,0100	176,8606	190	10,3638	
E73	23/11/2016	01/12/2016	15	0,61	11,5	15,1100	179,2250	150	8,1819	
F71	23/11/2016	01/12/2016	20	0,61	10,8	15,1400	179,9374	165	9,0001	9,0910
F72	23/11/2016	01/12/2016	20	0,61	10,8	15,1067	179,1467	175	9,5456	
F73	23/11/2016	01/12/2016	20	0,61	10,8	15,1500	180,1752	160	8,7274	

Lampiran E

Hasil Pengujian Kuat Tekan Beton ESP umur 14 hari

Kode	Dibuat Tanggal	Diuji tanggal	% ESP	Fas	Slump	Diameter (cm)	Luas (cm^2)	Gaya Tekan Maks (KN)	Kuat Tekan (MPa)	Rata – rata Kuat Tekan (Mpa)
A141	15/11/2016	29/11/2016	0	0,61	11,2	15,0700	178,2773	320	17,3930	18,1931
A142	15/11/2016	29/11/2016	0	0,61	11,2	15,1133	179,3033	330	17,8339	
A143	15/11/2016	29/11/2016	0	0,61	11,2	15,1533	180,2537	360	19,3526	
B141	16/11/2016	30/11/2016	5	0,61	10,9	15,1300	179,6998	310	16,7161	17,1091
B142	16/11/2016	30/11/2016	5	0,61	10,9	15,1533	180,2537	315	16,9335	
B143	16/11/2016	30/11/2016	5	0,61	10,9	15,2000	181,3664	335	17,8982	
C141	23/11/2016	08/12/2016	10	0,61	10,7	15,0300	177,3322	265	14,4803	14,8913
C142	23/11/2016	08/12/2016	10	0,61	10,7	15,1567	180,3346	270	14,5079	
C143	23/11/2016	08/12/2016	10	0,61	10,7	15,1067	179,1467	290	15,6859	
D141	23/11/2016	08/12/2016	12,5	0,61	11,3	15,0400	177,5683	265	14,4611	13,9027
D142	23/11/2016	08/12/2016	12,5	0,61	11,3	15,0767	178,4359	270	14,6623	
D143	23/11/2016	08/12/2016	12,5	0,61	11,3	15,0200	177,0963	230	12,5846	
E141	23/11/2016	08/12/2016	15	0,61	11,5	15,0500	177,8045	220	11,9895	13,3930
E142	23/11/2016	08/12/2016	15	0,61	11,5	15,0467	177,7265	250	13,6304	
E143	23/11/2016	08/12/2016	15	0,61	11,5	15,1300	179,6998	270	14,5592	
F141	23/11/2016	08/12/2016	20	0,61	10,8	15,0733	178,3554	230	12,4957	13,0499
F142	23/11/2016	08/12/2016	20	0,61	10,8	15,1000	178,9879	270	12,9930	
F143	23/11/2016	08/12/2016	20	0,61	10,8	15,1900	181,1278	225	12,0370	

Lampiran E

Hasil Pengujian Kuat Tekan Beton ESP umur 28 hari

Kode	Dibuat Tanggal	Diuji Tanggal	% ESP	Fas	Slump (cm)	Diameter (cm)	Luas (cm^2)	Gaya Tekan Maks (KN)	Kuat Tekan (MPa)	Rata – rata Kuat Tekan (Mpa)
A281	15/11/2016	13/12/2016	0	0,61	11,2	15,0867	178,6727	390	21,1508	23,8616
A282	15/11/2016	13/12/2016	0	0,61	11,2	15,0733	178,3554	450	24,4482	
A283	15/11/2016	13/12/2016	0	0,61	11,2	15,1000	178,9879	480	25,9859	
B281	16/11/2016	14/12/2016	5	0,61	10,9	15,1300	179,6998	410	22,1084	23,4614
B282	16/11/2016	14/12/2016	5	0,61	10,9	15,1767	180,8108	440	23,5803	
B283	16/11/2016	14/12/2016	5	0,61	10,9	15,1633	180,4916	490	24,6957	
C281	23/11/2016	22/12/2016	10	0,61	10,7	15,0400	177,5683	410	21,2823	21,5325
C282	23/11/2016	22/12/2016	10	0,61	10,7	15,0233	177,1741	390	22,4235	
C283	23/11/2016	22/12/2016	10	0,61	10,7	15,1800	180,8894	365	20,8916	
D281	23/11/2016	22/12/2016	12,5	0,61	11,3	15,0533	177,8824	375	20,4277	20,3815
D282	23/11/2016	22/12/2016	12,5	0,61	11,3	15,0933	178,8290	390	21,1323	
D283	23/11/2016	22/12/2016	12,5	0,61	11,3	15,0633	178,1189	360	19,5845	
E281	23/11/2016	22/12/2016	15	0,61	11,5	15,0233	177,1741	335	18,3217	18,7095
E282	23/11/2016	22/12/2016	15	0,61	11,5	15,0433	177,6462	340	18,5457	
E283	23/11/2016	22/12/2016	15	0,61	11,5	15,0833	178,5922	355	19,2613	
F281	23/11/2016	22/12/2016	20	0,61	10,8	15,1067	179,1467	295	15,9563	16,5749
F282	23/11/2016	22/12/2016	20	0,61	10,8	15,1067	179,1467	310	16,7677	
F283	23/11/2016	22/12/2016	20	0,61	10,8	15,1233	179,5406	315	17,0007	

Lampiran E

Kuat Tekan Rata – rata beton ESP umur 7, 14 dan 28 hari

% ESP	Umur (hari)	Rata–rata Kuat Tekan (MPa)	Umur (hari)	Rata–rata Kuat Tekan (MPa)	Umur (hari)	Rata-rata Kuat Tekan (MPa)
0	7	16,00	14	18,19	28	23,86
5	7	15,82	14	17,11	28	23,46
10	7	13,18	14	14,89	28	21,53
12,5	7	12,27	14	13,90	28	20,38
15	7	10,73	14	13,39	28	18,71
20	7	9,09	14	13,05	28	16,57

Contoh Perhitungan Kuat Tekan

Kode : A281

- Diameter silinder beton (d) = 15,0876 cm
- Gaya Tekan (P) = 390 kN
- Luas alas silinder beton (A) $= \frac{1}{4} \times \pi \times d^2 = \frac{1}{4} \times \pi \times 15{,}0876^2$

  $\frac{1}{4}\ x\ \pi\ x\ 15{,}0867^2$

  $= 178{,}6727\ cm^2$
- Kuat Tekan (f'c) $= \frac{P \times 1000}{A} = \frac{390 \times 1000}{178{,}677}$

  $= 21{,}1508$ MPa

Lampiran F

HASIL PENGUJIAN MODULUS ELASTISITAS BETON UMUR 7 HARI

Kode : A272
P0 = 20,05 cm
D = 15,1167 cm
Ec = 19378,5556 Mpa

Beban	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	17938.3976	0.0000	-0,1371	0
500	2	1	17938.3976	0.2734	0.0498	0.1869
1000	7	3.5	17938.3976	0.5469	0.1743	0.3114
1500	13	6.5	17938.3976	0.8203	0.3237	0.4608
2000	15	7.5	17938.3976	1.0937	0.3735	0.5106
2500	24	12	17938.3976	1.3672	0.5976	0.7347
3000	27	13.5	17938.3976	1.6406	0.6723	0.8094
3500	31	15.5	17938.3976	1.9141	0.7719	0.9090
4000	36	18	17938.3976	2.1875	0.8964	1.0335
4500	42	21	17938.3976	2.4609	1.0458	1.1829
5000	49	24.5	17938.3976	2.7344	1.2201	1.3572
5500	54	27	17938.3976	3.0078	1.3446	1.4817
6000	61	30.5	17938.3976	3.2812	1.5189	1.6560
6500	67	33.5	17938.3976	3.5547	1.6683	1.8054
7000	73	36.5	17938.3976	3.8281	1.8177	1.9548
7500	79	39.5	17938.3976	4.1015	1.9671	2.1042
8000	84	42	17938.3976	4.3750	2.0916	2.2287
8500	90	45	17938.3976	4.6484	2.2410	2.3781
9000	102	51	17938.3976	4.9218	2.4389	2.5398

Kode : A273
P0 = 19,9 cm
D = 15,133 cm
Ec = 19106,0940 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,1081	0
500	4	2	17977,8164	0,2728	0,1005	0,2086
1000	10	5	17977,8164	0,5457	0,2513	0,3594
1500	14	7	17977,8164	0,8185	0,3518	0,4599
2000	19	9,5	17977,8164	1,0913	0,4774	0,5855
2500	21	10,5	17977,8164	1,3642	0,5276	0,6357
3000	26	13	17977,8164	1,6370	0,6533	0,7614
3500	30	15	17977,8164	1,9099	0,7538	0,8619
4000	37	18,5	17977,8164	2,1827	0,9296	1,0377
4500	42	21	17977,8164	2,4555	1,0553	1,1634
5000	48	24	17977,8164	2,7284	1,2060	1,3141
5500	54	27	17977,8164	3,0012	1,3568	1,4649
6000	60	30	17977,8164	3,2740	1,5075	1,6156
6500	65	32,5	17977,8164	3,5469	1,6332	1,7413
7000	73	36,5	17977,8164	3,8197	1,8342	1,9423
7500	80	40	17977,8164	4,0925	2,0101	2,1182
8000	85	42,5	17977,8164	4,3654	2,1357	2,2438
8500	91	45,5	17977,8164	4,6382	2,2864	2,3945
9000	98	49	17977,8164	4,9111	2,4623	2,5704

Kode : B272
P0 = 19,96 cm
D = 15,18 cm
Ec = 19521,5019 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,1205	0
500	4	2	18088,9434	0,2712	0,1002	0,2207
1000	8	4	18088,9434	0,5423	0,2004	0,3209
1500	11	5,5	18088,9434	0,8135	0,2756	0,3961
2000	17	8,5	18088,9434	1,0846	0,4259	0,5464
2500	21	10,5	18088,9434	1,3558	0,5261	0,6466
3000	27	13,5	18088,9434	1,6270	0,6764	0,7969
3500	30	15	18088,9434	1,8981	0,7515	0,8720
4000	35	17,5	18088,9434	2,1693	0,8768	0,9973
4500	41	20,5	18088,9434	2,4404	1,0271	1,1476
5000	46	23	18088,9434	2,7116	1,1523	1,2728
5500	52	26	18088,9434	2,9828	1,3026	1,4231
6000	58	29	18088,9434	3,2539	1,4529	1,5734
6500	66	33	18088,9434	3,5251	1,6533	1,7738
7000	71	35,5	18088,9434	3,7962	1,7786	1,8991
7500	76	38	18088,9434	4,0674	1,9038	2,0243
8000	84	42	18088,9434	4,3386	2,1042	2,2247
8500	89	44,5	18088,9434	4,6097	2,2295	2,3500
9000	95	47,5	18088,9434	4,8809	2,3798	2,5003

Kode : B273
P0 = 20,13cm
D = 15,2033 cm
Ec = 17957,8071 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,1016	0
500	5	2,5	18144,5160	0,2703	0,1242	0,2258
1000	9	4,5	18144,5160	0,5407	0,2235	0,3251
1500	15	7,5	18144,5160	0,8110	0,3726	0,4742
2000	21	10,5	18144,5160	1,0813	0,5216	0,6232
2500	28	14	18144,5160	1,3516	0,6955	0,7971
3000	33	16,5	18144,5160	1,6220	0,8197	0,9213
3500	39	19,5	18144,5160	1,8923	0,9687	1,0703
4000	44	22	18144,5160	2,1626	1,0929	1,1945
4500	49	24,5	18144,5160	2,4330	1,2171	1,3187
5000	55	27,5	18144,5160	2,7033	1,3661	1,4677
5500	62	31	18144,5160	2,9736	1,5400	1,6416
6000	69	34,5	18144,5160	3,2440	1,7139	1,8155
6500	76	38	18144,5160	3,5143	1,8877	1,9893
7000	83	41,5	18144,5160	3,7846	2,0616	2,1632
7500	89	44,5	18144,5160	4,0549	2,2106	2,3122
8000	95	47,5	18144,5160	4,3253	2,3597	2,4613
8500	99	49,5	18144,5160	4,5956	2,4590	2,5606
9000	105	52,5	18144,5160	4,8659	2,6080	2,7096

Kode : C272
P0 = 20,08 cm
D = 15,0933 cm
Ec = 19068,2145 MPa

kgf	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	17882.9048	0	-0.0742	0
500	5	2.5	17882.9048	0.2743	0.1245	0.1987
1000	11	5.5	17882.9048	0.5486	0.2739	0.3482
1500	15	7.5	17882.9048	0.8229	0.3735	0.4478
2000	19	9.5	17882.9048	1.0971	0.4731	0.5474
2500	23	11.5	17882.9048	1.3714	0.5727	0.6470
3000	26	13	17882.9048	1.6457	0.6474	0.7217
3500	30	15	17882.9048	1.9200	0.7470	0.8213
4000	34	17	17882.9048	2.1943	0.8466	0.9209
4500	41	20.5	17882.9048	2.4686	1.0209	1.0952
5000	46	23	17882.9048	2.7428	1.1454	1.2197
5500	50	25	17882.9048	3.0171	1.2450	1.3193
6000	56	28	17882.9048	3.2914	1.3944	1.4687
6500	60	30	17882.9048	3.5657	1.4940	1.5683
7000	65	32.5	17882.9048	3.8400	1.6185	1.6928
7500	66	33	17882.9048	4.1143	1.6434	1.7177
8000	73	36.5	17882.9048	4.3885	1.8177	1.8920
8500	84	42	17882.9048	4.6628	2.0916	2.1659
9000	101	50.5	17882.9048	4.9371	2.5149	2.5892

Kode : C273
P0 = 20,06 cm
D = 15,12 cm
Ec = 198291,0524 MPa

kgf	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	17946.2304	0.0000	-0.0328	0.0000
500	4	2	17946.2304	0.2733	0.0997	0.1325
1000	9	4.5	17946.2304	0.5466	0.2243	0.2571
1500	13	6.5	17946.2304	0.8199	0.3240	0.3568
2000	19	9.5	17946.2304	1.0933	0.4736	0.5064
2500	25	12.5	17946.2304	1.3666	0.6231	0.6559
3000	32	16	17946.2304	1.6399	0.7976	0.8304
3500	38	19	17946.2304	1.9132	0.9472	0.9800
4000	45	22.5	17946.2304	2.1865	1.1216	1.1544
4500	53	26.5	17946.2304	2.4598	1.3210	1.3538
5000	56	28	17946.2304	2.7332	1.3958	1.4286
5500	60	30	17946.2304	3.0065	1.4955	1.5283
6000	63	31.5	17946.2304	3.2798	1.5703	1.6031
6500	71	35.5	17946.2304	3.5531	1.7697	1.8025
7000	77	38.5	17946.2304	3.8264	1.9192	1.9520
7500	81	40.5	17946.2304	4.0997	2.0189	2.0517
8000	85	42.5	17946.2304	4.3731	2.1186	2.1514
8500	91	45.5	17946.2304	4.6464	2.2682	2.3010
9000	101	50.5	17946.2304	4.9197	2.5174	2.5502

Kode : D272
P0 = 20,04 cm
D = 15,0033 cm
Ec = 17974,0183 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0104	0
500	2	1	17670,2724	0,2776	0,0499	0,0603
1000	8	4	17670,2724	0,5552	0,1996	0,2100
1500	14	7	17670,2724	0,8328	0,3493	0,3597
2000	23	11,5	17670,2724	1,1103	0,5739	0,5843
2500	39	19,5	17670,2724	1,3879	0,9731	0,9835
3000	44	22	17670,2724	1,6655	1,0978	1,1082
3500	50	25	17670,2724	1,9431	1,2475	1,2579
4000	56	28	17670,2724	2,2207	1,3972	1,4076
4500	64	32	17670,2724	2,4983	1,5968	1,6072
5000	70	35	17670,2724	2,7758	1,7465	1,7569
5500	75	37,5	17670,2724	3,0534	1,8713	1,8817
6000	82	41	17670,2724	3,3310	2,0459	2,0563
6500	89	44,5	17670,2724	3,6086	2,2206	2,2310
7000	94	47	17670,2724	3,8862	2,3453	2,3557
7500	97	48,5	17670,2724	4,1638	2,4202	2,4306
8000	102	51	17670,2724	4,4414	2,5449	2,5553
8500	108	54	17670,2724	4,7189	2,6946	2,7050
9000	111	55,5	17670,2724	4,9965	2,7695	2,7799

Kode : D273
P0 = 20,11 cm
D = 15,0033 cm
Ec = 18590,7512 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0770	0
500	4	2	17670,2724	0,2776	0,0995	0,1765
1000	9	4,5	17670,2724	0,5552	0,2238	0,3008
1500	15	7,5	17670,2724	0,8328	0,3729	0,4499
2000	19	9,5	17670,2724	1,1103	0,4724	0,5494
2500	24	12	17670,2724	1,3879	0,5967	0,6737
3000	28	14	17670,2724	1,6655	0,6962	0,7732
3500	35	17,5	17670,2724	1,9431	0,8702	0,9472
4000	42	21	17670,2724	2,2207	1,0443	1,1213
4500	49	24,5	17670,2724	2,4983	1,2183	1,2953
5000	54	27	17670,2724	2,7758	1,3426	1,4196
5500	58	29	17670,2724	3,0534	1,4421	1,5191
6000	63	31,5	17670,2724	3,3310	1,5664	1,6434
6500	70	35	17670,2724	3,6086	1,7404	1,8174
7000	75	37,5	17670,2724	3,8862	1,8647	1,9417
7500	82	41	17670,2724	4,1638	2,0388	2,1158
8000	87	43,5	17670,2724	4,4414	2,1631	2,2401
8500	91	45,5	17670,2724	4,7189	2,2626	2,3396
9000	105	52,5	17670,2724	4,9965	2,6106	2,6876

Kode : E272
P0 = 20,06 cm
D = 15,0100 cm
Ec = 19698,9282 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,2219	0
500	3	1,5	17686,0579	0,2773	0,0746	0,2965
1000	6	3	17686,0579	0,5547	0,1492	0,3711
1500	9	4,5	17686,0579	0,8320	0,2238	0,4457
2000	13	6,5	17686,0579	1,1093	0,3232	0,5451
2500	17	8,5	17686,0579	1,3867	0,4227	0,6446
3000	20	10	17686,0579	1,6640	0,4973	0,7192
3500	24	12	17686,0579	1,9414	0,5967	0,8186
4000	29	14,5	17686,0579	2,2187	0,7210	0,9429
4500	33	16,5	17686,0579	2,4960	0,8205	1,0424
5000	39	19,5	17686,0579	2,7734	0,9697	1,1916
5500	44	22	17686,0579	3,0507	1,0940	1,3159
6000	51	25,5	17686,0579	3,3280	1,2680	1,4899
6500	58	29	17686,0579	3,6054	1,4421	1,6640
7000	64	32	17686,0579	3,8827	1,5912	1,8131
7500	71	35,5	17686,0579	4,1601	1,7653	1,9872
8000	80	40	17686,0579	4,4374	1,9891	2,2110
8500	87	43,5	17686,0579	4,7147	2,1631	2,3850
9000	93	46,5	17686,0579	4,9921	2,3123	2,5342

Kode : E273
P0 = 20,04 cm
D = 15,1100 cm
Ec = 18595,7134 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0044	0
500	4	2	17922,4999	0,2737	0,0998	0,1042
1000	10	5	17922,4999	0,5474	0,2495	0,2539
1500	17	8,5	17922,4999	0,8210	0,4242	0,4286
2000	24	12	17922,4999	1,0947	0,5988	0,6032
2500	29	14,5	17922,4999	1,3684	0,7236	0,7280
3000	35	17,5	17922,4999	1,6421	0,8733	0,8777
3500	42	21	17922,4999	1,9157	1,0479	1,0523
4000	49	24,5	17922,4999	2,1894	1,2226	1,2270
4500	52	26	17922,4999	2,4631	1,2974	1,3018
5000	58	29	17922,4999	2,7368	1,4471	1,4515
5500	63	31,5	17922,4999	3,0105	1,5719	1,5763
6000	70	35	17922,4999	3,2841	1,7465	1,7509
6500	74	37	17922,4999	3,5578	1,8463	1,8507
7000	79	39,5	17922,4999	3,8315	1,9711	1,9755
7500	84	42	17922,4999	4,1052	2,0958	2,1002
8000	93	46,5	17922,4999	4,3789	2,3204	2,3248
8500	97	48,5	17922,4999	4,6525	2,4202	2,4246
9000	106	53	17922,4999	4,9262	2,6447	2,6491

Kode : F272
P0 = 20,03 cm
D = 15,1067 cm
Ec = 17103,0533 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0608	0
500	3	1,5	17914,6722	0,2738	0,0749	0,1357
1000	8	4	17914,6722	0,5476	0,1997	0,2605
1500	16	8	17914,6722	0,8214	0,3994	0,4602
2000	25	12,5	17914,6722	1,0952	0,6241	0,6849
2500	30	15	17914,6722	1,3690	0,7489	0,8097
3000	36	18	17914,6722	1,6428	0,8987	0,9595
3500	41	20,5	17914,6722	1,9166	1,0235	1,0843
4000	48	24	17914,6722	2,1904	1,1982	1,2590
4500	52	26	17914,6722	2,4642	1,2981	1,3589
5000	58	29	17914,6722	2,7380	1,4478	1,5086
5500	65	32,5	17914,6722	3,0118	1,6226	1,6834
6000	71	35,5	17914,6722	3,2856	1,7723	1,8331
6500	76	38	17914,6722	3,5594	1,8972	1,9580
7000	84	42	17914,6722	3,8332	2,0969	2,1577
7500	95	47,5	17914,6722	4,1070	2,3714	2,4322
8000	97	48,5	17914,6722	4,3808	2,4214	2,4822
8500	101	50,5	17914,6722	4,6546	2,5212	2,5820
9000	113	56,5	17914,6722	4,9284	2,8208	2,8816

Kode : F273
P0 = 20,07 cm
D = 15,1500cm
Ec = 17142,3088 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0185	0
500	5	2,5	18017,5163	0,2722	0,1246	0,1431
1000	11	5,5	18017,5163	0,5445	0,2740	0,2925
1500	16	8	18017,5163	0,8167	0,3986	0,4171
2000	21	10,5	18017,5163	1,0889	0,5232	0,5417
2500	34	17	18017,5163	1,3612	0,8470	0,8655
3000	39	19,5	18017,5163	1,6334	0,9716	0,9901
3500	46	23	18017,5163	1,9056	1,1460	1,1645
4000	51	25,5	18017,5163	2,1779	1,2706	1,2891
4500	54	27	18017,5163	2,4501	1,3453	1,3638
5000	58	29	18017,5163	2,7224	1,4449	1,4634
5500	65	32,5	18017,5163	2,9946	1,6193	1,6378
6000	72	36	18017,5163	3,2668	1,7937	1,8122
6500	77	38,5	18017,5163	3,5391	1,9183	1,9368
7000	83	41,5	18017,5163	3,8113	2,0678	2,0863
7500	91	45,5	18017,5163	4,0835	2,2671	2,2856
8000	97	48,5	18017,5163	4,3558	2,4165	2,4350
8500	103	51,5	18017,5163	4,6280	2,5660	2,5845
9000	114	57	18017,5163	4,9002	2,8401	2,8586

Lampiran F

HASIL PENGUJIAN MODULUS ELASTISITAS BETON UMUR 14 HARI

Kode : A142
P0 = 20,06 cm
D = 15,1133 cm
Ec = 19742,5458 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,1182	0
500	4	2	17930,3292	0,2736	0,0997	0,2179
1000	10	5	17930,3292	0,5471	0,2493	0,3675
1500	14	7	17930,3292	0,8207	0,3490	0,4672
2000	19	9,5	17930,3292	1,0942	0,4736	0,5918
2500	21	10,5	17930,3292	1,3678	0,5234	0,6416
3000	26	13	17930,3292	1,6414	0,6481	0,7663
3500	30	15	17930,3292	1,9149	0,7478	0,8660
4000	37	18,5	17930,3292	2,1885	0,9222	1,0404
4500	42	21	17930,3292	2,4620	1,0469	1,1651
5000	48	24	17930,3292	2,7356	1,1964	1,3146
5500	54	27	17930,3292	3,0091	1,3460	1,4642
6000	60	30	17930,3292	3,2827	1,4955	1,6137
6500	65	32,5	17930,3292	3,5563	1,6201	1,7383
7000	73	36,5	17930,3292	3,8298	1,8195	1,9377
7500	80	40	17930,3292	4,1034	1,9940	2,1122
8000	85	42,5	17930,3292	4,3769	2,1186	2,2368
8500	91	45,5	17930,3292	4,6505	2,2682	2,3864
9000	98	49	17930,3292	4,9241	2,4427	2,5609
9500	103	51,5	17930,3292	5,1976	2,5673	2,6855
10000	108	54	17930,3292	5,4712	2,6919	2,8101
10500	112	56	17930,3292	5,7447	2,7916	2,9098

Kode : A143
P0 = 20,04 cm
D = 15,1533 cm
Ec = 21484,8179 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0400	0
500	5	2,5	18025,3663	0,2721	0,1248	0,1648
1000	10	5	18025,3663	0,5442	0,2495	0,2895
1500	14	7	18025,3663	0,8163	0,3493	0,3893
2000	20	10	18025,3663	1,0885	0,4990	0,5390
2500	23	11,5	18025,3663	1,3606	0,5739	0,6139
3000	28	14	18025,3663	1,6327	0,6986	0,7386
3500	31	15,5	18025,3663	1,9048	0,7735	0,8135
4000	36	18	18025,3663	2,1769	0,8982	0,9382
4500	41	20,5	18025,3663	2,4490	1,0230	1,0630
5000	46	23	18025,3663	2,7212	1,1477	1,1877
5500	51	25,5	18025,3663	2,9933	1,2725	1,3125
6000	59	29,5	18025,3663	3,2654	1,4721	1,5121
6500	63	31,5	18025,3663	3,5375	1,5719	1,6119
7000	68	34	18025,3663	3,8096	1,6966	1,7366
7500	72	36	18025,3663	4,0817	1,7964	1,8364
8000	79	39,5	18025,3663	4,3539	1,9711	2,0111
8500	83	41,5	18025,3663	4,6260	2,0709	2,1109
9000	88	44	18025,3663	4,8981	2,1956	2,2356
9500	94	47	18025,3663	5,1702	2,3453	2,3853
10000	98	49	18025,3663	5,4423	2,4451	2,4851
10500	105	52,5	18025,3663	5,7144	2,6198	2,6598

Kode : B142
P0 = 20,04 cm
D = 15,1533 cm
Ec = 20962,2507 MPa

kgf		0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	18025,3663	0,0000	-0,0315	0,0000
500	5	2,5	18025,3663	0,2721	0,1248	0,1562
1000	9	4,5	18025,3663	0,5442	0,2246	0,2560
1500	15	7,5	18025,3663	0,8163	0,3743	0,4057
2000	20	10	18025,3663	1,0885	0,4990	0,5305
2500	24	12	18025,3663	1,3606	0,5988	0,6303
3000	29	14,5	18025,3663	1,6327	0,7236	0,7550
3500	33	16,5	18025,3663	1,9048	0,8234	0,8548
4000	37	18,5	18025,3663	2,1769	0,9232	0,9546
4500	40	20	18025,3663	2,4490	0,9980	1,0295
5000	44	22	18025,3663	2,7212	1,0978	1,1293
5500	49	24,5	18025,3663	2,9933	1,2226	1,2540
6000	53	26,5	18025,3663	3,2654	1,3224	1,3538
6500	57	28,5	18025,3663	3,5375	1,4222	1,4536
7000	62	31	18025,3663	3,8096	1,5469	1,5784
7500	68	34	18025,3663	4,0817	1,6966	1,7281
8000	74	37	18025,3663	4,3539	1,8463	1,8778
8500	79	39,5	18025,3663	4,6260	1,9711	2,0025
9000	84	42	18025,3663	4,8981	2,0958	2,1273
9500	88	44	18025,3663	5,1702	2,1956	2,2271
10000	95	47,5	18025,3663	5,4423	2,3703	2,4017
10500	108	54	18025,3663	5,7144	2,6946	2,7261

Kode : B143
P0 = 20,06 cm
D = 15,2 cm
Ec = 19886,1550 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0394	0
500	5	2,5	18136,6400	0,2704	0,1246	0,1640
1000	11	5,5	18136,6400	0,5409	0,2742	0,3136
1500	16	8	18136,6400	0,8113	0,3988	0,4382
2000	21	10,5	18136,6400	1,0818	0,5234	0,5628
2500	24	12	18136,6400	1,3522	0,5982	0,6376
3000	29	14,5	18136,6400	1,6227	0,7228	0,7622
3500	35	17,5	18136,6400	1,8931	0,8724	0,9118
4000	39	19,5	18136,6400	2,1636	0,9721	1,0115
4500	43	21,5	18136,6400	2,4340	1,0718	1,1112
5000	50	25	18136,6400	2,7045	1,2463	1,2857
5500	54	27	18136,6400	2,9749	1,3460	1,3854
6000	59	29,5	18136,6400	3,2454	1,4706	1,5100
6500	62	31	18136,6400	3,5158	1,5454	1,5848
7000	68	34	18136,6400	3,7863	1,6949	1,7343
7500	74	37	18136,6400	4,0567	1,8445	1,8839
8000	79	39,5	18136,6400	4,3272	1,9691	2,0085
8500	85	42,5	18136,6400	4,5976	2,1186	2,1580
9000	91	45,5	18136,6400	4,8680	2,2682	2,3076
9500	96	48	18136,6400	5,1385	2,3928	2,4322
10000	107	53,5	18136,6400	5,4089	2,6670	2,7064
10500	113	56,5	18136,6400	5,6794	2,8166	2,8560

Kode : C142
P0 = 20,05 cm
D = 15,1567 cm
Ec = 17719,3986 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0315	0
500	6	3	18033,4561	0,2720	0,1496	0,1811
1000	11	5,5	18033,4561	0,5440	0,2743	0,3058
1500	17	8,5	18033,4561	0,8160	0,4239	0,4554
2000	24	12	18033,4561	1,0880	0,5985	0,6300
2500	28	14	18033,4561	1,3600	0,6983	0,7298
3000	33	16,5	18033,4561	1,6320	0,8229	0,8544
3500	41	20,5	18033,4561	1,9040	1,0224	1,0539
4000	48	24	18033,4561	2,1760	1,1970	1,2285
4500	56	28	18033,4561	2,4480	1,3965	1,4280
5000	62	31	18033,4561	2,7199	1,5461	1,5776
5500	69	34,5	18033,4561	2,9919	1,7207	1,7522
6000	74	37	18033,4561	3,2639	1,8454	1,8769
6500	78	39	18033,4561	3,5359	1,9451	1,9766
7000	84	42	18033,4561	3,8079	2,0948	2,1263
7500	90	45	18033,4561	4,0799	2,2444	2,2759
8000	96	48	18033,4561	4,3519	2,3940	2,4255
8500	104	52	18033,4561	4,6239	2,5935	2,6250
9000	112	56	18033,4561	4,8959	2,7930	2,8245
9500	116	58	18033,4561	5,1679	2,8928	2,9243
10000	123	61,5	18033,4561	5,4399	3,0673	3,0988
10500	128	64	18033,4561	5,7119	3,1920	3,2235

Kode : C143
P0 = 20,04 cm
D = 15,1067 cm
Ec = 21127,8517 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0268	0
500	5	2,5	17914,6722	0,2738	0,1248	0,1516
1000	9	4,5	17914,6722	0,5476	0,2246	0,2514
1500	14	7	17914,6722	0,8214	0,3493	0,3761
2000	20	10	17914,6722	1,0952	0,4990	0,5258
2500	24	12	17914,6722	1,3690	0,5988	0,6256
3000	31	15,5	17914,6722	1,6428	0,7735	0,8003
3500	35	17,5	17914,6722	1,9166	0,8733	0,9001
4000	39	19,5	17914,6722	2,1904	0,9731	0,9999
4500	44	22	17914,6722	2,4642	1,0978	1,1246
5000	49	24,5	17914,6722	2,7380	1,2226	1,2494
5500	55	27,5	17914,6722	3,0118	1,3723	1,3991
6000	60	30	17914,6722	3,2856	1,4970	1,5238
6500	64	32	17914,6722	3,5594	1,5968	1,6236
7000	68	34	17914,6722	3,8332	1,6966	1,7234
7500	74	37	17914,6722	4,1070	1,8463	1,8731
8000	79	39,5	17914,6722	4,3808	1,9711	1,9979
8500	85	42,5	17914,6722	4,6546	2,1208	2,1476
9000	91	45,5	17914,6722	4,9284	2,2705	2,2973
9500	96	48	17914,6722	5,2022	2,3952	2,4220
10000	102	51	17914,6722	5,4760	2,5449	2,5717
10500	108	54	17914,6722	5,7498	2,6946	2,7214

Kode : D142
P0 = 19,97 cm
D = 15,0767 cm
Ec = 19817,8697 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0085	0
500	4	2	17843,5903	0,2749	0,1002	0,1087
1000	9	4,5	17843,5903	0,5498	0,2253	0,2338
1500	16	8	17843,5903	0,8247	0,4006	0,4091
2000	22	11	17843,5903	1,0996	0,5508	0,5593
2500	28	14	17843,5903	1,3744	0,7011	0,7096
3000	33	16,5	17843,5903	1,6493	0,8262	0,8347
3500	39	19,5	17843,5903	1,9242	0,9765	0,9850
4000	45	22,5	17843,5903	2,1991	1,1267	1,1352
4500	50	25	17843,5903	2,4740	1,2519	1,2604
5000	54	27	17843,5903	2,7489	1,3520	1,3605
5500	59	29,5	17843,5903	3,0238	1,4772	1,4857
6000	63	31,5	17843,5903	3,2987	1,5774	1,5859
6500	71	35,5	17843,5903	3,5736	1,7777	1,7862
7000	75	37,5	17843,5903	3,8484	1,8778	1,8863
7500	78	39	17843,5903	4,1233	1,9529	1,9614
8000	85	42,5	17843,5903	4,3982	2,1282	2,1367
8500	92	46	17843,5903	4,6731	2,3035	2,3120
9000	97	48,5	17843,5903	4,9480	2,4286	2,4371
9500	103	51,5	17843,5903	5,2229	2,5789	2,5874
10000	109	54,5	17843,5903	5,4978	2,7291	2,7376
10500	116	58	17843,5903	5,7727	2,9044	2,9129

Kode : D143
P0 = 20,01 cm
D = 15,02 cm
Ec = 21397,3150 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0196	0
500	4	2	17709,6314	0,2770	0,1000	0,1196
1000	10	5	17709,6314	0,5539	0,2499	0,2695
1500	15	7,5	17709,6314	0,8309	0,3748	0,3944
2000	21	10,5	17709,6314	1,1079	0,5247	0,5443
2500	24	12	17709,6314	1,3848	0,5997	0,6193
3000	29	14,5	17709,6314	1,6618	0,7246	0,7442
3500	34	17	17709,6314	1,9388	0,8496	0,8692
4000	41	20,5	17709,6314	2,2157	1,0245	1,0441
4500	46	23	17709,6314	2,4927	1,1494	1,1690
5000	50	25	17709,6314	2,7697	1,2494	1,2690
5500	55	27,5	17709,6314	3,0466	1,3743	1,3939
6000	59	29,5	17709,6314	3,3236	1,4743	1,4939
6500	64	32	17709,6314	3,6006	1,5992	1,6188
7000	69	34,5	17709,6314	3,8776	1,7241	1,7437
7500	74	37	17709,6314	4,1545	1,8491	1,8687
8000	79	39,5	17709,6314	4,4315	1,9740	1,9936
8500	84	42	17709,6314	4,7085	2,0990	2,1186
9000	91	45,5	17709,6314	4,9854	2,2739	2,2935
9500	96	48	17709,6314	5,2624	2,3988	2,4184
10000	103	51,5	17709,6314	5,5394	2,5737	2,5933
10500	108	54	17709,6314	5,8163	2,6987	2,7183

Kode : E142
P0 = 20,03 cm
D = 15,0467 cm
Ec = 19151,4719 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0557	0
500	6	3	17772,6497	0,2760	0,1498	0,2055
1000	11	5,5	17772,6497	0,5520	0,2746	0,3303
1500	15	7,5	17772,6497	0,8280	0,3744	0,4301
2000	22	11	17772,6497	1,1039	0,5492	0,6049
2500	26	13	17772,6497	1,3799	0,6490	0,7047
3000	33	16,5	17772,6497	1,6559	0,8238	0,8795
3500	37	18,5	17772,6497	1,9319	0,9236	0,9793
4000	42	21	17772,6497	2,2079	1,0484	1,1041
4500	48	24	17772,6497	2,4839	1,1982	1,2539
5000	54	27	17772,6497	2,7599	1,3480	1,4037
5500	60	30	17772,6497	3,0358	1,4978	1,5535
6000	66	33	17772,6497	3,3118	1,6475	1,7032
6500	72	36	17772,6497	3,5878	1,7973	1,8530
7000	78	39	17772,6497	3,8638	1,9471	2,0028
7500	85	42,5	17772,6497	4,1398	2,1218	2,1775
8000	90	45	17772,6497	4,4158	2,2466	2,3023
8500	97	48,5	17772,6497	4,6918	2,4214	2,4771
9000	106	53	17772,6497	4,9677	2,6460	2,7017
9500	110	55	17772,6497	5,2437	2,7459	2,8016
10000	115	57,5	17772,6497	5,5197	2,8707	2,9264
10500	119	59,5	17772,6497	5,7957	2,9705	3,0262

Kode : E143
P0 = 20,04 cm
D = 15,13 cm
Ec = 21484,8180 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,04	0
500	4	2,5	17969,977	0,2721	0,1248	0,1648
1000	9	5	17969,977	0,5442	0,2495	0,2895
1500	13	7	17969,977	0,8163	0,3493	0,3893
2000	17	10	17969,977	1,0885	0,4990	0,5390
2500	21	11,5	17969,977	1,3606	0,5739	0,6139
3000	25	14	17969,977	1,6327	0,6986	0,7386
3500	29	15,5	17969,977	1,9048	0,7735	0,8135
4000	32	18	17969,977	2,1769	0,8982	0,9382
4500	36	20,5	17969,977	2,4490	1,0230	1,0630
5000	40	23	17969,977	2,7212	1,1477	1,1877
5500	43	25,5	17969,977	2,9933	1,2725	1,3125
6000	44	29,5	17969,977	3,2654	1,4721	1,5121
6500	50	31,5	17969,977	3,5375	1,5719	1,6119
7000	55	34	17969,977	3,8096	1,6966	1,7366
7500	59	36	17969,977	4,0817	1,7964	1,8364
8000	63	39,5	17969,977	4,3539	1,9711	2,0111
8500	67	41,5	17969,977	4,6260	2,0709	2,1109
9000	71	44	17969,977	4,8981	2,1956	2,2356
9500	75	47	17969,977	5,1702	2,3453	2,3853
10000	80	49	17969,977	5,4423	2,4451	2,4851
10500	83	52,5	17969,977	5,7144	2,6198	2,6598

Kode : F142
P0 = 20,07 cm
D = 15,1 cm
Ec = 21190,3265 MPa

kgf	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	17898,7850	0,0000	-0,0003	0,0000
500	5	2,5	17898,7850	0,2740	0,1246	0,1249
1000	11	5,5	17898,7850	0,5481	0,2740	0,2743
1500	14	7	17898,7850	0,8221	0,3488	0,3491
2000	21	10,5	17898,7850	1,0962	0,5232	0,5235
2500	24	12	17898,7850	1,3702	0,5979	0,5982
3000	28	14	17898,7850	1,6442	0,6976	0,6979
3500	31	15,5	17898,7850	1,9183	0,7723	0,7726
4000	37	18,5	17898,7850	2,1923	0,9218	0,9221
4500	41	20,5	17898,7850	2,4664	1,0214	1,0217
5000	48	24	17898,7850	2,7404	1,1958	1,1961
5500	52	26	17898,7850	3,0145	1,2955	1,2958
6000	59	29,5	17898,7850	3,2885	1,4699	1,4702
6500	64	32	17898,7850	3,5625	1,5944	1,5947
7000	68	34	17898,7850	3,8366	1,6941	1,6944
7500	72	36	17898,7850	4,1106	1,7937	1,7940
8000	79	39,5	17898,7850	4,3847	1,9681	1,9684
8500	82	41	17898,7850	4,6587	2,0429	2,0432
9000	86	43	17898,7850	4,9327	2,1425	2,1428
9500	94	47	17898,7850	5,2068	2,3418	2,3421
10000	102	51	17898,7850	5,4808	2,5411	2,5414
10500	109	54,5	17898,7850	5,7549	2,7155	2,7158

Kode : F143
P0 = 20,05 cm
D = 15,19 cm
Ec = 19539,4438 MPa

kgf	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	18112,7839	0,0000	-0,0925	0,0000
500	3	1,5	18112,7839	0,2708	0,0748	0,1673
1000	5	2,5	18112,7839	0,5416	0,1247	0,2172
1500	8	4	18112,7839	0,8124	0,1995	0,2920
2000	11	5,5	18112,7839	1,0832	0,2743	0,3668
2500	15	7,5	18112,7839	1,3540	0,3741	0,4666
3000	17	8,5	18112,7839	1,6248	0,4239	0,5164
3500	20	10	18112,7839	1,8956	0,4988	0,5913
4000	23	11,5	18112,7839	2,1664	0,5736	0,6661
4500	26	13	18112,7839	2,4372	0,6484	0,7409
5000	30	15	18112,7839	2,7080	0,7481	0,8406
5500	35	17,5	18112,7839	2,9788	0,8728	0,9653
6000	39	19,5	18112,7839	3,2496	0,9726	1,0651
6500	43	21,5	18112,7839	3,5204	1,0723	1,1648
7000	47	23,5	18112,7839	3,7912	1,1721	1,2646
7500	51	25,5	18112,7839	4,0620	1,2718	1,3643
8000	60	30	18112,7839	4,3329	1,4963	1,5888
8500	68	34	18112,7839	4,6037	1,6958	1,7883
9000	79	39,5	18112,7839	4,8745	1,9701	2,0626
9500	84	42	18112,7839	5,1453	2,0948	2,1873
10000	102	51	18112,7839	5,4161	2,5436	2,6361
10500	113	56,5	18112,7839	5,6869	2,8180	2,9105

Lampiran F
HASIL PENGUJIAN MODULUS ELASTISITAS BETON UMUR 28 HARI

Kode : A282
P0 = 20,03 cm
D = 15,0733 cm
Ec = 22259,4192 MPa

kgf	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	17835,5433	0,0000	-0,0158	0,0000
500	2	1	17835,5433	0,2750	0,0499	0,0657
1000	6	3	17835,5433	0,5500	0,1498	0,1656
1500	9	4,5	17835,5433	0,8250	0,2247	0,2405
2000	13	6,5	17835,5433	1,1001	0,3245	0,3403
2500	18	9	17835,5433	1,3751	0,4493	0,4651
3000	22	11	17835,5433	1,6501	0,5492	0,5650
3500	28	14	17835,5433	1,9251	0,6990	0,7148
4000	33	16,5	17835,5433	2,2001	0,8238	0,8396
4500	39	19,5	17835,5433	2,4751	0,9735	0,9893
5000	44	22	17835,5433	2,7501	1,0984	1,1142
5500	49	24,5	17835,5433	3,0251	1,2232	1,2390
6000	53	26,5	17835,5433	3,3002	1,3230	1,3388
6500	58	29	17835,5433	3,5752	1,4478	1,4636
7000	64	32	17835,5433	3,8502	1,5976	1,6134
7500	71	35,5	17835,5433	4,1252	1,7723	1,7881
8000	76	38	17835,5433	4,4002	1,8972	1,9130
8500	82	41	17835,5433	4,6752	2,0469	2,0627
9000	87	43,5	17835,5433	4,9502	2,1717	2,1875
9500	93	46,5	17835,5433	5,2252	2,3215	2,3373
10000	97	48,5	17835,5433	5,5003	2,4214	2,4372
10500	104	52	17835,5433	5,7753	2,5961	2,6119
11000	109	54,5	17835,5433	6,0503	2,7209	2,7367
11500	113	56,5	17835,5433	6,3253	2,8208	2,8366
12000	117	58,5	17835,5433	6,6003	2,9206	2,9364
12500	122	61	17835,5433	6,8753	3,0454	3,0612
13000	127	63,5	17835,5433	7,1503	3,1702	3,1860
13500	133	66,5	17835,5433	7,4253	3,3200	3,3358

Kode : A283
P0 = 20,06 cm
D = 15,1 cm
Ec = 21752,834 MPa

kgf	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	17898,7850	0,0000	-0,0117	0,0000
500	5	2,5	17898,7850	0,2740	0,1246	0,1363
1000	10	5	17898,7850	0,5481	0,2493	0,2610
1500	15	7,5	17898,7850	0,8221	0,3739	0,3856
2000	20	10	17898,7850	1,0962	0,4985	0,5102
2500	26	13	17898,7850	1,3702	0,6481	0,6598
3000	31	15,5	17898,7850	1,6442	0,7727	0,7844
3500	36	18	17898,7850	1,9183	0,8973	0,9090
4000	41	20,5	17898,7850	2,1923	1,0219	1,0336
4500	46	23	17898,7850	2,4664	1,1466	1,1583
5000	50	25	17898,7850	2,7404	1,2463	1,2580
5500	55	27,5	17898,7850	3,0145	1,3709	1,3826
6000	61	30,5	17898,7850	3,2885	1,5204	1,5321
6500	68	34	17898,7850	3,5625	1,6949	1,7066
7000	73	36,5	17898,7850	3,8366	1,8195	1,8312
7500	80	40	17898,7850	4,1106	1,9940	2,0057
8000	85	42,5	17898,7850	4,3847	2,1186	2,1303
8500	91	45,5	17898,7850	4,6587	2,2682	2,2799
9000	96	48	17898,7850	4,9327	2,3928	2,4045
9500	101	50,5	17898,7850	5,2068	2,5174	2,5291
10000	107	53,5	17898,7850	5,4808	2,6670	2,6787
10500	111	55,5	17898,7850	5,7549	2,7667	2,7784
11000	115	57,5	17898,7850	6,0289	2,8664	2,8781
11500	119	59,5	17898,7850	6,3029	2,9661	2,9778
12000	124	62	17898,7850	6,5770	3,0907	3,1024
12500	129	64,5	17898,7850	6,8510	3,2154	3,2271
13000	132	66	17898,7850	7,1251	3,2901	3,3018
13500	136	68	17898,7850	7,3991	3,3898	3,4015

Kode : B282
P0 = 20,04 cm
D = 15,1767 cm
Ec = 19659,0714 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0581	0
500	4	2	18081,0795	0,2713	0,0998	0,1579
1000	10	5	18081,0795	0,5426	0,2495	0,3076
1500	15	7,5	18081,0795	0,8138	0,3743	0,4324
2000	21	10,5	18081,0795	1,0851	0,5240	0,5821
2500	24	12	18081,0795	1,3564	0,5988	0,6569
3000	29	14,5	18081,0795	1,6277	0,7236	0,7817
3500	35	17,5	18081,0795	1,8989	0,8733	0,9314
4000	41	20,5	18081,0795	2,1702	1,0230	1,0811
4500	47	23,5	18081,0795	2,4415	1,1727	1,2308
5000	52	26	18081,0795	2,7128	1,2974	1,3555
5500	59	29,5	18081,0795	2,9841	1,4721	1,5302
6000	64	32	18081,0795	3,2553	1,5968	1,6549
6500	70	35	18081,0795	3,5266	1,7465	1,8046
7000	75	37,5	18081,0795	3,7979	1,8713	1,9294
7500	81	40,5	18081,0795	4,0692	2,0210	2,0791
8000	88	44	18081,0795	4,3404	2,1956	2,2537
8500	95	47,5	18081,0795	4,6117	2,3703	2,4284
9000	100	50	18081,0795	4,8830	2,4950	2,5531
9500	105	52,5	18081,0795	5,1543	2,6198	2,6779
10000	111	55,5	18081,0795	5,4256	2,7695	2,8276
10500	116	58	18081,0795	5,6968	2,8942	2,9523
11000	121	60,5	18081,0795	5,9681	3,0190	3,0771
11500	127	63,5	18081,0795	6,2394	3,1687	3,2268
12000	131	65,5	18081,0795	6,5107	3,2685	3,3266
12500	136	68	18081,0795	6,7820	3,3932	3,4513
13000	142	71	18081,0795	7,0532	3,5429	3,6010
13500	147	73,5	18081,0795	7,3245	3,6677	3,7258

Kode : B283
P0 = 20,03 cm
D = 15,1633 cm
Ec = 23057,67907 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,2616	0
500	3	1,5	18049,1649	0,2718	0,0749	0,3365
1000	6	3	18049,1649	0,5435	0,1498	0,4114
1500	9	4,5	18049,1649	0,8153	0,2247	0,4863
2000	11	5,5	18049,1649	1,0870	0,2746	0,5362
2500	14	7	18049,1649	1,3588	0,3495	0,6111
3000	17	8,5	18049,1649	1,6305	0,4244	0,6860
3500	20	10	18049,1649	1,9023	0,4993	0,7609
4000	23	11,5	18049,1649	2,1741	0,5741	0,8357
4500	27	13,5	18049,1649	2,4458	0,6740	0,9356
5000	31	15,5	18049,1649	2,7176	0,7738	1,0354
5500	35	17,5	18049,1649	2,9893	0,8737	1,1353
6000	39	19,5	18049,1649	3,2611	0,9735	1,2351
6500	43	21,5	18049,1649	3,5329	1,0734	1,3350
7000	48	24	18049,1649	3,8046	1,1982	1,4598
7500	52	26	18049,1649	4,0764	1,2981	1,5597
8000	57	28,5	18049,1649	4,3481	1,4229	1,6845
8500	61	30,5	18049,1649	4,6199	1,5227	1,7843
9000	69	34,5	18049,1649	4,8916	1,7224	1,9840
9500	76	38	18049,1649	5,1634	1,8972	2,1588
10000	83	41,5	18049,1649	5,4352	2,0719	2,3335
10500	90	45	18049,1649	5,7069	2,2466	2,5082
11000	95	47,5	18049,1649	5,9787	2,3714	2,6330
11500	98	49	18049,1649	6,2504	2,4463	2,7079
12000	104	52	18049,1649	6,5222	2,5961	2,8577
12500	108	54	18049,1649	6,7939	2,6960	2,9576
13000	114	57	18049,1649	7,0657	2,8457	3,1073
13500	117	58,5	18049,1649	7,3375	2,9206	3,1822

Kode : C282
P0 = 19,97 cm
D = 15,0233 cm
Ec = 21354,6059 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0702	0
500	2	1	17717,4141	0,2768	0,0501	0,1203
1000	7	3,5	17717,4141	0,5537	0,1753	0,2455
1500	13	6,5	17717,4141	0,8305	0,3255	0,3957
2000	18	9	17717,4141	1,1074	0,4507	0,5209
2500	23	11,5	17717,4141	1,3842	0,5759	0,6461
3000	29	14,5	17717,4141	1,6611	0,7261	0,7963
3500	34	17	17717,4141	1,9379	0,8513	0,9215
4000	38	19	17717,4141	2,2148	0,9514	1,0216
4500	42	21	17717,4141	2,4916	1,0516	1,1218
5000	47	23,5	17717,4141	2,7685	1,1768	1,2470
5500	53	26,5	17717,4141	3,0453	1,3270	1,3972
6000	59	29,5	17717,4141	3,3222	1,4772	1,5474
6500	65	32,5	17717,4141	3,5990	1,6274	1,6976
7000	70	35	17717,4141	3,8758	1,7526	1,8228
7500	76	38	17717,4141	4,1527	1,9029	1,9731
8000	81	40,5	17717,4141	4,4295	2,0280	2,0982
8500	85	42,5	17717,4141	4,7064	2,1282	2,1984
9000	92	46	17717,4141	4,9832	2,3035	2,3737
9500	96	48	17717,4141	5,2601	2,4036	2,4738
10000	102	51	17717,4141	5,5369	2,5538	2,6240
10500	107	53,5	17717,4141	5,8138	2,6790	2,7492
11000	113	56,5	17717,4141	6,0906	2,8292	2,8994
11500	117	58,5	17717,4141	6,3675	2,9294	2,9996
12000	121	60,5	17717,4141	6,6443	3,0295	3,0997
12500	126	63	17717,4141	6,9212	3,1547	3,2249
13000	132	66	17717,4141	7,1980	3,3050	3,3752
13500	137	68,5	17717,4141	7,4748	3,4301	3,5003

Kode : C283
P0 = 20,06 cm
D = 15,18 cm
Ec = 21891,9162 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0791	0
500	3	1,5	18088,9434	0,2712	0,0748	0,1539
1000	5	2,5	18088,9434	0,5423	0,1246	0,2037
1500	9	4,5	18088,9434	0,8135	0,2243	0,3034
2000	15	7,5	18088,9434	1,0846	0,3739	0,4530
2500	20	10	18088,9434	1,3558	0,4985	0,5776
3000	25	12,5	18088,9434	1,6270	0,6231	0,7022
3500	31	15,5	18088,9434	1,8981	0,7727	0,8518
4000	36	18	18088,9434	2,1693	0,8973	0,9764
4500	42	21	18088,9434	2,4404	1,0469	1,1260
5000	49	24,5	18088,9434	2,7116	1,2213	1,3004
5500	54	27	18088,9434	2,9828	1,3460	1,4251
6000	61	30,5	18088,9434	3,2539	1,5204	1,5995
6500	64	32	18088,9434	3,5251	1,5952	1,6743
7000	69	34,5	18088,9434	3,7962	1,7198	1,7989
7500	73	36,5	18088,9434	4,0674	1,8195	1,8986
8000	76	38	18088,9434	4,3386	1,8943	1,9734
8500	83	41,5	18088,9434	4,6097	2,0688	2,1479
9000	87	43,5	18088,9434	4,8809	2,1685	2,2476
9500	92	46	18088,9434	5,1520	2,2931	2,3722
10000	96	48	18088,9434	5,4232	2,3928	2,4719
10500	104	52	18088,9434	5,6944	2,5922	2,6713
11000	107	53,5	18088,9434	5,9655	2,6670	2,7461
11500	111	55,5	18088,9434	6,2367	2,7667	2,8458
12000	116	58	18088,9434	6,5078	2,8913	2,9704
12500	121	60,5	18088,9434	6,7790	3,0160	3,0951
13000	127	63,5	18088,9434	7,0502	3,1655	3,2446
13500	131	65,5	18088,9434	7,3213	3,2652	3,3443

Kode : D282
P0 = 20,05 cm
D = 15,0933 cm
Ec = 17906,4903 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,1956	0
500	5	2,5	17882,9048	0,2743	0,1247	0,3203
1000	11	5,5	17882,9048	0,5486	0,2743	0,4699
1500	16	8	17882,9048	0,8229	0,3990	0,5946
2000	18	9	17882,9048	1,0971	0,4489	0,6445
2500	23	11,5	17882,9048	1,3714	0,5736	0,7692
3000	27	13,5	17882,9048	1,6457	0,6733	0,8689
3500	33	16,5	17882,9048	1,9200	0,8229	1,0185
4000	38	19	17882,9048	2,1943	0,9476	1,1432
4500	42	21	17882,9048	2,4686	1,0474	1,2430
5000	49	24,5	17882,9048	2,7428	1,2219	1,4175
5500	56	28	17882,9048	3,0171	1,3965	1,5921
6000	61	30,5	17882,9048	3,2914	1,5212	1,7168
6500	68	34	17882,9048	3,5657	1,6958	1,8914
7000	74	37	17882,9048	3,8400	1,8454	2,0410
7500	81	40,5	17882,9048	4,1143	2,0200	2,2156
8000	88	44	17882,9048	4,3885	2,1945	2,3901
8500	95	47,5	17882,9048	4,6628	2,3691	2,5647
9000	102	51	17882,9048	4,9371	2,5436	2,7392
9500	112	56	17882,9048	5,2114	2,7930	2,9886
10000	123	61,5	17882,9048	5,4857	3,0673	3,2629
10500	128	64	17882,9048	5,7600	3,1920	3,3876
11000	134	67	17882,9048	6,0343	3,3416	3,5372
11500	137	68,5	17882,9048	6,3085	3,4165	3,6121
12000	142	71	17882,9048	6,5828	3,5411	3,7367
12500	148	74	17882,9048	6,8571	3,6908	3,8864
13000	151	75,5	17882,9048	7,1314	3,7656	3,9612
13500	158	79	17882,9048	7,4057	3,9401	4,1357

Kode : D283
P0 = 20,04 cm
D = 15,0633 cm
Ec = 25079,8577 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0704	0
500	5	2,5	17811,8860	0,2754	0,1248	0,1952
1000	8	4	17811,8860	0,5508	0,1996	0,2700
1500	11	5,5	17811,8860	0,8261	0,2745	0,3449
2000	15	7,5	17811,8860	1,1015	0,3743	0,4447
2500	19	9,5	17811,8860	1,3769	0,4741	0,5445
3000	23	11,5	17811,8860	1,6523	0,5739	0,6443
3500	27	13,5	17811,8860	1,9276	0,6737	0,7441
4000	30	15	17811,8860	2,2030	0,7485	0,8189
4500	35	17,5	17811,8860	2,4784	0,8733	0,9437
5000	39	19,5	17811,8860	2,7538	0,9731	1,0435
5500	43	21,5	17811,8860	3,0292	1,0729	1,1433
6000	48	24	17811,8860	3,3045	1,1976	1,2680
6500	52	26	17811,8860	3,5799	1,2974	1,3678
7000	59	29,5	17811,8860	3,8553	1,4721	1,5425
7500	62	31	17811,8860	4,1307	1,5469	1,6173
8000	67	33,5	17811,8860	4,4060	1,6717	1,7421
8500	71	35,5	17811,8860	4,6814	1,7715	1,8419
9000	76	38	17811,8860	4,9568	1,8962	1,9666
9500	80	40	17811,8860	5,2322	1,9960	2,0664
10000	83	41,5	17811,8860	5,5076	2,0709	2,1413
10500	89	44,5	17811,8860	5,7829	2,2206	2,2910
11000	94	47	17811,8860	6,0583	2,3453	2,4157
11500	99	49,5	17811,8860	6,3337	2,4701	2,5405
12000	104	52	17811,8860	6,6091	2,5948	2,6652
12500	108	54	17811,8860	6,8844	2,6946	2,7650
13000	112	56	17811,8860	7,1598	2,7944	2,8648
13500	116	58	17811,8860	7,4352	2,8942	2,9646

Kode : E282
P0 = 19,98 cm
D = 15,0433 cm
Ec = 21725,1334 MPa

kgf	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	17764,6187	0,0000	-0,0281	0,0000
500	1	0,5	17764,6187	0,2761	0,0250	0,0531
1000	6	3	17764,6187	0,5522	0,1502	0,1783
1500	10	5	17764,6187	0,8283	0,2503	0,2784
2000	14	7	17764,6187	1,1044	0,3504	0,3785
2500	18	9	17764,6187	1,3806	0,4505	0,4786
3000	26	13	17764,6187	1,6567	0,6507	0,6788
3500	32	16	17764,6187	1,9328	0,8008	0,8289
4000	39	19,5	17764,6187	2,2089	0,9760	1,0041
4500	43	21,5	17764,6187	2,4850	1,0761	1,1042
5000	49	24,5	17764,6187	2,7611	1,2262	1,2543
5500	53	26,5	17764,6187	3,0372	1,3263	1,3544
6000	58	29	17764,6187	3,3133	1,4515	1,4796
6500	62	31	17764,6187	3,5894	1,5516	1,5797
7000	67	33,5	17764,6187	3,8655	1,6767	1,7048
7500	72	36	17764,6187	4,1417	1,8018	1,8299
8000	75	37,5	17764,6187	4,4178	1,8769	1,9050
8500	79	39,5	17764,6187	4,6939	1,9770	2,0051
9000	84	42	17764,6187	4,9700	2,1021	2,1302
9500	87	43,5	17764,6187	5,2461	2,1772	2,2053
10000	91	45,5	17764,6187	5,5222	2,2773	2,3054
10500	95	47,5	17764,6187	5,7983	2,3774	2,4055
11000	98	49	17764,6187	6,0744	2,4525	2,4806
11500	109	54,5	17764,6187	6,3505	2,7277	2,7558
12000	114	57	17764,6187	6,6267	2,8529	2,8810
12500	121	60,5	17764,6187	6,9028	3,0280	3,0561
13000	128	64	17764,6187	7,1789	3,2032	3,2313
13500	136	68	17764,6187	7,4550	3,4034	3,4315

Kode : E283
P0 = 20,02 cm
D = 15,0833 cm
Ec = 21149,8050 MPa

kgf	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	17859,2162	0,0000	-0,0846	0,0000
500	2	1	17859,2162	0,2746	0,0500	0,1346
1000	7	3,5	17859,2162	0,5493	0,1748	0,2594
1500	11	5,5	17859,2162	0,8239	0,2747	0,3593
2000	15	7,5	17859,2162	1,0986	0,3746	0,4592
2500	18	9	17859,2162	1,3732	0,4496	0,5342
3000	22	11	17859,2162	1,6479	0,5495	0,6341
3500	26	13	17859,2162	1,9225	0,6494	0,7340
4000	31	15,5	17859,2162	2,1972	0,7742	0,8588
4500	34	17	17859,2162	2,4718	0,8492	0,9338
5000	39	19,5	17859,2162	2,7465	0,9740	1,0586
5500	44	22	17859,2162	3,0211	1,0989	1,1835
6000	48	24	17859,2162	3,2958	1,1988	1,2834
6500	54	27	17859,2162	3,5704	1,3487	1,4333
7000	58	29	17859,2162	3,8451	1,4486	1,5332
7500	61	30,5	17859,2162	4,1197	1,5235	1,6081
8000	66	33	17859,2162	4,3944	1,6484	1,7330
8500	69	34,5	17859,2162	4,6690	1,7233	1,8079
9000	72	36	17859,2162	4,9437	1,7982	1,8828
9500	78	39	17859,2162	5,2183	1,9481	2,0327
10000	81	40,5	17859,2162	5,4930	2,0230	2,1076
10500	90	45	17859,2162	5,7676	2,2478	2,3324
11000	97	48,5	17859,2162	6,0423	2,4226	2,5072
11500	104	52	17859,2162	6,3169	2,5974	2,6820
12000	113	56,5	17859,2162	6,5916	2,8222	2,9068
12500	118	59	17859,2162	6,8662	2,9471	3,0317
13000	126	63	17859,2162	7,1409	3,1469	3,2315
13500	137	68,5	17859,2162	7,4155	3,4216	3,5062

Kode : F282
P0 = 20,03 cm
D = 15,1067 cm
Ec = 21331,3926 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0457	0
500	5	2,5	17914,6722	0,2738	0,1248	0,1705
1000	9	4,5	17914,6722	0,5476	0,2247	0,2704
1500	13	6,5	17914,6722	0,8214	0,3245	0,3702
2000	19	9,5	17914,6722	1,0952	0,4743	0,5200
2500	24	12	17914,6722	1,3690	0,5991	0,6448
3000	29	14,5	17914,6722	1,6428	0,7239	0,7696
3500	32	16	17914,6722	1,9166	0,7988	0,8445
4000	39	19,5	17914,6722	2,1904	0,9735	1,0192
4500	44	22	17914,6722	2,4642	1,0984	1,1441
5000	48	24	17914,6722	2,7380	1,1982	1,2439
5500	56	28	17914,6722	3,0118	1,3979	1,4436
6000	61	30,5	17914,6722	3,2856	1,5227	1,5684
6500	67	33,5	17914,6722	3,5594	1,6725	1,7182
7000	72	36	17914,6722	3,8332	1,7973	1,8430
7500	76	38	17914,6722	4,1070	1,8972	1,9429
8000	80	40	17914,6722	4,3808	1,9970	2,0427
8500	85	42,5	17914,6722	4,6546	2,1218	2,1675
9000	89	44,5	17914,6722	4,9284	2,2217	2,2674
9500	93	46,5	17914,6722	5,2022	2,3215	2,3672
10000	97	48,5	17914,6722	5,4760	2,4214	2,4671
10500	106	53	17914,6722	5,7498	2,6460	2,6917
11000	114	57	17914,6722	6,0236	2,8457	2,8914
11500	119	59,5	17914,6722	6,2974	2,9705	3,0162
12000	124	62	17914,6722	6,5712	3,0954	3,1411
12500	129	64,5	17914,6722	6,8449	3,2202	3,2659
13000	132	66	17914,6722	7,1187	3,2951	3,3408
13500	137	68,5	17914,6722	7,3925	3,4199	3,4656

Kode : F283
P0 = 20,05 cm
D = 15,1233 cm
Ec = 21422,3543 MPa

Beban (kgf)	ΔP	0,5 ΔP	A (mm^2)	Tegangan (MPa)	Regangan (10^{-4})	Regangan Koreksi (10^{-4})
0	0	0	0	0	-0,0767	0
500	5	2,5	17954,0649	0,2732	0,1247	0,2014
1000	10	5	17954,0649	0,5464	0,2494	0,3261
1500	14	7	17954,0649	0,8196	0,3491	0,4258
2000	20	10	17954,0649	1,0928	0,4988	0,5755
2500	23	11,5	17954,0649	1,3660	0,5736	0,6503
3000	28	14	17954,0649	1,6392	0,6983	0,7750
3500	31	15,5	17954,0649	1,9124	0,7731	0,8498
4000	36	18	17954,0649	2,1856	0,8978	0,9745
4500	41	20,5	17954,0649	2,4588	1,0224	1,0991
5000	46	23	17954,0649	2,7320	1,1471	1,2238
5500	51	25,5	17954,0649	3,0052	1,2718	1,3485
6000	59	29,5	17954,0649	3,2784	1,4713	1,5480
6500	63	31,5	17954,0649	3,5516	1,5711	1,6478
7000	68	34	17954,0649	3,8248	1,6958	1,7725
7500	72	36	17954,0649	4,0980	1,7955	1,8722
8000	79	39,5	17954,0649	4,3712	1,9701	2,0468
8500	83	41,5	17954,0649	4,6444	2,0698	2,1465
9000	88	44	17954,0649	4,9175	2,1945	2,2712
9500	95	47,5	17954,0649	5,1907	2,3691	2,4458
10000	101	50,5	17954,0649	5,4639	2,5187	2,5954
10500	108	54	17954,0649	5,7371	2,6933	2,7700
11000	113	56,5	17954,0649	6,0103	2,8180	2,8947
11500	118	59	17954,0649	6,2835	2,9426	3,0193
12000	124	62	17954,0649	6,5567	3,0923	3,1690
12500	129	64,5	17954,0649	6,8299	3,2170	3,2937
13000	132	66	17954,0649	7,1031	3,2918	3,3685
13500	135	67,5	17954,0649	7,3763	3,3666	3,4433

Lampiran G

HASIL PENGUJIAN PENYERAPAN AIR BETON UMUR 7, 14 DAN 28 HARI

Hasil Pengujian Penyerapan Air Beton ESP Umur 7 Hari

Kode	% ESP	Berat Kering (gr)	Berat Basah (gr)	Penyerapan Air (%)	Rata - rata Penyerapan air (%)
A71	0	12985	14294	10,0809	9,7283
A72	0	13278	14476	9,0224	
A73	0	12984	14293	10,0816	
B71	5	12924	14196	9,8422	9,6950
B72	5	12855	14124	9,8716	
B73	5	13168	14402	9,3712	
C71	10	12671	14012	10,5832	9,6315
C72	10	13209	14438	9,3043	
C73	10	13234	14426	9,0071	
D71	12,5	13135	14364	9,3567	9,6482
D72	12,5	13044	14429	10,6179	
D73	12,5	13322	14517	8,9701	
E71	15	13157	14538	10,4963	9,5339
E72	15	13291	14496	9,0663	
E73	15	13198	14391	9,0392	
F71	20	13188	14397	9,1674	9,4142
F72	20	13247	14494	9,4135	
F73	20	13238	14517	9,6616	

Hasil Pengujian Penyerapan Air Beton ESP Umur 14 Hari

Kode	% ESP	Berat Kering (gr)	Berat Basah (gr)	Penyerapan Air (%)	Rata – rata penyerapan Air (%)
A141	0	13065	14374	10,0191	9,9984
A142	0	13274	14413	8,5807	
A143	0	12944	14419	11,3952	
B141	5	13194	14391	9,0723	9,5257
B142	5	12865	14270	10,9211	
B143	5	13281	14421	8,5837	
C141	10	12971	14202	9,4904	9,5037
C142	10	13290	14483	8,9767	
C143	10	13142	14462	10,0441	
D141	12,5	13135	14536	10,6662	9,5251
D142	12,5	13204	14491	9,7470	
D143	12,5	13232	14312	8,1620	
E141	15	13159	14369	9,1952	9,4518
E142	15	13271	14496	9,2307	
E143	15	13183	14492	9,9295	
F141	20	13189	14387	9,0833	9,4301
F142	20	13243	14496	9,4616	
F143	20	13278	14572	9,7454	

Hasil Pengujian Penyerapan Air Beton ESP Umur 28 Hari

Kode`	% ESP	Berat Kering (gr)	Berat Basah (gr)	Penyerapan Air (%)	Rata – rata penyerapan air (%)
A281	0	12896	14294	10,8406	10,3456
A282	0	13274	14577	9,8162	
A283	0	12948	14292	10,3800	
B281	5	12925	14207	9,9188	10,1975
B282	5	12802	14224	11,1076	
B283	5	13161	14420	9,5661	
C281	10	12678	14122	11,3898	9,8954
C282	10	13204	14438	9,3457	
C283	10	13239	14424	8,9508	
D281	12,5	13134	14386	9,5325	9,6649
D282	12,5	13054	14427	10,5178	
D283	12,5	13327	14519	8,9442	
E281	15	13175	14536	10,3302	9,7387
E282	15	13289	14498	9,0978	
E283	15	13179	14469	9,7883	
F281	20	13178	14494	9,9863	9,6311
F282	20	13243	14491	9,4238	
F283	20	13234	14489	9,4831	

Contoh Perhitungan Penyerapan Air

Kode : A71

M_k = 12985

M_j = 14294

Penyerapan Air $= \left(\frac{M_j - M_k}{M_k} \right) x100\%$

Penyerapan Air $= \left(\frac{14294 - 12985}{12985} \right) x100\%$

= 10,0809 %

Lampiran H

HASIL PENGUJIAN DENSITAS BETON ESP UMUR 7, 14 DAN 28 HARI

Hasil Pengujian Densitas Beton ESP Umur 7 Hari

Kode	% ESP	Berat Kering(gr)	Berat Basah (gr)	Berat dalam air (gr)	Berat Penggantung (gr)	Densitas (gr/cm^3)	Rata – rata Densitas (gr/cm^3)
A71	0	12985	14294	9831	1376	2,2238	2,1415
A72	0	13278	14476	9603	1376	2,1248	
A73	0	12984	14293	9414	1376	2,0758	
B71	5	12924	14209	9727	1376	2,2062	2,1845
B72	5	12855	14124	9416	1376	2,1129	
B73	5	13168	14402	9885	1376	2,2345	
C71	10	12671	14012	9346	1376	2,0972	2,1216
C72	10	13209	14438	9672	1376	2,1506	
C73	10	13234	14426	9551	1376	2,1171	
D71	12,5	13135	14364	9375	1376	2,0636	2,0650
D72	12,5	13044	14429	9463	1376	2,0568	
D73	12,5	13322	14517	9472	1376	2,0748	
E71	15	13157	14538	9512	1376	2,0551	2,0820
E72	15	13291	14496	9627	1376	2,1283	
E73	15	13198	14391	9368	1376	2,0625	
F71	20	13188	14397	9572	1376	2,1268	2,0875
F72	20	13247	14494	9476	1376	2,0718	
F73	20	13238	14517	9479	1376	2,0639	

Hasil Pengujian Densitas Beton ESP Umur 14 Hari

Kode	% ESP	Berat Kering (gr)	Berat Basah (gr)	Berat dalam air (gr)	Berat Penggantung (gr)	Densitas (gr/cm^3)	Rata - rata Densitas (gr/cm^3)
A141	0	13065	14374	9483	1492	2,0468	2,0193
A142	0	13274	14413	9481	1492	2,0663	
A143	0	12944	14419	9255	1492	1,9447	
B141	5	13194	14391	9356	1492	2,0214	2,0220
B142	5	12865	14270	9176	1492	1,9534	
B143	5	13281	14421	9562	1492	2,0912	
C141	10	12971	14102	9574	1492	2,1547	2,0849
C142	10	13290	14483	9487	1492	2,0484	
C143	10	13142	14462	9548	1492	2,0515	
D141	12,5	13135	14536	9459	1492	1,9995	2,0751
D142	12,5	13204	14491	9623	1492	2,0761	
D143	12,5	13232	14312	9649	1492	2,1498	
E141	15	13159	14369	9753	1492	2,1544	2,0826
E142	15	13271	14496	9478	1492	2,0386	
E143	15	13183	14492	9568	1492	2,0547	
F141	20	13189	14379	9591	1492	2,1002	2,0639
F142	20	13243	14491	9576	1492	2,0670	
F143	20	13278	14552	9486	1492	2,0247	

Hasil Pengujian Densitas Beton ESP Umur 28 Hari

Kode`	% ESP	Berat Kering (gr)	Berat Basah (gr)	Berat dalam air (gr)	Berat Penggantung (gr)	Densitas (gr/cm^3)	Rata - rata Densitas (gr/cm^3)
A281	0	12896	14294	9683	1457	2,1252	2,1267
A282	0	13274	14577	9694	1457	2,0937	
A283	0	12948	14292	9758	1457	2,1612	
B281	5	12925	14207	9745	1457	2,1836	2,1721
B282	5	12802	14224	9781	1457	2,1698	
B283	5	13161	14420	9792	1457	2,1629	
C281	10	12678	14122	9689	1457	2,1525	2,1531
C282	10	13204	14438	9673	1457	2,1221	
C283	10	13239	14424	9821	1457	2,1847	
D281	12,5	13134	14366	9766	1457	2,1684	2,1694
D282	12,5	13054	14427	9785	1457	2,1404	
D283	12,5	13327	14519	9917	1457	2,1995	
E281	15	13175	14536	9806	1457	2,1295	2,1578
E282	15	13289	14498	9834	1457	2,1711	
E283	15	13179	14469	9861	1457	2,1730	
F281	20	13178	14494	9788	1457	2,1382	2,1453
F282	20	13243	14491	9768	1457	2,1429	
F283	20	13234	14517	9832	1457	2,1547	

Contoh Perhitungan Densitas

Kode : A71

m_s = 12985 gr

m_b = 14294 gr

m_g = 9831 gr

m_k = 1376 gr

ρ_{Air} = 1 gr/cm^3

Densitas $= \left(\frac{m_s}{(m_b - (m_g - m_k))} \right) x \rho_{Air}$

Densitas $= \left(\frac{12985}{(14294 - (9831 - 1376))} \right)$ x 1 gr/cm^3

Densitas = 2,1415 gr/cm^3

Lampiran I

HASIL PENGUJIAN PENYUSUTAN BETON ESP UMUR 7, 14 DAN 28 HARI

Hasil Pengujian Penyusutan Beton ESP Umur 7 Hari

Kode	% ESP	Rata – rata Panjang awal (cm)	Rata - rata Panjang Akhir (cm)	Penyusutan (%)	Rata – rata Penyusutan (%)
A71	0	30,3500	30,3333	0,0550	0,1477
A72	0	30,1367	30,1167	0,0664	
A73	0	30,0600	29,9633	0,3217	
B71	5	30,3733	30,3367	0,1205	0,1511
B72	5	30,0467	29,9667	0,2663	
B73	5	30,0533	30,0333	0,0665	
C71	10	30,1533	30,1000	0,1768	0,0918
C72	10	30,5200	30,5033	0,0547	
C73	10	30,3833	30,3700	0,0438	
D71	12,5	30,2100	30,1933	0,0553	0,0553
D72	12,5	30,0700	30,0433	0,0888	
D73	12,5	30,5800	30,5733	0,0219	
E71	15	30,1433	30,1367	0,0219	0,0474
E72	15	30,6033	30,5833	0,0654	
E73	15	30,3800	30,3633	0,0550	
F71	20	30,3967	30,3867	0,0329	0,0442
F72	20	30,2600	30,2533	0,0221	
F73	20	30,0900	30,0667	0,0774	

Hasil Pengujian Penyusutan Beton ESP Umur 14 Hari

Kode	% ESP	Rata – rata Panjang awal (cm)	Rata – rata Panjang Akhir (cm)	Penyusutan (%)	Rata – rata penyusutan (%)
A141	0	30,3667	30,3333	0,1100	0,1770
A142	0	30,1367	30,1267	0,0332	
A143	0	30,0800	29,9633	0,3880	
B141	5	30,3833	30,3367	0,1534	0,1585
B142	5	30,0167	29,9267	0,2998	
B143	5	30,0400	30,0333	0,0223	
C141	10	30,0700	30,0067	0,2105	0,1070
C142	10	30,3267	30,3033	0,0772	
C143	10	30,1000	30,0900	0,0332	
D141	12,5	30,1433	30,1333	0,0332	0,0477
D142	12,5	30,4700	30,4567	0,0436	
D143	12,5	30,1133	30,0933	0,0664	
E141	15	30,0633	30,0400	0,0775	0,0737
E142	15	30,1500	30,1300	0,0663	
E143	15	30,3067	30,2833	0,0772	
F141	20	30,2367	30,2067	0,0992	0,0885
F142	20	30,0967	30,0600	0,1219	
F143	20	30,2067	30,1933	0,0444	

Hasil Pengujian Penyusutan Beton ESP Umur 28 Hari

Kode	% ESP	Rata - rata Panjang awal (cm)	Rata – rata Panjang Akhir (cm)	Penyusutan (%)	Rata- rata Penyusutan (%)
A281	0	30,3400	30,3333	0,0221	0,1841
A282	0	30,1267	30,1106	0,0534	
A283	0	30,0600	29,9167	0,4767	
B281	5	30,3533	30,3367	0,0547	0,1771
B282	5	30,0467	29,9867	hasil	
B283	5	30,0533	29,9633	0,2995	
C281	10	30,1533	30,1330	0,0673	0,1641
C282	10	30,6200	30,5033	0,3811	
C283	10	30,3833	30,3700	0,0438	
D281	12,5	30,2100	30,1933	0,0553	0,1546
D282	12,5	30,0700	29,9833	0,2883	
D283	12,5	30,5100	30,4733	0,1203	
E281	15	30,1633	30,1367	0,0882	0,1132
E282	15	30,6033	30,5533	0,1634	
E283	15	30,3800	30,3533	0,0879	
F281	20	30,3967	30,3867	0,0329	0,1329
F282	20	30,2600	30,2533	0,0221	
F283	20	30,0700	29,9667	0,3435	

Contoh Perhitungan Penyusutan

Kode : A71
Lo = 30,3500
Lt = 30,3333

Penyusutan $= \left(\frac{Lo - Lt}{Lo}\right) x100\%$

Penyusutan $= \left(\frac{30,3500}{30,3333}\right) x100\%$

$= 0,0550\ \%$

DOKUMENTASI PENELITIAN

Pembersihan cangkang telur

Pengeringan cangkang telur

Pengayakan cangkang telur

Eggshell Powder **(lolos ayakan No.200)**

Pengujian Kadar Air Agregat

Pengujian Analisa Saringan Agregat

Pengujian Kandungan Lumpur Agregat

Mixing

Pengujian *Slump*

Cetakan Beton

Pengujian Kuat Tekan

Pengujian Modulus Elastisitas

Pengujian Densitas