LAMPIRAN 1

HASIL PEMERIKSAAN MATERIAL

a) Pemeriksaan Agregat Halus

Analisa Spesific Gravity dan Absorpsi dari Agregat Halus

	Sampel 1	Sampel 2	Rata-rata
A (gram)	495	498	496,5
B (gram)	668	644	656
C (gram)	980	956	968

A = Berat pasir kering udara (*oven dry*)

B = Berat piknometer + air

C = Berat piknometer + air + pasir

***Bulk Spesific Gravity* (Berat Jenis Butir)**

$$\text{Bulk SG} = \frac{A}{B + 500 - C} = \frac{496{,}5}{656 + 500 - 968} = 2{,}640957447 \approx 2{,}641$$

***Bulk Spesific Gravity* (*Saturated Surface Dry Basis*)**

$$\text{Bulk SG} = \frac{500}{B + 500 - C} = \frac{500}{656 + 500 - 968} = 2{,}659574468 \approx 2{,}66$$

Apparent Spesific Gravity

$$\text{Apparent SG} = \frac{A}{B + A - C} = \frac{496{,}5}{656 + 496{,}5 - 968} = 2{,}691056911 \approx 2{,}691$$

***Absorption* (Penyerapan)**

$$\%Absorpsi = \frac{500 - A}{A} \times 100\% = \frac{500 - 496{,}5}{496{,}5} \times 100\% = 0{,}704934541\% \approx 0{,}705\%$$

Pemeriksaan Berat Isi Agregat Halus

1. Berat isi lepas

	Sampel 1	Sampel 2	Rata-rata
w_1 (gram)	1055	1055	1055
w_2 (gram)	3700	3800	3750
w_3 (gram)	2645	2745	2695

$$\text{Berat Isi Agregat} = \frac{w_3}{V} = \frac{2{,}695}{2} = 1{,}3475 \, \text{kg} \big/ \text{dm}^3$$

2. Dengan cara penusukan

	Sampel 1	Sampel 2	Rata-rata
w_1 (gram)	1055	1055	1055
w_2 (gram)	4100	4150	4125
w_3 (gram)	3045	3095	3070

$$\text{Berat Isi Agregat} = \frac{w_3}{V} = \frac{3{,}07}{2} = 1{,}535 \, \text{kg}/\text{dm}^3$$

3. Dengan cara penggoyangan

	Sampel 1	Sampel 2	Rata-rata
w_1 (gram)	1055	1055	1055
w_2 (gram)	4281	4290	4285,5
w_3 (gram)	3226	3235	3230,5

$$\text{Berat Isi Agregat} = \frac{w_3}{V} = \frac{3{,}2305}{2} = 1{,}61525 \, \text{kg}/\text{dm}^3$$

w_1 = Berat wadah; w_2 = Berat wadah + pasir; w_3 = $w_2 - w_1$

V = Volume wadah = 2000 cm^3

Analisa Saringan Agregat Halus

Sieve Size		Sample No. 1			Sample No. 2			Average		
		Weight Ret.	Ind. %	Cum. %	Weight Ret.	Ind. %	Cum. %	Ind. %	Cum. %	Cum. %
mm	No.	Grams	Ret.	Ret.	Grams	Ret.	Ret.	Ret.	Ret.	Passing
9,5	3/8"	0	0	0	0	0	0	0	0	100
4,75	No. 4	0	0	0	0	0	0	0	0	100
2,36	No. 8	4	0,8	0,8	4	0,8	0,8	0,8	0,8	99,2
1,18	No. 16	49	9,8	10,6	46	9,2	10	9,5	10,3	89,7
0,6	No. 30	130	26	36,6	123	24,6	34,6	25,3	35,6	64,4
0,3	No. 50	130	26	62,6	131	26,2	60,8	26,1	61,7	38,3
0,15	No. 100	153	30,6	93,2	159	31,8	92,6	31,2	92,9	7,1
0,074	No. 200	31	6,2	99,4	32	6,4	99	6,3	99,2	0,8
PAN		3	0,6	100	4	0,8	99,8	0,7	99,9	0,1
TOTAL		500			499					
FM		2,038			1,994					

Pemeriksaan Bahan Lewat Saringan No. 200

	Sampel 1	Sampel 2	Rata-rata
w_1 (gram)	500	500	500
W_4 (gram)	474	484	479

$$\Sigma \text{ lewat saringan No. } 200 = \frac{w_1 - w_4}{w_1} = \frac{500 - 479}{500} = 4{,}2\%$$

Pemeriksaan Kotoran Organik dalam Agregat Halus

Dengan menggunakan larutan NaOH sebesar 5% dengan 15 gram butir NaOH dicampur dengan 500 ml air. Kemudian pasir direndam manggunakan larutan ini selama 1 hari. Hasil yang didapat kandungan bernomor 4 berwarna keruh coklat tua. Berarti pasir mempunyai kadar organik melampaui 5% maka pasir harus dicuci terlebih dahulu sebelum digunakan.

b) Pemeriksaan Agregat Kasar

Analisa Spesific Gravity dan Absorpsi dari Agregat Kasar

	Sampel 1	Sampel 2	Rata-rata
A (gram)	4843	4833	4838
B (gram)	5000	5000	5000
C (gram)	3033	3031	3032

A = Berat pasir kering udara (*oven dry*)

B = Berat split kondisi SSD

C = Berat split jenuh

***Bulk Spesific Gravity* (*Saturated Surface Dry Basis*)**

$$\text{Bulk SG} = \frac{B}{B - C} = \frac{5000}{5000 - 3032} = 2{,}540650407 \approx 2{,}541$$

Apparent Spesific Gravity

$$\text{Apparent SG} = \frac{A}{A - C} = \frac{4838}{4838 - 3032} = 2{,}678848284 \approx 2{,}679$$

***Absorption* (Penyerapan)**

$$\%Absorpsi = \frac{B - A}{A} \times 100\% = \frac{5000 - 4838}{4838} \times 100\% = 3{,}348491112\% \approx 3{,}348\%$$

Pemeriksaan Berat Isi Agregat Kasar

1. Berat isi lepas

	Sampel 1
w_1 (gram)	5098
w_2 (gram)	18200
w_3 (gram)	13102

$$\text{Berat Isi Agregat} = \frac{w_3}{V} = \frac{13{,}102}{9{,}263} = 1{,}414444565 \approx 1{,}414 \, \text{kg}/\text{dm}^3$$

2. Dengan cara penusukan

	Sampel 1
w_1 (gram)	5098
w_2 (gram)	19400
w_3 (gram)	14302

$$\text{Berat Isi Agregat} = \frac{w_3}{V} = \frac{14{,}302}{9{,}263} = 1{,}543992227 \approx 1{,}544 \, \text{kg}/\text{dm}^3$$

3. Dengan cara penggoyangan

	Sampel 1
w_1 (gram)	5098
w_2 (gram)	19200
w_3 (gram)	14102

$$\text{Berat Isi Agregat} = \frac{w_3}{V} = \frac{14{,}102}{9{,}263} = 1{,}52240095 \approx 1{,}522 \, \text{kg}/\text{dm}^3$$

w_1 = Berat wadah

w_2 = Berat wadah + pasir

w_3 = $w_2 - w_1$

V = Volume wadah = 9263 cm^3

Analisa Saringan Agregat Kasar

Sieve Size		Sample No. 1			Sample No. 2			Average		
		Weight Ret.	Ind. %	Cum. %	Weight Ret.	Ind. %	Cum. %	Ind. %	Cum. %	Cum. %
mm	No.	Grams	Ret.	Ret.	Grams	Ret.	Ret.	Ret.	Ret.	Passing
25,4	1"	0	0	0	0	0	0	0	0	100
19,05	3/4"	111	2,22	2,22	57	1,14	1,14	1,68	1,68	98,32
12,7	1/2"	2429	48,58	50,8	2332	46,64	47,78	47,61	49,29	50,71
9,525	3/8"	1618	32,36	83,16	1538	30,76	78,54	31,56	80,85	19,15
6,35	1/4"	739	14,78	97,94	865	17,3	95,84	16,04	96,89	3,11
3,175	1/8"	9	0,18	98,12	25	0,5	96,34	0,34	97,23	2,77
PAN		94	1,88	100	183	3,66	100	2,77	100	0
TOTAL		5000			5000					

Pemeriksaan Keausan Agregat dengan Mesin Los Angeles

Split seberat 5000 gram (2500 gram tertahan saringan ½" dan 2500 gram tertahan saringan $^3/_8$") bersama-sama 11 bola baja dimasukkan ke dalam *Los Angeles Machine*, didapatkan hasil sebagai berikut:

a = Berat semula (kering udara) = 5000 gram

b = Berat akhir (setelah 50 putaran) = 3760 gram

Maka persentase kehilangan

$$\text{Keausan} = \frac{a-b}{a} \times 100\% = \frac{5000 - 3760}{5000} \times 100\% = 24{,}8\%$$

Sesuai dengan PBI 1971 pasal 3.4.5. adalah pembubukan maksimum boleh terjadi sebesar 50% dalam percobaan dengan *Los Angeles Machine* ini. Pada percobaan dihasilkan 24,8% berarti split yang dipakai cukup keras dan dapat dipakai sebagai adukan beton.

LAMPIRAN 2

PERHITUNGAN *MIX DESIGN*

Data Material

- Semen : *Portland Composite Cement, Specific Gravity* (ρ_c) = 3,15 kg/ltr
- Agregat Halus : *Natural Sand, Specific Gravity* (ρ_{fa}) = 1,544 kg/ltr
  FM = 2,04
- Agregat Kasar : *Crushed Stone Size 25 mm, Specific Gravity* (ρ_{ca}) = 1,615 kg/ltr
- Air : *Density of Water* (ρ_w) = 1,0 kg/ltr

Rancangan Campuran Beton

- **Menentukan target kuat tekan**

  Mutu Beton : K-368

  fc' = 30 MPa

  MSA (*Maximum Size Aggregates*) : 25 mm

  Slump : 10 ± 2 cm

- **Menghitung jumlah air (W)**

  Berdasarkan tabel dibawah dengan ukuran agregat maksimum 25 mm, maka:

3) MIXING WATER & AIR CONTENT

NON-AIR-ENTRAINED CONCRETE								
Approximate mixing water (kg/m³) for indicated nominal maximum sizes of aggregate								
Slump (mm)	9.5 mm	12.5 mm	19 mm	25 mm	37.5 mm	50 mm	75 mm	150 mm
25 to 50	207	199	190	179	166	154	130	113
75 to 100	228	216	205	193	181	169	145	124
150 to 175	243	228	216	202	190	178	160	-
More than 175	-	-	-	-	-	-	-	-
Approximate amount of entrapped air in non-air-entrained concrete (%)								
Slump (mm)	9.5 mm	12.5 mm	19 mm	25 mm	37.5 mm	50 mm	75 mm	150 mm
All	3.0	2.5	2.0	1.5	1.0	0.5	0.3	0.2

Enter (from Table above) water weight for non-air-entrained concrete = 195 kg/m³

Enter (from Table above) amount of entrapped air = 1.5 %

- **Menghitung jumlah Semen**

  Dari W/C = 0,54 dan W = 195 kg, dapat dihitung jumlah semen yang diperlukan, yaitu :

$$C = \frac{W}{w/c} = \frac{195}{0.54} = 361.11 \text{ kg}$$

4) WATER-CEMENT RATIO

Relationship between water-cement or water-cementitious materials ratio and compressive strength of concrete	
Compressive strength at 28 days (MPa)	Water-cement ratio by weight (Non-air-entrained concrete)
40	0.42
35	0.47
30	0.54
25	0.61
20	0.69
15	0.79

Enter compressive strength at 28 days = 30 MPa

Enter (from Table above) water-cement (or water-cementitious materials) ratio = 0.54

Weight of cement = 361.11 kg/m^3

- **Menghitung banyaknya agregat kasar dan pasir yang diperlukan :**

5) COARSE AGGREGATE

Volume of oven-dry-rodded coarse aggregate per unit volume of concrete for different fineness moduli of fine aggregate				
Nominal maximum size of aggregate (mm)	2.40	2.60	2.80	3.00
9.5	0.50	0.48	0.46	0.44
12.5	0.59	0.57	0.55	0.53
19	0.66	0.64	0.62	0.60
25	0.71	0.69	0.67	0.65
37.5	0.75	0.73	0.71	0.69
50	0.78	0.76	0.74	0.72
75	0.82	0.80	0.78	0.76
150	0.87	0.85	0.83	0.81

Display Nominal maximum size of aggregate = 25 mm

Enter unit weight of coarse aggregate (if unknown, use 1500 to 1900 kg/m^3 for normal weight aggregate) = 1615 kg/m^3

Enter fineness modulus of fine aggregate = 2

Enter (from Table above) volume of coarse aggregate per unit volume of concrete = 0.71

Compute

Weight of coarse aggregate = 1146.65 kg/m^3

6) FINE AGGREGATE

First estimate of concrete weight (kg/m^3)	
Nominal maximum size of aggregate (mm)	Non-air-entrained concrete
9.5	2280
12.5	2310
19	2345
25	2380
37.5	2410
50	2445
75	2490
150	2530

Display Nominal maximum size of aggregate = 25 mm

Enter (from Table above) first estimate of concrete weight = 2380 kg/m^3

Compute

Weight of fine aggregate = 677.24 kg/m^3

- Berdasarkan perhitungan di atas, banyaknya material beton per m^3 dan kebutuhan material untuk 0,045 m^3 adalah :

8) SUMMARY OF MIX DESIGN

Enter batch percentage = 4.5 %

Summarize

Compressive strength at 28 days = 30 MPa

Slump:

maximum = 100 mm

minimum = 25 mm

Nominal maximum size of aggregate = 25 mm

Water-cement (or water-cementitious materials) ratio = 0.54

Concrete type is Non-air-entrained

Air content = 1.5 %

Unit weight of coarse aggregate = 1615 kg/m^3

Ingredients of Concrete Mixture

Water kg/m^3	Cement kg/m^3	Coarse Aggregate kg/m^3	Fine Aggregate kg/m^3	Pozzolanic Materials kg/m^3	Water Reducer kg/m^3
195	361.11	1146.65	677.24		

Ingredients of 4.5 % Concrete Batch

Water *kg*	Cement *kg*	Coarse Aggregate *kg*	Fine Aggregate *kg*	Pozzolanic Materials *kg*	Water Reducer *kg*
8.78	16.25	51.6	30.48	0	0

LAMPIRAN 3

HASIL *MIX DESIGN*

- **HASIL PEMERIKSAAN BETON SEGAR**

Berdasarkan pemeriksaan-pemeriksaan agregat pada lampiran sebelumnya menghasilkan proporsi beton untuk setiap kali pengecoran (volume = 0,045 m^3) dengan berbagai variasi sebagai berikut:

	Proporsi 1	Proporsi 2	Proporsi 3
Water	8,78 kg	8,78 kg	7,8 kg
Cement	16,25 kg	19,72 kg	14,1806 kg
Coarse Agregat	51,6 kg	51,6 kg	45,44 kg
Sand	30,48 kg	27,01 kg	25,872 kg

Pada kenyataannya dibutuhkan kekentalan yang cukup tergantung kondisi dari pasir dan split, sehingga dibutuhkan penyesuaian jumlah air yang dibutuhkan, sehingga poporsi campuran beton menjadi:

	Proporsi 1	Proporsi 2	Proporsi 3
Water	9,3 kg	7 kg	7,8 kg
Cement	17 kg	19,7 kg	14,5 kg
Coarse Agregat	52 kg	52 kg	45,5 kg
Sand	30,5 kg	27, kg	26 kg

- **Slump**

	Proporsi 1	Proporsi 2	Proporsi 3
Slump	8 ± 2 cm	10 ± 2 cm	10 ± 2 cm

Jika nilai slump semakin kecil, maka semen / pasir / split bersifat menyerap air. Semakin besar nilai slump maka pada beton diadakan penambahan air sebanyak 2 – 3 kg sehingga *workability* beton menjadi baik.

- **Pemeriksaan Kuat Tekan**

Proporsi 1

NO.	TANGGAL		UMUR	BENTUK & LUAS	SLUMP	BERAT	BEBAN	TEGANGAN
	DICOR	DITEST	(HARI)	PENAMPANG (CM^2)	(CM)	(KG)	(TON)	(KG/CM^2)
1	8-Feb-07	15-Feb-07	7	SILINDER	8.0	12.385	35.00	198
2	8-Feb-07	22-Feb-07	14	176.6	"	12.554	56.00	317

Proporsi 2

NO.	TANGGAL		UMUR	BENTUK & LUAS	SLUMP	BERAT	BEBAN	TEGANGAN
	DICOR	DITEST	(HARI)	PENAMPANG (CM^2)	(CM)	(KG)	(TON)	(KG/CM^2)
1	8-Feb-07	15-Feb-07	7	SILINDER	10.0	12.582	56.00	317
2	8-Feb-07	22-Feb-07	14	176.6	"	12.561	64.00	362
3	8-Feb-07	1-Mar-07	21		"	12.559	67.50	382

Proporsi 3

NO.	TANGGAL		UMUR	BENTUK & LUAS	SLUMP	BERAT	BEBAN	TEGANGAN
	DICOR	DITEST	(HARI)	PENAMPANG (CM^2)	(CM)	(KG)	(TON)	(KG/CM^2)
1	14-Dec-06	21-Dec-06	7	SILINDER	10.0	12.04	62.50	354
2	14-Dec-06		14	176.6	"	12.00	60.00	340
3	14-Dec-06		21		"	12.01	57.75	327

- **DATA**

Berdasarkan hasil pemeriksaan proporsi beton pada lampiran sebelumnya didapatkan proporsi campuran beton untuk dipakai seterusnya dalam penelitian skripsi dengan proporsi sebagai berikut:

	Proporsi 1
Water	6,3 kg + (1 s.d. 3) kg
Cement	17 kg
Coarse Agregat	52 kg
Sand	30,5 kg

Dengan beberapa pertimbangan seperti di bawah ini:

1. Air ditambahkan jika keadaan pasir atau kerikil sangat kering tergantung kemampuan agregat menyerap air.
2. Mendekati *design strength* yang akan diuji yakni *fc'* = 30 MPa = 300 kg/cm^2 untuk umur beton 28 hari. Berdasarkan proporsi 1 didapat kuat tekan beton untuk 28 hari *fc'* = 30 dan 36 MPa.
3. Proporsi 1 lebih mendekati *design strength* dibandingkan dengan proporsi 2 didapat kuat tekan beton untuk 28 hari *fc'* = 48 dan 41 MPa yang sangat melebihi *design strength* yang diinginkan. Dan proporsi 3 didapat kuat tekan beton untuk 28 hari *fc'* = 22,7 MPa yang hasilnya jauh di bawah *design strength* yang diinginkan

LAMPIRAN 4

DATA PENELITIAN

Nilai Batas Uji Chi-Square

Hari	S	Chi-Square		Batas	
		σ_{low}	σ_{up}	Lower	Upper
1	0.70711	0.40962	3.47524	6.09038	9.97524
2	0.84984	0.45211	19.0029	6.88122	26.3363
3	0.70711	0.40962	3.47524	11.0904	14.9752
4	0.40825	0.21719	9.12871	11.2828	20.6287
5	0.84984	0.45211	19.0029	13.8812	33.3363
6	2.27303	1.20924	50.8265	13.7908	65.8265
7	1.52971	0.88613	7.51809	14.7139	23.1181
8	1.84089	0.97935	41.1636	15.1873	57.3303
9	0.4714	0.25078	10.5409	18.9159	29.7076
10	2.3214	1.23497	51.908	17.5984	70.7414
11	1.31233	0.69816	29.3447	22.4685	52.5114
12	0.62361	0.33176	13.9443	19.8349	34.111
13	1.24722	0.66351	27.8887	20.0032	48.5553
14	2.13073	1.2343	10.472	18.8657	30.572
15	1.08012	0.57462	24.1523	18.4254	43.1523
16	1.24722	0.66351	27.8887	20.0032	48.5553
17	1.31233	0.69816	29.3447	20.4685	50.5114
18	2.62467	1.39631	58.6894	21.937	82.0227
19	1.0274	0.54657	22.9734	23.6201	47.1401
20	1.24722	0.66351	27.8887	21.0032	49.5553
21	2	1.15857	9.82946	26.8414	37.8295
22	1.43372	0.76273	32.059	22.0706	54.8923
23	3.29983	1.75549	73.7865	29.0778	104.62
24	1.69967	0.90422	38.0058	26.9291	65.8392
25	5.40062	2.8731	120.761	30.1269	153.761
26	5.54276	2.94872	123.94	26.2179	153.107
27	5.10446	2.71555	114.139	31.1178	147.973
28	2.31084	1.33864	11.3572	33.2614	45.9572
56	1.64317	0.95186	8.07573	36.0481	45.0757
84	2.88791	1.67292	14.1933	36.7271	52.5933

LABORATORIUM STRUKTUR DAN MATERIAL
Departemen Sipil - Fakultas Teknik
Universitas Indonesia
Kampus Baru UI Depok, Telp. 787 4878 - 727 0029 (Ext.110/111) - 727 0028 (Fax)

No.Surat : /LAB./FTUI/B/2007.
Untuk : ARIF YURIS K.
Proyek : TUGAS AKHIR
Alamat : DEPOK

HASIL UJI KUAT LENTUR BETON
CONCRETE FLEXURAL STRENGTH TEST

NO.	TANGGAL		UMUR	KODE	BENTUK & LUAS	SLUMP	BEBAN	MEAN	CHI-SQUARE
	DICOR	DITEST	(HARI)		PENAMPANG (CM^2)	(CM)	(KN)	(KN)	
1	20/06/07	21/06/07	1	PCC-A	BALOK	10.0	7.5	7.5	7.5
2				"	176.7145868	"	6.5	6.5	6.5
3	20/06/07						6	6	6
4							5.5	5.5	
5							7	7	7
								6.5	**6.75**
1	20/06/07	22/06/07	2	PCC-A	BALOK	10.0	8.5	8.5	
2				"	176.7145868	"	6.5	6.5	6.5
3							7	7	7
								7.333	**6.75**
1	13/06/07	10/06/07	3	PCC-A	BALOK	10.0	11.5	11.5	11.5
2				"	176.7145868	"	12	12	12
3							10.5	10.5	
4							11	11	11
5							12.5	12.5	12.5
								11.5	**11.75**

1	13/06/07	17/06/07	4	PCC-A	BALOK	10.0	11	11	11
2				"	176.7145868	"	11.5	11.5	11.5
3							12	12	12
								11.5	**11.5**
1	8/06/07	13/06/07	5	PCC-A	BALOK	10.0	14	14	14
2				"	176.7145868	"	13.5	13.5	13.5
3							15.5	15.5	
								14.33	**13.75**
1	6/06/07	12/06/07	6	PCC-A	BALOK	10.0	15.5	15.5	15.5
2				"	176.7145868	"	17.5	17.5	17.5
3							12	12	
								15	**16.5**
1	8/06/07	15/06/07	7	PCC-A	BALOK	10.0	16.5	16.5	16.5
2				"	176.7145868	"	16	16	16
3							15	15	15
4							17.5	17.5	
5							13	13	
								15.6	**15.83333333**
1	6/06/07	14/06/07	8	PCC-A	BALOK	10.0	18.5	18.5	18.5
2				"	176.7145868	"	16	16	16
3							14	14	
								16.17	**17.25**
1	1/06/07	10/06/07	9	PCC-A	BALOK	10.0	19.5	19.5	19.5
2				"	176.7145868	"	18.5	18.5	
3							19.5	19.5	19.5
								19.17	**19.5**
1	1/06/07	11/06/07	10	PCC-A	BALOK	10.0	18	18	18
2				"	176.7145868	"	22	22	22
3							16.5	16.5	
								18.83	**20**

1	1/06/07	12/06/07	11	PCC-A	BALOK	10.0	22	22	22
2				"	176.7145868	"	25	25	
3							22.5	22.5	22.5
								23.17	**22.25**
1	30/05/07	11/06/07	12	PCC-A	BALOK	10.0	20	20	20
2				"	176.7145868	"	19.5	19.5	
3							21	21	21
								20.17	**20.5**
	30/05/07	12/06/07	13	PCC-A	BALOK	10.0	21	21	21
2				"	176.7145868	"	22	22	22
3							19	19	
								20.67	**21.5**
1	18/05/07	1/06/07	14	PCC-A	BALOK	10.0	20.5	20.5	20.5
2				"	176.7145868	"	21.5	21.5	21.5
3							18.5	18.5	
4							17	17	
5							23	23	23
								20.1	**21.66666667**
1	25/05/07	9/06/07	15	PCC-A	BALOK	10.0	19.5	19.5	19.5
2				"	176.7145868	"	17.5	17.5	
3							20	20	20
								19	**19.75**
1	25/05/07	10/06/07	16	PCC-A	BALOK	10.0	21	21	21
2				"	176.7145868	"	22	22	22
3							19	19	
								20.67	**21.5**
1	25/05/07	11/06/07	17	PCC-A	BALOK	10.0	20	20	20
2				"	176.7145868	"	20.5	20.5	20.5
3							23	23	23
								21.17	**21.16666667**

1	23/05/07	10/06/07	18	PCC-A	BALOK	10.0	21	21	21
2				"	176.7145868	"	22	22	22
3							27	27	
								23.33	**21.5**
1	23/05/07	11/06/07	19	PCC-A	BALOK	10.0	23	23	23
2				"	176.7145868	"	24	24	24
3							25.5	25.5	
								24.17	**23.5**
1	16/05/07	5/06/07	20	PCC-A	BALOK	10.0	22	22	22
2				"	176.7145868	"	23	23	23
3							20	20	
								21.67	**22.5**
1	18/05/07	9/06/07	21	PCC-A	BALOK	10.0	25	25	
2				"	176.7145868	"	31	31	
3							28	28	28
4							29	29	29
5							27	27	27
								28	**28**
1	16/05/07	7/06/07	22	PCC-A	BALOK	10.0	21	21	
2				"	176.7145868	"	23	23	23
3							24.5	24.5	24.5
								22.83	**23.75**
1	9/05/07	1/06/07	23	PCC-A	BALOK	10.0	28.5	28.5	28.5
2				"	176.7145868	"	35.5	35.5	
3							28.5	28.5	28.5
								30.83	**28.5**
1	9/05/07	2/06/07	24	PCC-A	BALOK	10.0	25.5	25.5	
2				"	176.7145868	"	29.5	29.5	29.5
3							28.5	28.5	28.5
								27.83	**29**
1	4/05/07	29/05/07	25	PCC-A	BALOK	10.0	28	28	
2				"	176.7145868	"	30.5	30.5	30.5
3							40.5	40.5	
								33	**30.5**

1	2/05/07	28/05/07	26	PCC-A	BALOK	10.0	37	37	
2				"	176.7145868	"	25	25	25
3							25.5	25.5	25.5
								29.17	**25.25**
1	25/04/07	22/05/07	27	PCC-A	BALOK	10.0	40	40	
2				"	176.7145868	"	34	34	34
3							27.5	27.5	
								33.83	**34**
1	17/03/08	14/04/08	28	PCC-A	BALOK	10.0	33	33	
2				"	176.7145868	"	34.5	34.5	34.5
3							34	34	34
4							32.5	32.5	
5							39	39	
								34.6	**34.25**
1	13/03/08	8/05/08	56	PCC-A	BALOK	10.0	36	36	36
2				"	176.7145868	"	35.5	35.5	35.5
3							40	40	
4							37.5	37.5	
5							36	36	36
								37	**35.83333333**
1	5/03/08	28/05/08	84	PCC-A	BALOK	10.0	38	38	
2				"	176.7145868	"	36.5	36.5	36.5
3							36	36	36
4							44	44	
5							37.5	37.5	37.5
								38.4	**36.66666667**

HASIL UJI SUSUT BETON

Date of Test	Jam	Remarks	Hari ke-	Sampel 1				Sampel 2				Sampel 3			
				Dial Redialing	ΔL	Batang Baja	% Shrinkage	Dial Redialing	ΔL	Batang Baja	% Shrinkage	Dial Redialing	ΔL	Batang Baja	% Shrinkage
30-May	11.55	61%, 29.9	1	14.37	0	14.8	0.000	14.76	0	14.8	0.000	14.64	0	14.8	0.000
31-May	11.50	62%, 29.9	2	14.37	0	14.8	0.000	14.76	0	14.8	0.000	14.63	0.01	14.8	0.020
1-Jun	13.40	78%, 28.2	3	14.35	0.02	14.8	0.040	14.76	0	14.8	0.000	14.64	0	14.8	0.000
2-Jun	13.36	67%, 28.6	4	14.36	0.01	14.8	0.020	14.75	0.01	14.8	0.020	14.64	0	14.8	0.000
3-Jun	11.16	72%, 27.8	5	14.34	0.03	14.8	0.060	14.75	0.01	14.8	0.020	14.63	0.01	14.8	0.020
4-Jun	15.33	78%, 28.2	6	14.34	0.03	14.8	0.060	14.74	0.02	14.8	0.040	14.63	0.01	14.8	0.020
5-Jun	10.25	75%, 28.4	7	14.33	0.04	14.8	0.080	14.75	0.01	14.8	0.020	14.63	0.01	14.8	0.020
6-Jun	10.30	77%, 28.7	8	14.33	0.04	14.8	0.080	14.74	0.02	14.8	0.040	14.62	0.02	14.8	0.040
7-Jun	12.38	72%, 28.3	9	14.34	0.03	14.8	0.060	14.74	0.02	14.8	0.040	14.62	0.02	14.8	0.040
8-Jun	12.23	63%, 28.3	10	14.33	0.04	14.8	0.080	14.74	0.02	14.8	0.040	14.61	0.03	14.8	0.060
9-Jun	14.01	69%, 28.9	11	14.33	0.04	14.8	0.080	14.74	0.02	14.8	0.040	14.61	0.03	14.8	0.060
10-Jun	14.35	64%, 28.4	12	14.32	0.05	14.8	0.100	14.74	0.02	14.8	0.040	14.61	0.03	14.8	0.060
11-Jun	12.50	70%, 27.8	13	14.31	0.06	14.8	0.120	14.75	0.01	14.8	0.020	14.6	0.04	14.8	0.080
12-Jun	10.12	75%, 28.5	14	14.3	0.07	14.8	0.140	14.75	0.01	14.8	0.020	14.6	0.04	14.8	0.080
13-Jun	15.32	78%, 27.8	15	14.3	0.07	14.8	0.140	14.74	0.02	14.8	0.040	14.58	0.06	14.8	0.120
14-Jun	12.17	77%, 27.2	16	14.31	0.06	14.8	0.120	14.74	0.02	14.8	0.040	14.58	0.06	14.8	0.120
15-Jun	12.27	79%, 28.2	17	14.3	0.07	14.8	0.140	14.74	0.02	14.8	0.040	14.58	0.06	14.8	0.120
16-Jun	9.57	80%, 27.5	18	14.31	0.06	14.8	0.120	14.73	0.03	14.8	0.060	14.57	0.07	14.8	0.140
17-Jun	10.07	79%, 29	19	14.29	0.08	14.8	0.160	14.73	0.03	14.8	0.060	14.57	0.07	14.8	0.140
18-Jun	9.30	82%, 26.8	20	14.29	0.08	14.8	0.160	14.73	0.03	14.8	0.060	14.56	0.08	14.8	0.160
19-Jun	15.43	80%, 27.4	21	14.29	0.08	14.8	0.160	14.74	0.02	14.8	0.040	14.56	0.08	14.8	0.160
20-Jun	13.08	82%, 27.3	22	14.28	0.09	14.8	0.180	14.74	0.02	14.8	0.040	14.56	0.08	14.8	0.160
21-Jun	16.10	83%, 27.1	23	14.28	0.09	14.8	0.180	14.72	0.04	14.8	0.080	14.56	0.08	14.8	0.160
22-Jun	15.04	73%, 28.6	24	14.28	0.09	14.8	0.180	14.71	0.05	14.8	0.100	14.55	0.09	14.8	0.180
23-Jun	09.07	76%, 28.8	25	14.27	0.1	14.8	0.200	14.71	0.05	14.8	0.100	14.55	0.09	14.8	0.180
24-Jun	10.34	71%, 28.1	26	14.26	0.11	14.8	0.220	14.71	0.05	14.8	0.100	14.55	0.09	14.8	0.180
25-Jun	11.39	75%, 28.3	27	14.27	0.1	14.8	0.200	14.71	0.05	14.8	0.100	14.54	0.1	14.8	0.200
26-Jun	10.12	69%, 29.6	28	14.26	0.11	14.8	0.220	14.71	0.05	14.8	0.100	14.53	0.11	14.8	0.220
27-Jun	15.20	75%, 28.3	29	14.25	0.12	14.8	0.240	14.71	0.05	14.8	0.100	14.52	0.12	14.8	0.240
28-Jun	10.44	83%, 27.5	30	14.26	0.11	14.8	0.220	14.71	0.05	14.8	0.100	14.53	0.11	14.8	0.220

29-Jun	13.41	84%, 27.5	31	14.25	0.12	14.8	0.240	14.73	0.03	14.8	0.060	14.53	0.11	14.8	0.220
30-Jun	15.49	86%, 27.4	32	14.25	0.12	14.8	0.240	14.73	0.03	14.8	0.060	14.54	0.1	14.8	0.200
1-Jul	15.24	74%, 28.4	33	14.24	0.13	14.8	0.261	14.73	0.03	14.8	0.060	14.53	0.11	14.8	0.220
2-Jul	15.40	81%, 27.6	34	14.24	0.13	14.8	0.261	14.73	0.03	14.8	0.060	14.52	0.12	14.8	0.240
3-Jul	10.16	85%, 28.2	35	14.24	0.13	14.8	0.261	14.73	0.03	14.8	0.060	14.53	0.11	14.8	0.220
4-Jul	10.49	85% 26.8	36	14.23	0.14	14.8	0.281	14.72	0.04	14.8	0.080	14.53	0.11	14.8	0.220
5-Jul	14.52	85%, 27.2	37	14.23	0.14	14.8	0.281	14.7	0.06	14.8	0.120	14.53	0.11	14.8	0.220
6-Jul	16.45	91%, 26.5	38	14.23	0.14	14.8	0.281	14.69	0.07	14.8	0.140	14.52	0.12	14.8	0.240
7-Jul	16.30	84%, 27.3	39	14.22	0.15	14.8	0.301	14.68	0.08	14.8	0.160	14.52	0.12	14.8	0.240
8-Jul	13.54	89%, 27.3	40	14.23	0.14	14.8	0.281	14.68	0.08	14.8	0.160	14.52	0.12	14.8	0.240
9-Jul	13.50	85%, 26.6	41	14.22	0.15	14.8	0.301	14.68	0.08	14.8	0.160	14.52	0.12	14.8	0.240
10-Jul	13.29	72%, 29.1	42	14.22	0.15	14.8	0.301	14.69	0.07	14.8	0.140	14.51	0.13	14.8	0.261
11-Jul	13.08	75%, 28.7	43	14.21	0.16	14.8	0.321	14.69	0.07	14.8	0.140	14.51	0.13	14.8	0.261
12-Jul	13.50	76%, 29.1	44	14.21	0.16	14.8	0.321	14.69	0.07	14.8	0.140	14.52	0.12	14.8	0.240
13-Jul	12.38	80%, 27	45	14.21	0.16	14.8	0.321	14.69	0.07	14.8	0.140	14.51	0.13	14.8	0.261
14-Jul	10.25	81%, 27.3	46	14.21	0.16	14.8	0.321	14.68	0.08	14.8	0.160	14.51	0.13	14.8	0.261
15-Jul	13.36	79%, 27.1	47	14.2	0.17	14.8	0.341	14.67	0.09	14.8	0.180	14.51	0.13	14.8	0.261
16-Jul	11.54	82%, 27.1	48	14.2	0.17	14.8	0.341	14.67	0.09	14.8	0.180	14.5	0.14	14.8	0.281
17-Jul	10.20	90%, 26.4	49	14.21	0.16	14.8	0.321	14.66	0.1	14.8	0.200	14.5	0.14	14.8	0.281
18-Jul	10.40	83%, 27.6	50	14.2	0.17	14.8	0.341	14.67	0.09	14.8	0.180	14.5	0.14	14.8	0.281
19-Jul	13.40	79%, 28	51	14.2	0.17	14.8	0.341	14.65	0.11	14.8	0.220	14.51	0.13	14.8	0.261
20-Jul	15.33	78%, 27.8	52	14.2	0.17	14.8	0.341	14.65	0.11	14.8	0.220	14.51	0.13	14.8	0.261
21-Jul	11.16	81%, 27.6	53	14.2	0.17	14.8	0.341	14.64	0.12	14.8	0.240	14.5	0.14	14.8	0.281
22-Jul	10.30	71%, 28.6	54	14.19	0.18	14.8	0.361	14.64	0.12	14.8	0.240	14.5	0.14	14.8	0.281
23-Jul	12.23	73%, 28.4	55	14.19	0.18	14.8	0.361	14.64	0.12	14.8	0.240	14.5	0.14	14.8	0.281
24-Jul	14.01	74%, 28.2	56	14.2	0.17	14.8	0.341	14.64	0.12	14.8	0.240	14.49	0.15	14.8	0.301
25-Jul	11.22	79%, 28.3	57	14.19	0.18	14.8	0.361	14.63	0.13	14.8	0.261	14.49	0.15	14.8	0.301
26-Jul	13.05	87%, 26.5	58	14.19	0.18	14.8	0.361	14.63	0.13	14.8	0.261	14.49	0.15	14.8	0.301
27-Jul	15.00	83%, 27.2	59	14.19	0.18	14.8	0.361	14.63	0.13	14.8	0.261	14.49	0.15	14.8	0.301
28-Jul	10.56	84%, 26.8	60	14.19	0.18	14.8	0.361	14.63	0.13	14.8	0.261	14.49	0.15	14.8	0.301

Kuat Tekan Beton dengan PCC

Hari Ke-	Konversi Umur	Kuat Tekan PCC fc' 30 Mpa Mpa
1	0.22	7.723
2	0.38	13.226
3	0.47	16.079
4	0.68	23.215
5	0.58	19.885
6	0.60	20.625
7	0.65	22.351
8	0.69	23.631
9	0.63	21.550
10	0.64	21.828
11	0.78	26.822
12	0.86	29.412
13	0.84	28.950
14	0.83	28.434
15	0.78	26.730
16	0.84	28.950
17	0.72	24.903
18	0.85	29.227
19	0.94	32.279
20	0.90	30.938
21	0.96	33.125
22	0.92	31.770
23	1.00	34.221
24	0.85	29.319
25	0.91	31.447
26	0.95	32.742
27	0.95	32.742
28	1.00	34.370
56	1.09	37.301
84	1.11	38.290

Kuat Tekan Beton OPC

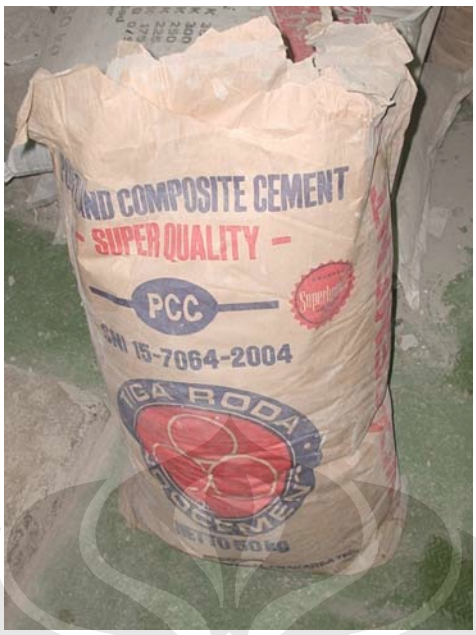
Hari Ke-	Konversi Umur	Kuat Tekan OPC	
		K-368	fc' 30 Mpa
		kg/cm^2	Mpa
1	0.21	75.994	6.186
2	0.35	129.324	10.526
3	0.46	168.812	13.740
4	0.54	199.228	16.216
5	0.61	223.377	18.182
6	0.66	243.015	19.780
7	0.70	259.297	21.106
8	0.74	273.016	22.222
9	0.77	284.734	23.176
10	0.80	294.858	24.000
11	0.82	303.692	24.719
12	0.85	311.469	25.352
13	0.86	318.368	25.914
14	0.88	324.529	26.415
15	0.90	330.065	26.866
16	0.91	335.066	27.273
17	0.92	339.606	27.642
18	0.93	343.746	27.979
19	0.94	347.537	28.288
20	0.95	351.021	28.571
21	0.96	354.234	28.833
22	0.97	357.206	29.075
23	0.98	359.964	29.299
24	0.98	362.530	29.508
25	0.99	364.923	29.703
26	0.99	364.923	29.703
27	1.00	368.572	30.000
28	1.00	368.572	30.000
56	1.09	400.001	32.558
84	1.11	410.611	33.422

LAMPIRAN 5

FOTO PENELITIAN

Pemeriksaan Agregat Halus

Pemeriksaan Agregat Kasar



Portland Composite Cement

Proses Pengadukan Beton

Uji Slump

Setelah Pengecoran

Curing

Uji Kuat Lentur

Uji Susut

Pembacaan Temperatur dan Kelembaban