

Lampiran 1. Data *Mix Design*

Ukuran benda uji 8 x 16 cm²

Jumlah benda uji untuk masing – masing mix design = 6 buah

Setting = Berat bahan untuk pengujian *setting time* untuk masing – masing *mix design*.

Tabel A.1 Berat masing – masing material untuk *mix design* beton

<i>Mix design</i>	Material			OH (molar)	Ratio		<i>Visco crete</i> (gr)	Alkali total (gr)
	<i>fly ash</i> (gr)	kerikil (gr)	pasir (gr)		Si : OH	alkali : <i>fly ash</i>		
1N	6149.376	3279.667	4919.501	10	1.5	0.333	61.494	2049.792
1P	5425.92	2893.824	4340.736	10	1.5	0.333	54.259	1808.64
Σ	11575.296	6173.491	9260.237				115.753	3858.432
<i>setting 1</i>	261	-	-	10	1.5	0.333	2.610	87
2N	5425.92	2893.824	4340.736	10	2	0.333	54.259	1808.64
2P	4702.464	2507.981	3761.971	10	2	0.333	47.025	1567.488
Σ	10128.384	5401.805	8102.707				101.284	3376.128
<i>setting 2</i>	261	-	-	10	2	0.333	2.610	87
3N	5064.192	2700.902	4051.354	10	2.5	0.333	50.642	1688.064
3P	4702.464	2507.981	3761.971	10	2.5	0.333	47.025	1567.488
Σ	9766.656	5208.883	7813.325				97.667	3255.552
<i>setting 3</i>	261	-	-	10	2.5	0.333	3.023	87
4N	5064.192	2700.902	4051.354	10	1.5	0.333	101.284	1688.064
4P	4702.464	2507.981	3761.971	10	1.5	0.333	94.049	1567.488
Σ	9766.656	5208.883	7813.325				195.333	3255.552
<i>setting 4</i>	261	-	-	10	1.5	0.333	5.220	87
5N	5064.192	2700.902	4051.354	10	2	0.333	101.284	1688.064
5P	4702.464	2507.981	3761.971	10	2	0.333	94.049	1567.488
Σ	9766.656	5208.883	7813.325				195.333	3255.552
<i>setting 5</i>	261	-	-	10	2	0.333	5.220	87
6N	5064.192	2700.902	4051.354	10	2.5	0.333	101.284	1688.064
6P	4702.464	2507.981	3761.971	10	2.5	0.333	94.049	1567.488
Σ	9766.656	5208.883	7813.325				195.333	3255.552
<i>setting 6</i>	261	-	-	10	2.5	0.333	5.220	87

Tabel lanjutan

Mix design	Alkali Aktivator		Water Content		Total water	Water/binder	added water (gr)	Solid	
	NaOH (gr)	Na ₂ SiO ₃ (gr)	NaOH (gr)	Na ₂ SiO ₃ (gr)	Na		Na	NaOH (gr)	Na ₂ SiO ₃ (gr)
1N	819.9	1229.9	567.8	564.1	1132.0	0.2	281.5	252.1	665.7
1P	723.5	1085.2	501.0	497.8	998.8	0.2	248.3	222.4	587.4
Σ	1543.4	2315.1	1068.9	1061.9	2130.8	0.4	529.8	474.5	1253.1
setting 1	34.8	52.2	24.101	23.944	48.045	0.2	11.946	10.6989	28.2559
2N	602.9	1205.8	417.5	553.1	970.6	0.2	282.2	185.3	652.7
2P	522.5	1045.0	361.9	479.3	841.2	0.2	244.6	160.6	565.7
Σ	1125.4	2250.8	779.4	1032.4	1811.8	0.4	526.7	346.0	1218.3
setting 2	29	58.0	20.084	26.604	46.688	0.2	13.574	8.9158	31.3954
3N	482.3	1205.8	334.0	553.1	887.1	0.2	285.9	148.3	652.7
3P	447.9	1119.6	310.2	513.6	823.7	0.2	265.5	137.7	606.1
Σ	930.2	2325.4	644.2	1066.7	1710.8	0.4	551.4	286.0	1258.7
setting 3	24.857	62.1	17.215	28.505	45.720	0.2	14.736	7.6421	33.6379
4N	675.2	1012.8	467.6	464.6	932.2	0.2	231.8	207.6	548.2
4P	627.0	940.5	434.2	431.4	865.6	0.2	215.2	192.8	509.1
Σ	1302.2	1953.3	901.9	896.0	1797.9	0.4	447.0	400.4	1057.3
setting 4	34.8	52.2	24.101	23.944	48.045	0.2	11.946	10.6989	28.2559
5N	562.7	1125.4	389.7	516.2	905.9	0.2	263.4	173.0	609.2
5P	522.5	1045.0	361.9	479.3	841.2	0.2	244.6	160.6	565.7
Σ	1085.2	2170.4	751.6	995.5	1747.1	0.4	507.9	333.6	1174.8
setting 5	29	58.0	20.084	26.605	46.688	0.2	13.573	8.9158	31.3954
6N	482.3	1205.8	334.02	553.1	887.1	0.2	285.9	148.3	652.7
6P	447.9	1119.6	310.2	513.6	823.7	0.2	265.5	137.7	606.1
Σ	930.2	2325.4	644.2	1066.7	1710.8	0.4	551.4	286.0	1258.7
setting 6	24.857	62.1	17.215	28.505	45.720	0.2	14.736	7.6421	33.6379



Lampiran 2. Hasil Pengujian Agregat Halus

Tabel B.1 Nilai Water content

NOMOR SAMPEL		I	II	III	IV	V
Berat cawan + contoh basah	(gram)	59.2	82.4	86.4	67.6	61.4
Berat cawan + contoh kering	(gram)	58.2	80.8	84.8	65.6	59.6
Berat cawan	(gram)	30.2	36.2	37.6	13.2	7.4
Berat air	(gram)	1	1.6	1.6	2	1.8
Berat contoh kering	(gram)	28	44.6	47.2	52.4	52.2
Kadar air	(%)	3.57	3.59	3.39	3.82	3.45
Kadar air rata-rata	(%)	3.56				

Dari percobaan kadar air, didapat kadar air yang dikandung pada pasir sebesar 3,56%. Pasir yang dibeli pada keadaan agak basah.

Tabel B.2 Nilai Berat Jenis dan Absorpsi Agregat Halus

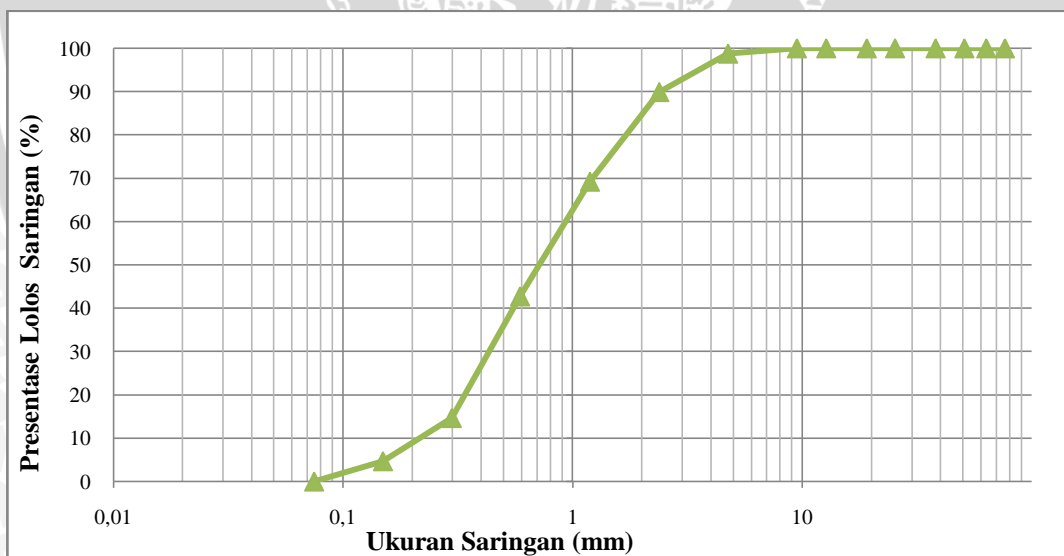
NOMOR SAMPEL			A
Berat benda uji jenuh kering permukaan	Bj	(gram)	500
Berat benda uji kering oven	Bk	(gram)	480.4
Berat piknometer diisi air	Ba	(gram)	668
berat piknometer + Benda uji(ssd) + air (pada suhu kamar)	Bt	(gram)	940.2

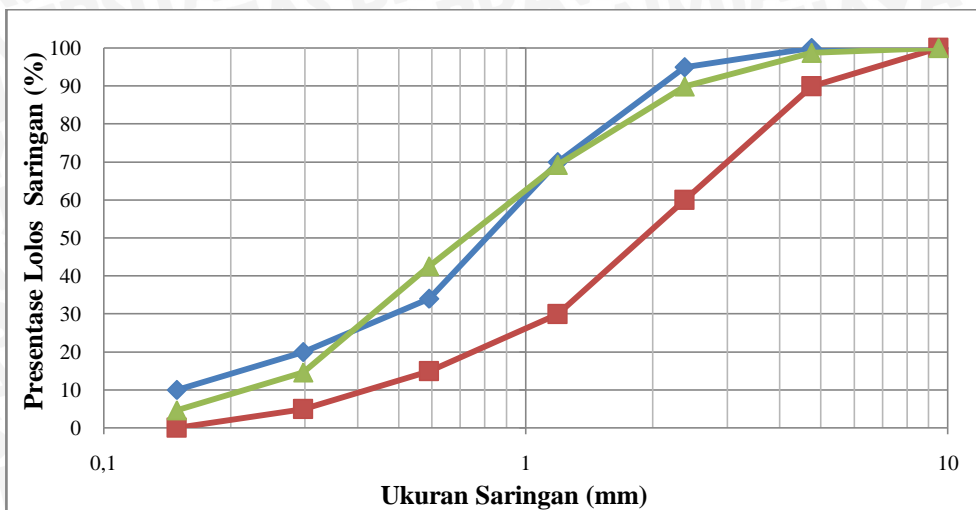
NOMOR SAMPEL			A
Berat jenis curah (Bulk specific gravity)	$Bk/(Ba+Bj-Bt)$		2.11
Berat jenuh kering permukaan (Bulk specific gravity saturated surface dry)	$Bj/(Ba+Bj-Bt)$		2.19
Berat jenis semu (apparent specific gravity)	$Bk/(Ba+Bk-Bt)$		2.31
Penyerapan (absorption)	$(Bj-Bk)/Bk \times 100\%$		4.08

Dari percobaan analisa perhitungan berat jenis dan penyerapan air, didapat berat jenuh kering permukaan untuk pasir sebesar 2,19 dan penyerapan pasir sebesar 4,08%.

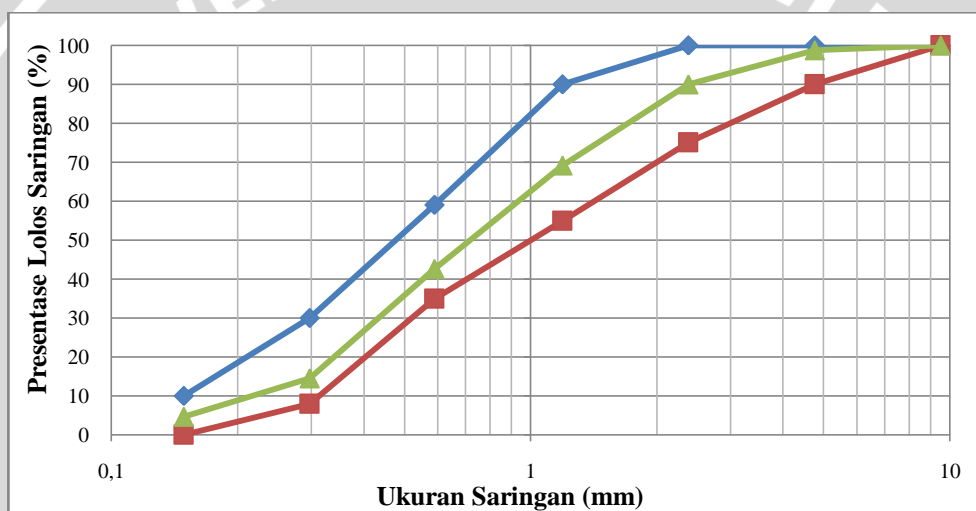
Tabel B.3 Analisa Saringan Agregat Halus

Lubang saringan		Tertinggal		Kumulatif (%)	
No	mm	gram	%	Tertinggal	Lolos
3"	76.2	0	0	0	100
2,5"	63.5	0	0	0	100
2"	50.8	0	0	0	100
1,5"	38.1	0	0	0	100
1"	25.4	0	0	0	100
3/4"	19.1	0	0.0	0.0	100.0
1/2"	12.7	0	0.0	0.0	100.0
3/8"	9.5	0	0.0	0.0	100.0
4	4.76	12.4	1.3	1.3	98.7
8	2.38	86.8	8.8	10.1	89.9
16	1.19	204	20.7	30.8	69.2
30	0.59	262	26.6	57.3	42.7
50	0.297	276.4	28.0	85.4	14.6
100	0.149	97.6	9.9	95.3	4.7
200	0.075	46.4	4.7	100.0	0.0
Pan		14.4			
Σ		1000		380.11	

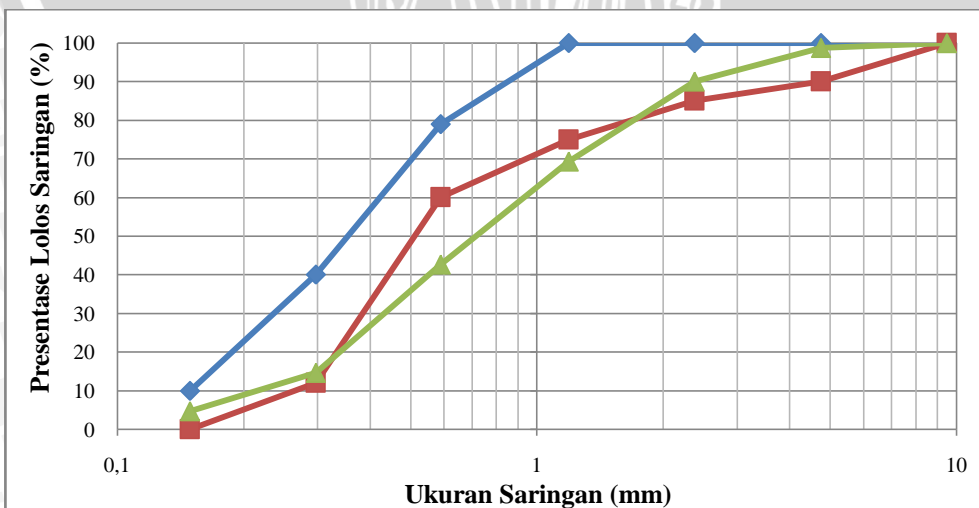
**Gambar. B.1** Analisa saringan agregat halus



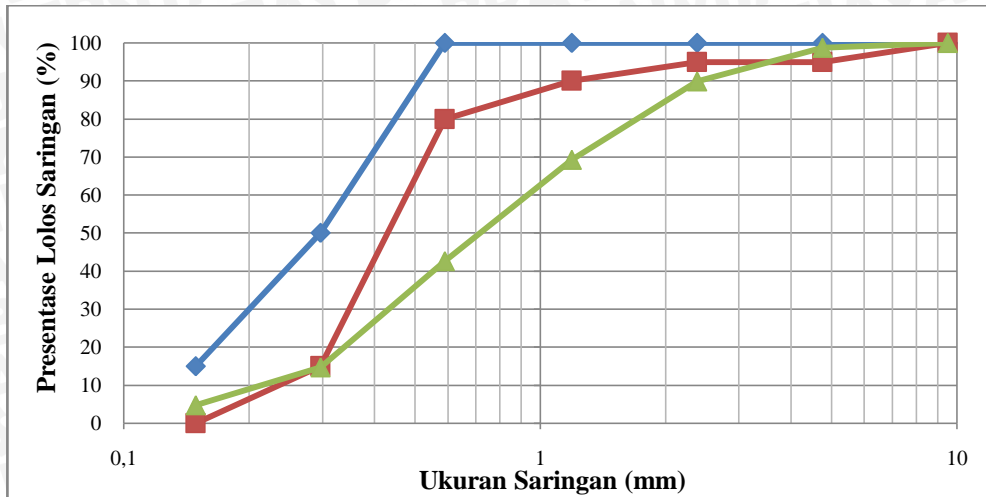
Gambar. B.2 Ayakan agregat halus zona 1



Gambar. B.3 Ayakan agregat halus zona 2



Gambar. B.4 Ayakan agregat halus zona 3



Gambar. B.5 Ayakan agregat halus zona 4

Dari percobaan analisa saringan, didapat kadar lumpur pada pasir sebesar 1,44%. Kemudian diplotkan kedalam grafik, dan didapat gradasi pasir masuk pada grafik ayakana pasir zona 2.



Lampiran 3. Hasil Pengujian Agregat Kasar

Tabel C.1 Nilai Water content

NOMOR SAMPEL		I	II	III	IV	V
Berat cawan + contoh basah	(gram)	88.8	105.4	123.2	119.8	123.2
Berat cawan + contoh kering	(gram)	87.9	104.6	122.1	118.8	122.1
Berat cawan	(gram)	13.6	34.8	34.5	37.5	30.1
Berat air	(gram)	0.95	0.78	1.12	1.01	1.07
Berat contoh kering	(gram)	74.24	69.86	87.62	81.25	92.04
Kadar air	(%)	1.28	1.12	1.28	1.24	1.16
Kadar air rata-rata	(%)	1.22				

Dari percobaan kadar air, didapat kadar air yang dikandung pada kerikil sebesar 1,22%.

Tabel C.2 Nilai Berat Jenis dan Absorpsi

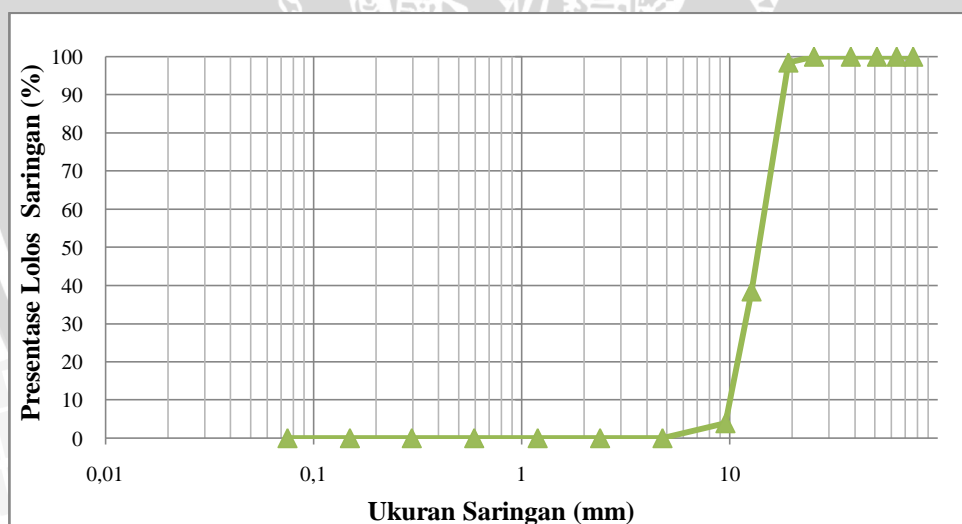
NOMOR SAMPEL			A
Berat benda uji jenuh kering permukaan	B _j	(gram)	5000
Berat benda uji kering oven	B _k	(gram)	4938
Berat benda uji dalam air	B _a	(gram)	3038.4

NOMOR SAMPEL			A
Berat jenis curah (Bulk specific gravity)	B _k /(B _j -B _a)		2.52
Berat jenuh kering permukaan (Bulk specific gravity saturated surface dry)	B _j /(B _j -B _a)		2.55
Berat jenis semu (apparent specific gravity)	B _k /(B _k -B _a)		2.60
Penyerapan (absorption)	(B _j -B _k)/B _k x 100%		1.26

Dari percobaan analisa perhitungan berat jenis dan penyerapan air, didapat berat jenuh kering permukaan untuk kerikil sebesar 2,55 dan penyerapan kerikil sebesar 1,26%.

Tabel C.3 Analisa Saringan

Lubang saringan		Tertinggal		Kumulatif (%)	
No	mm	gram	%	Tertinggal	Lolos
3"	76.2	0	0	0	100
2,5"	63.5	0	0	0	100
2"	50.8	0	0	0	100
1,5"	38.1	0	0	0	100
1"	25.4	0	0	0	100
3/4"	19.1	79.4	1.6	1.6	98.4
1/2"	12.7	2986.8	60.0	61.6	38.4
3/8"	9.5	1717.2	34.5	96.1	3.9
4	4.76	195.4	3.9	100	0
8	2.38	0	0	100	0
16	1.19	0	0	100	0
30	0.59	0	0	100	0
50	0.297	0	0	100	0
100	0.149	0	0	100	0
200	0.075	0	0	100	0
Pan		21.2			
Σ		5000		859.26	



Gambar. C.1 Analisa saringan agregat kasar

Berdasarkan grafik diatas susunan gradasi agregat kasar tidak termasuk keadalam zona – zona gradasi agregat kasar, dikarenakan agregat kasar yang digunakan adalah agregat kasar yang sudah dilakukan pemilihan ukuran sebelum digunakan dalam campuran beton.

Lampiran 4. Hasil Pengujian Fly Ash


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JURUSAN TEKNIK KIMIA FTI - ITS
TEAM AFILIASI DAN KONSULTASI INDUSTRI
REPORT OF ANALYSIS

No.144/LTAKI/II/2010

Principals : **Sdr Qomariah**
 Politeknik Negeri Malang
 Jl. Veteran PO. Box 04
 Malang
 Type sample : Fly Ash
 Code sample : Produk Paiton B
 Tested for : Chemical Analysis
 Packing : Plastic bag
 Received On : 26 February 2010

Parameter	Unit	Test Results	Methode Test
Silicon dioxide (SiO ₂)	%	65.88	Gravimetry
Alumunium Oxide (Al ₂ O ₃)	%	4.27	Spektrophotometry
Iron Oxide (Fe ₂ O ₃)	%	6.86	AAS
Calsium Oxide (CaO)	%	9.82	Titrimetry
Magnesium Oxide (MgO)	%	6.74	Titrimetry
Sodium dioxide (Na ₂ O)	%	0.92	Flamephotometry
Kalium dioxide (K ₂ O)	%	0.48	Flamephotometry
Sulfur trioxide (SO ₃)	%	0.54	Spektrophotometry
Phosphate as (P ₂ O ₅)	%	1.35	Spektrophotometry
Titanium Dioxide (TiO ₂)	%	0.12	Spektrophotometry
Los Of Ignition (LOI)	%	2.21	Gravimetry

Note :

- ◆ This certificate is based on the tested sample only


 Prof. Dr. Ir. Achmad Roesyadi, DEA
 Head of Team

Obj = 2,8


Lampiran 5: Hasil Pengujian Kuat Tarik Belah

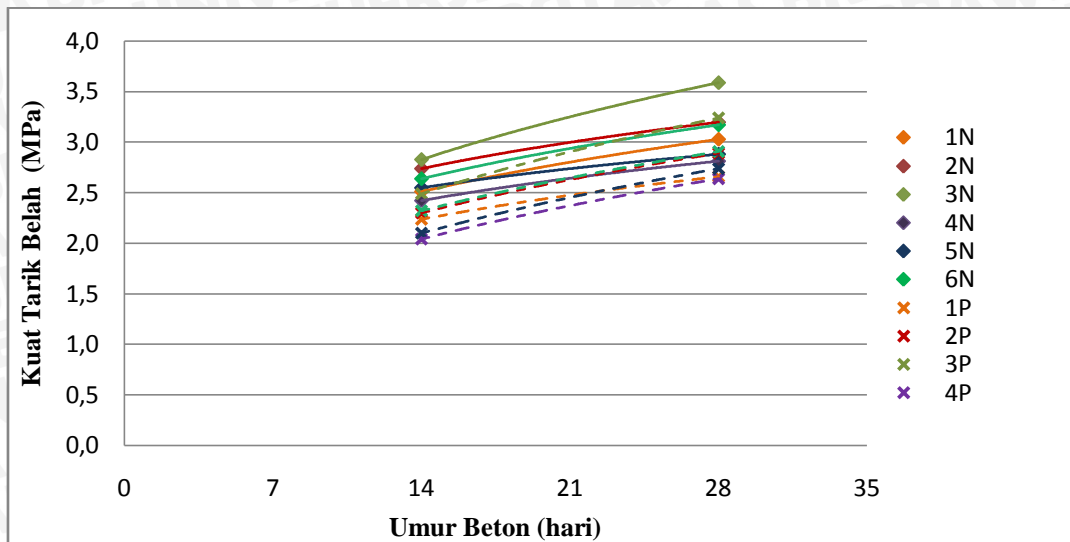
Tabel E.1 Hasil Pengujian Kuat Tarik Belah Umur 14 Hari

Kode	Berat (kg)	Diameter (cm)	Tinggi (cm)	Umur (hari)	Beban Maks (kN)	Rata-rata	Kuat Tarik (MPa)	Rata-rata
1N (1)	2056.6	8.20	15.80	14	56.00	50.6667	2.75	2.51
1N (2)	2044.8	8.20	15.80	14	50.00		2.46	
1N (3)	1861.2	8.00	15.80	14	46.00		2.32	
1P (1)	2003.2	8.20	15.80	14	49.00	45.6667	2,41	2.24
1P (2)	2073.2	8.00	16.00	14	41.00		2.04	
1P (3)	2096.0	8.30	15.90	14	47.00		2.27	
2N (1)	1937.0	7.80	16.00	14	59.00	54.3333	3.01	2.74
2N (2)	1915.4	7.80	16.10	14	52.00		2.64	
2N (3)	1872.8	8.00	16.10	14	52.00		2.57	
2P (1)	2040.2	8.20	15.90	14	44.00	46.3333	2.15	2.30
2P (2)	2100.8	8.10	16.00	14	49.00		2.41	
2P (3)	1896.0	7.80	16.10	14	46.00		2.33	
3N (1)	2042.6	8.20	16.10	14	60.00	58	2.89	2.83
3N (2)	2033.9	8.20	16.10	14	58.00		2.80	
3N (3)	1856.4	8.00	16.00	14	56.00		2.79	
3P (1)	2054.2	8.10	16.00	14	50.00	50.6667	2.46	2.49
3P (2)	1898.0	8.00	16.00	14	48.00		2.39	
3P (3)	2106.0	8.20	16.00	14	54.00		2.62	
4N (1)	1988.2	8.00	16.00	14	52.00	48.6667	2.59	2.42
4N (2)	1839.6	8.00	16.00	14	44.00		2.19	
4N (3)	1855.8	8.00	16.10	14	50.00		2.47	
4P (1)	1938.0	8.00	16.10	28	41.00	41	2.03	2.04
4P (2)	2082.4	8.10	16.00	28	43.00		2.11	
4P (3)	1918.4	7.90	16.00	28	39.00		1.97	
5N (1)	1864.6	8.20	16.00	14	50.00	52.6667	2.43	2.55
5N (2)	2107.2	8.40	16.00	14	58.00		2.75	
5N (3)	1892.4	8.00	16.00	14	50.00		2.49	
5P (1)	2015.2	8.20	15.80	14	45.00	43.3333	2.21	2.10
5P (2)	2055.0	8.30	16.00	14	43.00		2.06	
5P (3)	2086.4	8.30	16.00	14	42.00		2.01	
6N (1)	2046.0	8.20	16.00	14	60.00	54	2.91	2.64
6N (2)	1872.2	8.00	16.00	14	50.00		2.49	
6N (3)	2087.2	8.20	16.00	14	52.00		2.52	
6P (1)	1878.6	8.20	16.20	14	47.00	48	2.25	2.32
6P (2)	2141.6	8.20	16.20	14	52.00		2.49	
6P (3)	1831.8	8.00	16.10	14	45.00		2.23	

Tabel E.2 Hasil Pengujian Kuat Tarik Belah Umur 28 Hari

Kode	Berat (kg)	Diameter (cm)	Tinggi (cm)	Umur (hari)	Beban Maks (kN)	Rata-rata	Kuat Tarik (MPa)	Rata-rata
1N (1)	1843.4	8.00	15.90	28	47.00	62.00	2.35	3.03
1N (2)	2085.6	8.20	15.80	28	65.00		3.20	
1N (3)	2056.6	8.30	16.00	28	74.00		3.55	
1P (1)	1929.2	8.00	16.00	28	57.00	54.00	2.84	2.66
1P (2)	2096.6	8.20	16.00	28	51.00		2.48	
1P (3)	1865.4	8.10	16.00	28	54.00		2.65	
2N (1)	2065.8	8.00	16.00	28	62.00	66.00	3.09	3.20
2N (2)	2079.6	8.30	16.20	28	70.00		3.32	
2N (3)	2093.0	8.20	16.00	28	66.00		3.20	
2P (1)	2078.4	8.20	16.10	28	54.00	59.00	2.61	2.89
2P (2)	2139.2	8.20	16.20	28	60.00		2.88	
2P (3)	1869.4	7.90	16.00	28	63.00		3.17	
3N (1)	2015.0	8.30	16.00	28	69.00	71.67	3.31	3.59
3N (2)	1883.6	7.80	16.00	28	72.00		3.67	
3N (3)	1895.4	7.80	16.00	28	74.00		3.78	
3P (1)	2061.8	8.20	16.00	28	64.00	65.33	3.11	3.24
3P (2)	1866.2	7.90	16.00	28	64.00		3.23	
3P (3)	1894.6	7.90	16.20	28	68.00		3.38	
4N (1)	1914.8	8.00	16.00	28	55.00	57.67	2.74	2.81
4N (2)	2128.6	8.30	16.00	28	60.00		2.88	
4N (3)	2082.8	8.20	16.00	28	58.00		2.82	
4P (1)	1864.8	8.10	16.00	28	49.00	53.67	2.90	2.64
4P (2)	1914.4	7.90	16.00	28	50.00		2.52	
4P (3)	2040.4	8.30	16.00	28	52.00		2.49	
5N (1)	1892.6	8.00	16.00	28	59.00	58.33	2.94	2.88
5N (2)	1903.2	8.10	16.20	28	61.00		2.96	
5N (3)	1851.2	8.00	16.00	28	55.00		2.74	
5P (1)	1884.4	8.00	16.00	28	60.00	56.00	2.99	2.74
5P (2)	1907.2	8.00	16.20	28	44.00		2.16	
5P (3)	1925.6	8.20	16.20	28	64.00		3.07	
6N (1)	1891.4	7.80	15.90	28	65.00	62.67	3.34	3.17
6N (2)	1894.4	7.90	16.00	28	62.00		3.12	
6N (3)	1884.4	8.00	16.00	28	61.00		3.04	
6P (1)	1907.4	8.00	16.20	28	66.00	59.33	3.24	2.91
6P (2)	1900.6	8.00	16.00	28	57.00		2.84	
6P (3)	2089.0	8.30	16.00	28	55.00		2.64	

Lampiran 6: Hubungan Kuat Tarik Belah Beton dan Umur Beton



Gambar F.1 Hubungan kuat tarik belah dan umur beton.

Rumus Regresi :

$$1N = 1,225 \cdot X^{0,271}$$

$$2N = 2,517 \cdot X^{0,223}$$

$$3N = 1,144 \cdot X^{0,343}$$

$$4N = 1,370 \cdot X^{0,215}$$

$$5N = 1,604 \cdot X^{0,175}$$

$$6N = 1,315 \cdot X^{0,263}$$

$$1P = 1,164 \cdot X^{0,247}$$

$$2P = 0,964 \cdot X^{0,329}$$

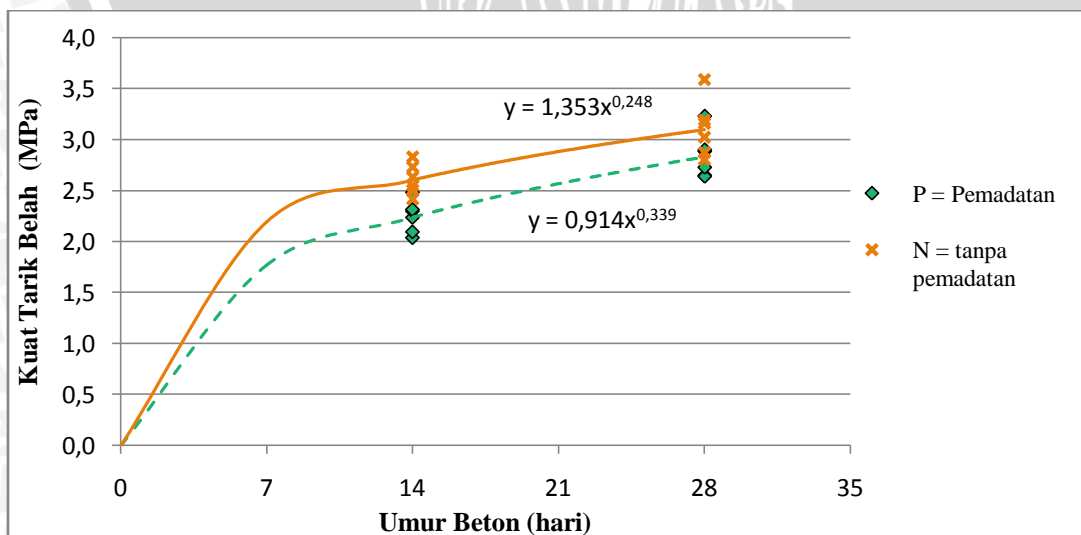
$$3P = 0,913 \cdot X^{0,379}$$

$$4P = 0,764 \cdot X^{0,372}$$

$$5P = 0,762 \cdot X^{0,383}$$

$$6P = 0,979 \cdot X^{0,326}$$

Dimana "X" adalah umur beton.



Gambar F.2 Hasil regresi hubungan kuat tarik belah dan umur beton.

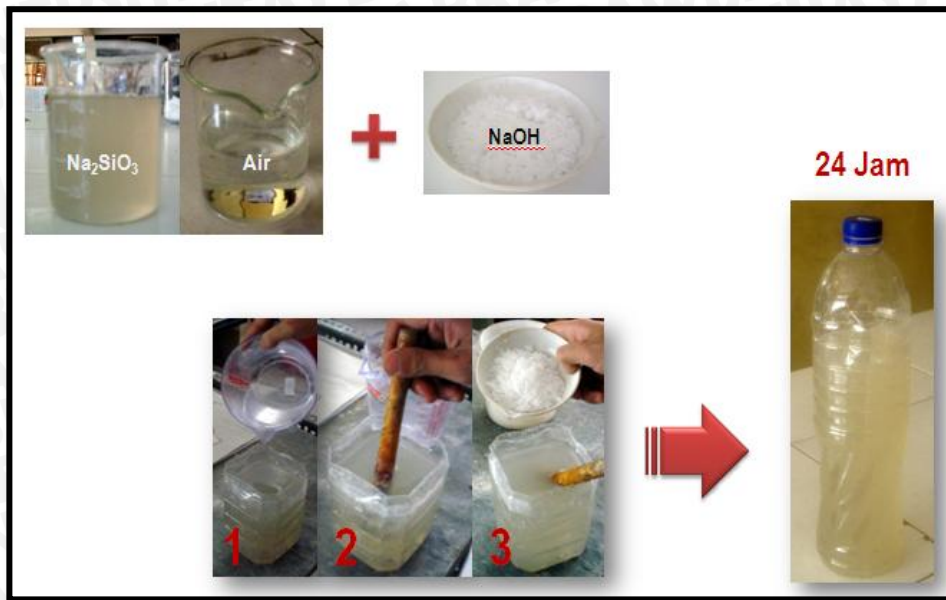
Lampiran 7: Dokumentasi Penelitian



Gambar G.1 Alat – alat yang digunakan dalam penelitian.



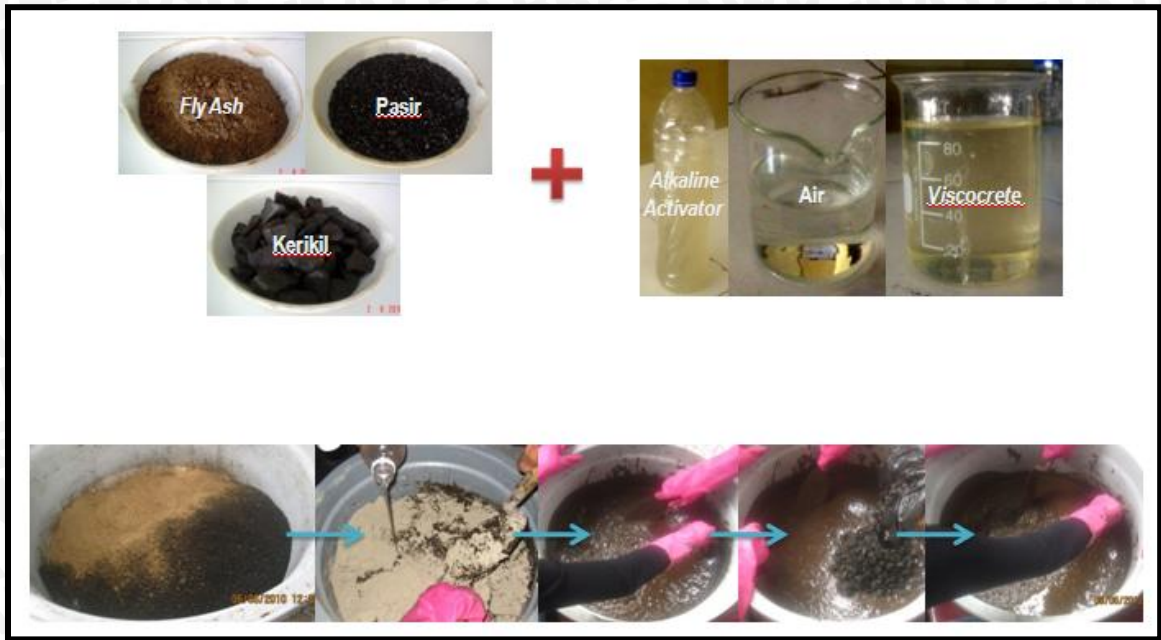
Gambar G.2 Bahan - bahan yang digunakan dalam penelitian.



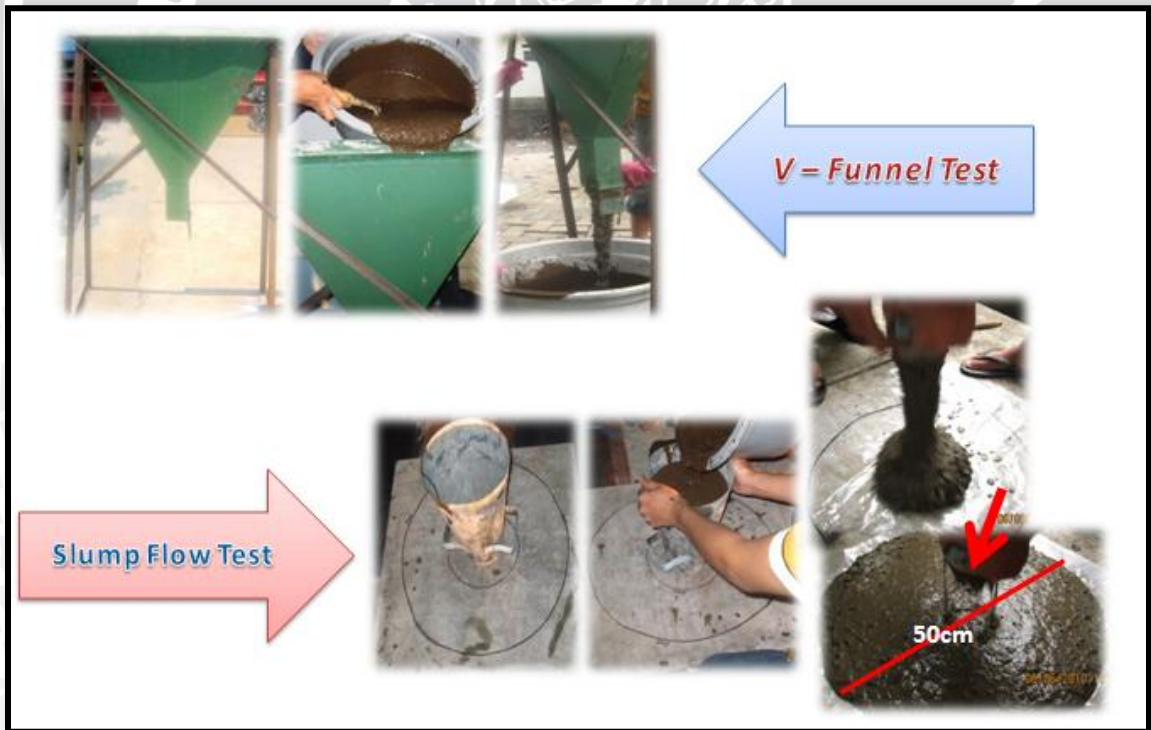
Gambar G.3 Proses pembuatan *alkaline activator*



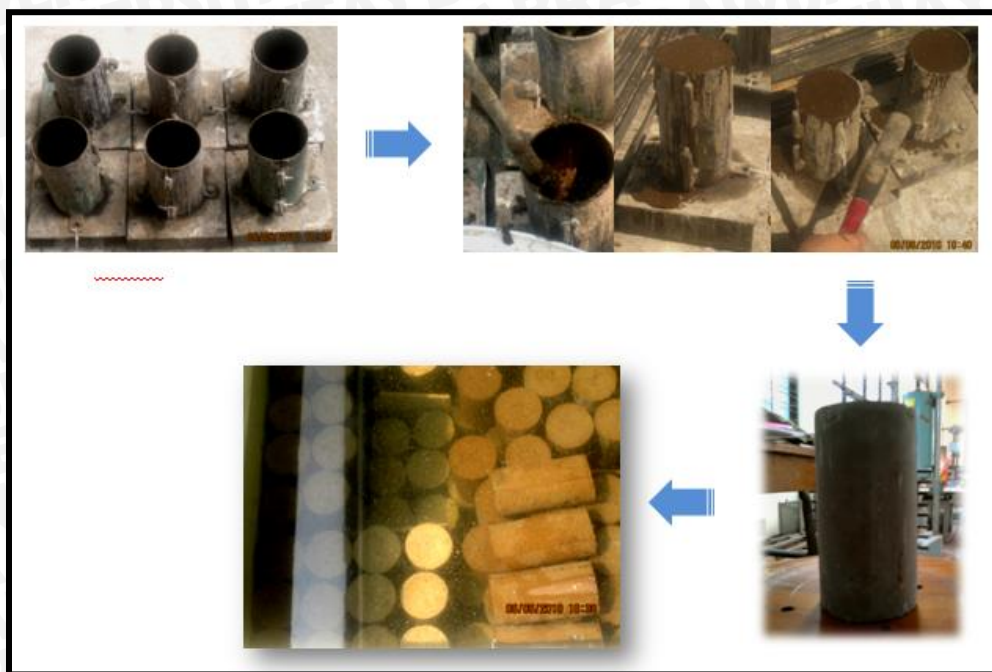
Gambar G.4 Proses pengujian *setting time*.



Gambar G.5 Proses pencampuran bahan-bahan beton geopolimer fly ash SCC.



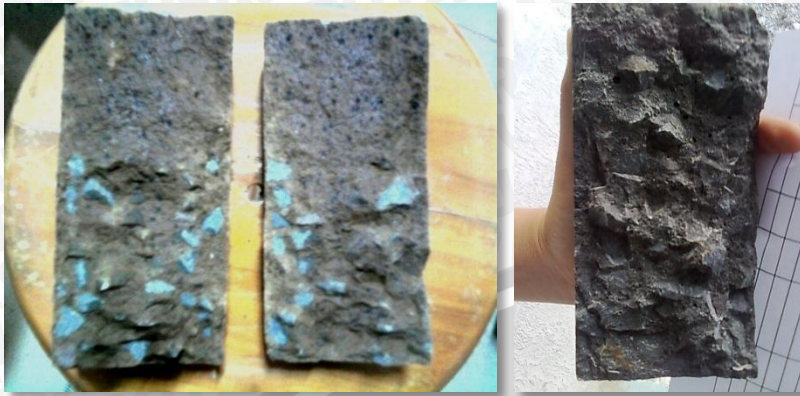
Gambar G.6 Proses pengujian kriteria SCC.



Gambar G.7 Proses pengecoran beton geopolimer *fly ash* SCC.



Gambar G.8 Proses pengujian kuat tarik belah beton geopolimer *fly ash* SCC.



(a)

(b)

Gambar G.9 (a) beton yang mengalami segregasi, (b) beton yang tidak mengalami segregasi.

