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## LAMPIRAN

1. Hasil Pengujian Karakteristik Material
2. Rekapitulasi Pengujian Kuat Tarik (*Tensile Strength*)
3. Dokumentasi Penelitian





### PENURUNAN BERAT ASPAL

Sampel : Aspal Minyak Pen. 60/70  
Metode : SNI 06-2440-1991

No. Sampel	A	B	C	D	E	F	G
	(gram)	(gram)	(gram)	(gram)	(gram)	(gram)	(gram)
1	9.20	84.00	74.80	83.86	74.66	0.14	0.19
2	9.10	86.00	76.90	85.84	76.74	0.16	0.21
Rata-rata							0.20

Keterangan:

A = Berat tinbox

B = Berat tinbox + aspal sebelum dioven

C = Berat aspal sebelum dioven  
= B - A

D = Berat tinbox + aspal setelah dioven

E = Berat aspal setelah dioven  
= D - A

F = Jumlah penurunan berat  
= C - E

G = % penurunan berat aspal  
= F/C x 100%

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**PENETRASI ASPAL SEBELUM KEHILANGAN BERAT**

Sampel : Aspal Minyak Pen. 60/70  
Metode : SNI 06-2456-1991

Penetrasi Aspal Penurunan 5 Detik	No. Sampel	
	I	II
5	63.00	66.50
5	68.00	65.00
5	64.50	63.00
5	65.00	64.50
5	63.50	67.00
Rata-rata	64.80	65.20
	65.00	

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### PENETRASI ASPAL SETELAH KEHILANGAN BERAT

Sampel : Aspal Minyak Pen. 60/70  
Metode : SNI 06-2456-1991

Penetrasi Aspal Penurunan 5 Detik	No. Sampel	
	I	II
5	84.00	80.50
5	81.00	85.00
5	81.50	86.00
5	85.50	83.00
5	80.00	83.50
Rata-rata	82.40	83.60
	83.00	

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### DAKTALITAS

Sampel : Aspal Minyak Pen. 60/70  
Berat sampel : 100 gr  
Metode : SNI 06-2432-1991

Pengamatan	Daktalitas pada 25 <sup>0</sup> C, 5 cm per menit
Pengamatan I	110.00
Pengamatan II	109.00
Pengamatan III	111.00
<b>Rata-rata</b>	110.00

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### BERAT JENIS ASPAL

Sampel : Aspal Minyak Pen. 60/70  
Metode : SNI 06-2441-1991

No. Sampel	A (gr)	B (gr)	C (gr)	D (gr)	Berat Jenis
1	53.00	110.00	98.00	111.00	1.02
2	53.00	113.00	99.00	113.00	1.00
<b>Rata-rata</b>					1.01

Rumus yang digunakan:

$$BJ = (C - A) / ((B - A) - (D - C))$$

dimana:

- A = Berat piknometer
- B = Berat piknometer + air suling
- C = Berat piknometer + aspal
- D = Berat piknometer + aspal + air suling

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**TITIK NYALA ASPAL**

Sampel : Aspal Minyak Pen. 60/70  
Metode : SNI 06-2433-1991

No.	Suhu ( °C )		Waktu ( Detik )	
	I	II	I	II
1	200	200	00 ° 00 ' 00 "	00 ° 00 ' 00 "
2	210	210	00 ° 00 ' 45 "	00 ° 00 ' 37 "
3	220	220	00 ° 01 ' 04 "	00 ° 00 ' 56 "
4	230	230	00 ° 01 ' 45 "	00 ° 01 ' 20 "
5	240	240	00 ° 02 ' 21 "	00 ° 02 ' 05 "
6	250	250	00 ° 02 ' 59 "	00 ° 02 ' 41 "
7	260	260	00 ° 03 ' 29 "	00 ° 03 ' 10 "
8	270	270	00 ° 04 ' 17 "	00 ° 04 ' 20 "
9	280	280	00 ° 05 ' 07 "	00 ° 05 ' 40 "
10	290	290	00 ° 06 ' 15 "	00 ° 06 ' 23 "
11	300	300	00 ° 07 ' 18 "	00 ° 07 ' 18 "
12	310*	310*	00 ° 07 ' 45 "	00 ° 07 ' 46 "
13	320	320	00 ° 08 ' 15 "	00 ° 08 ' 23 "

\* Titik nyala

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**TITIK LEMBEK ASPAL**

Sampel : Aspal Minyak Pen. 60/70  
Metode : SNI 06-2434-1991

No.	Suhu ( °C )		Waktu ( Detik )	
	I	II	I	II
1	5	5	00 ° 00 ' 00 "	00 ° 00 ' 00 "
2	10	10	00 ° 02 ' 53 "	00 ° 02 ' 53 "
3	15	15	00 ° 09 ' 05 "	00 ° 09 ' 05 "
4	20	20	00 ° 11 ' 11 "	00 ° 11 ' 11 "
5	25	25	00 ° 13 ' 17 "	00 ° 13 ' 17 "
6	30	30	00 ° 16 ' 06 "	00 ° 16 ' 06 "
7	35	35	00 ° 17 ' 25 "	00 ° 17 ' 25 "
8	40	40	00 ° 18 ' 43 "	00 ° 18 ' 43 "
9	45	45	00 ° 21 ' 02 "	00 ° 21 ' 02 "
10	50	50	00 ° 22 ' 26 "	00 ° 22 ' 26 "
11	51*	53*	00 ° 22 ' 52 "	00 ° 23 ' 56 "
Titik lembek ( °C )			51	53
Titik lembek rata-rata ( °C )			52	

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### BERAT JENIS DAN PENYERAPAN AGREGAT KASAR

Sampel : Agregat kasar (chipping)  
Berat sampel : 2500 gram  
Metode : SNI 03-1969-2008

NO. CONTOH		I	II	Rata-rata
Berat contoh kering oven (gr)	A	2430.00	2406.00	2418.00
Berat contoh kering permukaan (gr)	B	2483.50	2467.00	2475.25
Berat contoh dalam air (gr)	C	1536.00	1519.00	1527.50
Berat jenis bulk (atas dasar kering oven)	$\frac{A}{B - C}$	2.56	2.54	2.55
Berat jenis bulk (atas dasar kering permukaan)	$\frac{B}{B - C}$	2.62	2.60	2.61
Berat jenis semu	$\frac{A}{A - C}$	2.72	2.71	2.72
Penyerapan air	$\frac{B - A}{A} \times 100\%$	2.20	2.54	2.37

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### BERAT JENIS DAN PENYERAPAN AGREGAT HALUS

Sampel : Agregat halus (pasir)  
Berat sampel : 500 gram  
Metode : SNI 03-1970-2008

NO. CONTOH		I	II	Rata-rata
Berat contoh kering oven (gr)	A	490.00	491.50	490.75
Berat botol+air sampai batas kalibrasi (gr)	B	754.00	759.00	756.50
Berat contoh+botol+air sampai batas kalibrasi (gr)	C	1064.0	1066.3	1065.15
Berat jenis bulk (atas dasar kering oven)	$\frac{A}{B+500-C}$	2.58	2.55	2.56
Berat jenis bulk (atas dasar kering permukaan)	$\frac{500}{B+500-C}$	2.63	2.59	2.61
Berat jenis semu	$\frac{A}{B+A-C}$	2.72	2.67	2.70
Penyerapan air	$\frac{500-A}{A} \times 100\%$	2.04	1.73	1.89

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**BERAT JENIS DAN PENYERAPAN FILLER**

Sampel : Debu batu (filler)  
Berat sampel : 500 gram  
Metode : SNI 03-1970-2008

NO. CONTOH		I	II	Rata-rata
Berat contoh kering oven (gr)	A	489.40	488.20	488.80
Berat botol+air sampai batas kalibrasi (gr)	B	759.00	757.00	758.00
Berat contoh+botol+air sampai batas kalibrasi (gr)	C	1070.0	1063.0	1066.50
Berat jenis bulk (atas dasar kering oven)	$\frac{A}{B+500-C}$	2.59	2.52	2.55
Berat jenis bulk (atas dasar kering permukaan)	$\frac{500}{B+500-C}$	2.65	2.58	2.61
Berat jenis semu	$\frac{A}{B+A-C}$	2.74	2.68	2.71
Penyerapan air	$\frac{500-A}{A} \times 100\%$	2.17	2.42	2.29

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**KEAUSAN AGREGAT DENGAN MESIN LOS ANGELES**

Sampel : Agregat kasar (*chipping*)  
Metode : SNI 03-2417-2008

Gradasi Saringan		No. Sampel	
		I	
Lolos	Tertahan	A	B
		Berat Sebelum (gr)	Berat Sesudah (gr)
3/4"	1/2"	2500	3868
1/2"	3/8"	2500	
Jumlah Berat (gram)		5000	
Berat Tertahan Saringan No. 12 (gram)		3868	
Keausan		$\frac{5000 - 3868}{5000} \times 100\% = 22.64\%$	
Rata - rata		22.64%	

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### INDEKS KEPIPIHAN AGREGAT

Sampel : Agregat kasar (chipping )  
Berat sampel : 1000 gram  
Metode : SNI 03-4137-1996

No.	Gradasi Saringan		Ukuran Thickness Gauge		Berat Lolos Slot (Gram)	Berat Ter-tahan Slot (Gram)	Total Berat (Gram)
			Lebar (mm)	Panjang (mm)			
					A	B	C
I	3/4"	1/2"	6.67	38.2	57.4	442.6	500
II	1/2"	3/8"	4.8	25.4	24.7	475.3	500
Total					82.1	917.9	1000
<b>Indeks Kepipihan</b> = $\frac{\text{Total Berat A}}{\text{Total Berat C}} \times 100\%$					$\frac{82.1}{1000} \times 100\% = 8.21\%$		

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### KADAR LUMPUR AGREGAT KASAR

Sampel : Agregat kasar (*chipping* )  
Metode : SNI 03-4142-1996

A. Berat kering sebelum dicuci = 1000.00 gram  
B. Berat kering setelah dicuci = 993.40 gram

$$\begin{aligned}\text{Kadar lumpur} &= \frac{A - B}{B} \times 100\% \\ &= \frac{1000.00 - 993.40}{1000.00} \times 100\% \\ &= 0.66\%\end{aligned}$$

Dari hasil percobaan diperoleh kadar lumpur agregat kasar (kerikil) adalah :  
Dik. karakteristik pasir untuk beton harus mempunyai spesifikasi kadar lumpur Maks.1  
sehingga dapat disimpulkan bahwa benda uji material memenuhi standar spesifikasi.

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*SAND EQUIVALENT*

Sampel : Agregat halus (pasir)  
Metode : SNI 03-4428-1997

No.	Uraian	No. Contoh	
		I	II
1	Tera tinggi tangkai penunjuk ke dalam gelas ukur (gelas dalam keadaan kosong).	10.2	10.2
2	Baca skala lumpur. (Pembacaan skala permukaan lumpur dilihat pada dinding gelas ukur).	3.5	3.9
3	Pembacaan skala beban pada gelas ukur (beban dimasukkan pada gelas keadaan kosong).	13.2	13.4
4	Pembacaan skala pasir. (Pembacaan 3 - Pembacaan 1)	3	3.2
5	Nilai Sand Equivalent $\frac{\text{Skala Pasir (4)}}{\text{Skala Lumpur (2)}} \times 100\%$	85.7	82.1
6	Rata-rata nilai Sand Equivalent (%)	83.9	

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### ANALISA SARINGAN AGREGAT KASAR

Sampel : Agregat kasar (*chipping*)  
Berat sampel : 1500 gram  
Metode : SNI 03-1968-1990

No. Saringan	Berat Tertahan (gram)	Kumulatif Tertahan (gram)	Persen Total Tertahan (%)	Persen Lolos (%)
3/4"	0	0	0.00	100.00
1/2"	44.9	44.9	2.99	97.01
3/8"	749.3	794.2	52.95	47.05
4	705.8	1500	100.00	0.00
8	0	1500	100.00	0.00
16	0	1500	100.00	0.00
30	0	1500	100.00	0.00
50	0	1500	100.00	0.00
100	0	1500	100.00	0.00
200	0	1500	100.00	0.00
PAN	0	1500	100.00	0.00

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### ANALISA SARINGAN AGREGAT HALUS

Sampel : Agregat halus (pasir)  
Berat sampel : 500 gram  
Metode : SNI 03-1968-1990

No. Saringan	Berat Tertahan (gram)	Kumulatif Tertahan (gram)	Persen Total Tertahan (%)	Persen Lolos (%)
3/4"	0	0	0.00	100.00
1/2"	0	0	0.00	100.00
3/8"	0	0	0.00	100.00
4	0	0	0.00	100.00
8	200	200	20.00	80.00
16	0	200	20.00	80.00
30	0	200	20.00	80.00
50	0	200	20.00	80.00
100	0	200	20.00	80.00
200	661.2	861.2	86.12	13.88
PAN	138.8	1000	100.00	0.00

Mengetahui,  
Kepala Laboratorium Ecomaterial

**Prof. Dr. H. Muh. Wibardi Tiaronge, ST., M.Eng.**  
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### ANALISA SARINGAN AGREGAT HALUS

Sampel : Agregat halus (*filler*)  
Berat sampel : 1500 gram  
Metode : SNI 03-1968-1990

No. Saringan	Berat Tertahan (gram)	Kumulatif Tertahan (gram)	Persen Total Tertahan (%)	Persen Lolos (%)
3/4"	0	0	0.00	100.00
1/2"	0	0	0.00	100.00
3/8"	0	0	0.00	100.00
4	0	0	0.00	100.00
8	400	400	40.00	60.00
16	0	400	40.00	60.00
30	0	400	40.00	60.00
50	0	400	40.00	60.00
100	0	400	40.00	60.00
200	322.4	722.4	72.24	27.76
PAN	277.6	1000	100.00	0.00

Mengetahui,  
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# DOKUMENTASI

## 1. Penyiapan Alat dan Material



Pencucian/pembersihan Agregat



Proses pengeringan agregat



Persiapan Alat Sebelum Pembuatan Benda Uji



## 2. Proses Pembuatan Benda Uji



Proses Pemanasan Agregat dan Aspal Minyak



Proses Pemadatan Campuran Aspal



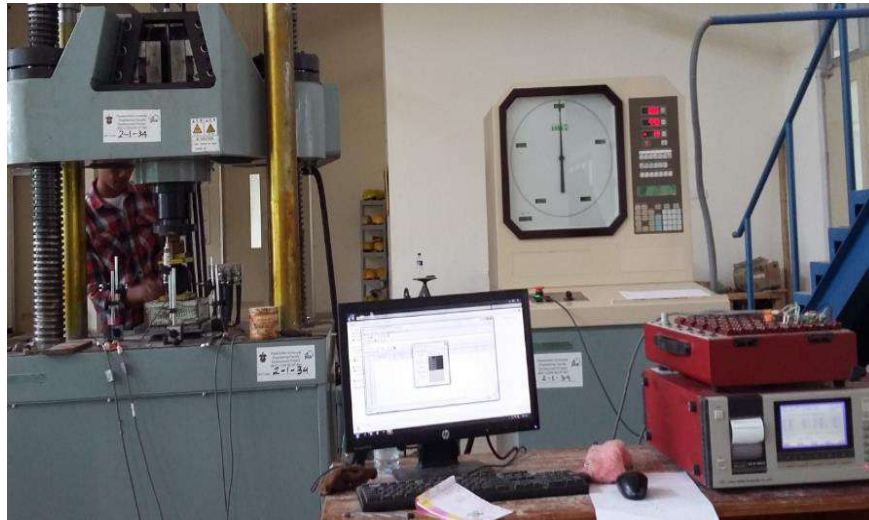
Proses pengeluaran benda uji dari mould dengan alat *ejector*



### 3. Proses Pengujian Air Laut



#### 4. Proses Pengujian Kuat Tarik



Persiapan Alat Pengujian Kuat Tarik



Proses Pengujian Kuat Tarik



Hasil Pengujian Kuat Tarik





Optimization Software:  
[www.balesio.com](http://www.balesio.com)