Lampiran A

VARIASI JUMLAH TUMBUKAN TERHADAP
KARAKTERISTIK AC-WC GRADASI KASAR DENGAN
SUHU IDEAL PENCAMPURAN ASPAL

LABORATORIUM INTI JALAN RAYA
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PEMERIKSAAN PENETRASI BAHAN-BAHAN BITUMEN

(*Penetrastion of Bituminous Materials*)

No	Kegiatan	Uraian	
1	Pembukaan Contoh	Contoh dipanaskan Mulai jam = 09.40 Selesai jam = 10.00	Pembacaan suhu oven = 70° C
2	Mendinginkan Contoh	Didiamkan di suhu ruangan Mulai jam = 10.00 Selesai jam = 11.00	
3	Mencapai suhu pemeriksaan	Direndam pada suhu 25°C Mulai jam = 11.00 Selesai jam = 12.30	Pembacaan suhu waterbath = 25° C
4.	Pemeriksaan	Penetrasi pada suhu 25°C Mulai jam = 12.30 Selesai jam = 13.00	Pembacaan suhu penetrometer = 25°C

No	Penetrasi pada 25C, 100gr, 5 detik	I	II
1.	Pengamat I	72	63
2.	Pengamat 2	66	67
3.	Pengamat 3	69	68
Rata-rata		69	66

Catatan : Rata-rata penetrasi dari kedua sampel tersebut adalah 67,5.

Berdasarkan SNI 06-2456-1991 pen 60/70 berkisar antara 60-79.

Jadi penetrasi sampel tersebut masuk dalam spesifikasi.

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PEMERIKSAAN BERAT JENIS BITUMEN KERAS DAN TER

(Specific Gravity of Semi Solid Bituminous Materials)

No	Kegiatan	Uraian	
1	Pembukaan Contoh	Contoh dipanaskan Mulai jam =10.00 Selesai jam =10.15	Pembacaan suhu oven = 70° C
2	Mendinginkan Contoh	Didiamkan di suhu ruangan Mulai jam =10.15 Selesai jam =10.45	
3	Mencapai suhu pemeriksaan	Direndam pada suhu 25°C Mulai jam =10.45 Selesai jam =11.15	Pembacaan suhu waterbath = 25° C

		Sampel 1	Sampel 2
Berat piknometer + air	=	51,51 gr	51,50 gr
Berat Piknometer	=	27,24 gr	27,26 gr
Berat air / Isi piknometer	=	24,27 gr	24,24 gr
Berat piknometer + contoh	=	32,45 gr	32,25 gr
Berat piknometer	=	27,24 gr	27,26 gr
Berat contoh	=	5,21 gr	4,99 gr
Berat piknometer + air + contoh	=	51,67 gr	51,67 gr
Berat piknometer + contoh	=	32,45 gr	32,25 gr
Berat air	=	19,22 gr	19,42 gr

Isi bitumen sampel 1 = 24,27 – 19,22 = 5,05 gr

Isi bitumen sampel 2 = 24,24 – 19,42 = 4,82 gr

Berat jenis sampel 1 $= \frac{\text{Berat contoh}}{\text{Isi bitumen}} = \frac{5,21}{5,05} = 1,0317 \text{ gr/cm}^3$

Berat jenis sampel 2 $= \frac{\text{Berat contoh}}{\text{Isi bitumen}} = \frac{4,99}{4,82} = 1,0353 \text{ gr/cm}^3$

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PEMERIKSAAN TITIK LEMBEK ASPAL DAN TER

(Softening Point of Asphalt and Tar in Ethylene Glycol (Ring and Ball))

No.	Suhu Yang Diamati (^{O}C)	Waktu	
		Sampel 1	Sampel 2
1.	5	0	0
2.	10	2'19"	2'19"
3.	15	1'47"	1'47"
4.	20	1'41"	1'41"
5.	25	1'14"	1'14"
6.	30	1'07"	1'07"
7.	35	1'00"	1'00"
8.	40	1'02"	1'02"
9.	45	1'01"	1'01"
12.	50	1'02"	1'02"
13.	53	1'09"	1'15"

Catatan : Menurut spesifikasi SNI 06-2434-1991 yaitu untuk jenis aspal 60/70 titik lembek berkisar antara 48°C – 58°C. Hasil pengujian menunjukkan kedua sampel memenuhi persyaratan.

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PEMERIKSAAN DAKTILITAS BAHAN-BAHAN BITUMEN

(*Ductility Of Bituminous Materials*)

No	Kegiatan	Uraian	
1	Pembukaan Contoh	Contoh dipanaskan Mulai jam =10.00 Selesai jam =10.15	Pembacaan suhu oven = 70° C
2	Mendinginkan Contoh	Didiamkan di suhu ruangan Mulai jam =10.15 Selesai jam =10.45	
3	Mencapai suhu pemeriksaan	Direndam pada suhu 25°C Mulai jam =10.45 Selesai jam =11.15	Pembacaan suhu waterbath = 25° C

Daktilitas pada 25°C, 5 cm per menit	Pembacaan pengukuran pada alat
Pengamatan I Pengamatan II	101 cm 101 cm
Rata-rata	101 cm

Catatan : Dari hasil praktikum nilai daktilitas lebih dari 100 cm, dengan demikian aspal tersebut mempunyai daktilitas yang baik, berarti mampu mengikat aspal dengan baik dalam perkerasan.

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PENGUJIAN KEHILANGAN BERAT MINYAK DAN ASPAL

No	Kegiatan	Uraian	
1	Pembukaan Contoh	Contoh dipanaskan Mulai jam =13.00 Selesai jam =13.15	Pembacaan suhu oven = 70° C
2	Mendinginkan Contoh	Didiamkan di suhu ruangan Mulai jam =13.15 Selesai jam =14.45	
3	Mencapai suhu pemeriksaan	Direndam pada suhu 25°C Mulai jam = Selesai jam =	Pembacaan suhu waterbath = 25° C

	Sampel I	**Sampel II**
Berat cawan + aspal keras	= 66,81 gr	= 68,24 gr
Berat cawan kosong	= 14,89 gr	= 14,76 gr
Berat aspal keras	= 51,92 gr	= 53,48 gr
Berat sebelum pemanasan	= 66,81 gr	= 68,24 gr
Berat sesudah pemanasan	= 66,47 gr	= 67,77 gr
Berat endapan	= 0,34 gr	= 0,47 gr
Atau	= 0,6549 %	= 0,7839 %
Rata-rata	= 0,7194%	

Catatan : Dari hasil praktikum yang dilakukan didapatkan kehilangan berat rata-rata yaitu 0,7194 %. Maka hasil yang diperoleh ini memenuhi standar persyaratan SNI yaitu untuk penetrasi 60 – 70 kehilangan berat maksimum 0,8 %.

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PENGUJIAN KEKUATAN AGREGAT TERHADAP TUMBUKAN

(*Aggregate Impact Value*)

Item Pengujian	Berat (gram)	
	Sampel I	Sampel II
Berat sampel awal (A)	575,1	657,6
Berat sampel setelah penekanan dan tertahan saringan 2,36 mm (B)	539,3	622,5
Berat sampel setelah penekanan dan lolos saringan 2,36 mm (C)	35,8	35,1
Aggregate Impact Value (AIV)	6,2250 %	5,3376 %
Rata-rata AIV (%)	5,7813 %	

Catatan : Dari percobaan yang telah dilakukan, didapat nilai AIV *(Aggregate Impact Value)* untuk sampel I sebesar 6,2250 % dan untuk sampel II sebesar 5,3376 %. Hasil ini masuk dalam standar spesifikasi Bina Marga untuk perkerasan jalan yaitu < 30 %.

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BERAT JENIS DAN PENYERAPAN AGREGAT HALUS

(Specific Gravity and Water Absorption of Fine Aggregate)

No.	Kegiatan	Berat Sampel
1.	Mengukur Berat benda uji kering permukaan jenuh (Bk)	500 gr
2.	Mengukur Berat benda uji kering oven (Bk)	487,28 gr
3.	Mengukur Berat Piknometer yangdiisi air (B)	723,83 gr
4.	Mengukur Berat Piknometer + Benda uji SSD + air (Bt)	1031,81 gr

No.	Perhitungan	Sampel A
1.	Berat Jenis Bulk $\frac{Bk}{B+A-Bt}$	$\frac{487,28}{723,83+500-1031,81} = 2,5377$
2.	Berat Jenis Permukaan Jenuh $\frac{A}{B+A-Bt}$	$\frac{500}{723,83+500-1031,81} = 2,6039$
3.	Berat Jenis Semu $\frac{Bk}{B+Bk-Bt}$	$\frac{487,28}{723,83+487,28-103181} = 2,7177$
4.	Penyerapan $\frac{A-Bk}{Bk}$ x 100%	$\frac{500-487,28}{487,28}$ x 100% = 2,6104 %

Catatan : Berdasarkan SKBI penterapan maksimum maximum 5% dan berat jenis minimum 2,5 jadi agregat halus tersebut memenuhi standar.

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BERAT JENIS DAN PENYERAPAN AGREGAT KASAR

(Specific Gravity and Water Absorption of Coarse Aggregate)

No.	Kegiatan	Berat Sampel
1.	Mengukur Berat sampel kering oven (Bk)	5000 gr
2.	Mengukur Berat sampel kering permukaan jenuh (Bj)	5000,1 gr
3.	Mengukur Berat sampel di dalam air (Ba)	3115,2 gr

No.	Perhitungan	Sampel A
1.	Berat Jenis Bulk $\frac{Bk}{Bj - Ba}$	$\frac{5000}{5001,1 - 3115,2} = 2,6513$
2.	Berat Jenis Permukaan Jenuh $\frac{Bj}{Bj-Ba}$	$\frac{5001,1}{5001,1-3115,2} = 2,6518$
3.	Berat Jenis Semu $\frac{Bk}{Bk-Ba}$	$\frac{5000}{5000-3115,2} = 2,6528$
4.	Penyerapan $\frac{Bj-Bk}{Bk}$ x 100%	$\frac{5001,1-5000}{5000}$ x 100% = 0,022 %

Catatan : Berdasarkan SKBI penyerapan maximum 3 % dan berat jenis bulk minimum 2,5. Jadi agregat ini memenuhi standar.

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PENGUJIAN KEKUATAN AGREGAT TERHADAP TEKANAN

(*Aggregate Crushing Value*)

Item Pengujian	Berat (gram)	
	Sampel I	Sampel II
Berat sampel awal (A)	1000	1000
Berat sampel setelah penekanan dan tertahan saringan 2,36 mm (B)	988,7	989,6
Berat sampel setelah penekanan dan lolos saringan 2,36 mm (C)	11,3	10,4
Aggregate Crushing Value (ACV)	1,13 %	1,04 %
Rata-rata ACV (%)	1,085 %	

Catatan : Dari percobaan yang telah dilakukan, didapat nilai ACV (*Aggregate Crushing Value*) untuk sampel I sebesar 1,13 % dan untuk sampel II sebesar 1,04 %. Hasil ini masuk dalam standar spesifikasi Bina Marga untuk perkerasan jalan yaitu < 30 %.

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PENGUJIAN KEAUSAN AGREGAT DENGAN MESIN LOS ANGELES

500 Putaran

Gradasi pemeriksaan		Fraksi B (10 – 20 mm)			
Saringan (mm)		Berat sampel I		Berat Sampel 2	
Lolos	Tertahan	Sebelum	Sesudah	Sebelum	Sesudah
76,2	63,5	-	-	-	-
63,5	50,8	-	-	-	-
50,8	37,5	-	-	-	-
37,5	25,4	-	-	-	-
25,4	19,0	-	-	-	-
19,0	12,5	2500 gr	-	-	-
12,5	9,5	2500 gr	-	-	-
9,5	6,3	-	-	-	-
6,3	4,75	-	-	-	-
4,75	2,38	-	-	-	-
Jumlah berat		5000 gr	-	-	-
Berat tertahan saringan					

A = 5000 gr

B = 4394,4 gr

A - B = 605,6 gr

$$\text{Keausan I} = \frac{A-B}{A} \times 100\ \% = \frac{5000-4394,4}{5000} \times 100\ \% = 12,1120\ \%$$

Catatan : Berdasarkan standar keausan SKBI keausan maksimum yaitu 40 %.

Jadi agregat tersebut memenuhi persyaratan standar.

Lampiran B

VARIASI JUMLAH TUMBUKAN TERHADAP
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TABEL PERHITUNGAN JOB MIX FORMULA (JMF)

Tabel Pembagian Butir Agregat Halus dan Agregat Kasar Pada Gradasi Batas Tengah

Saringan	Diameter	% Lolos	%Tertahan	PB
3/4"	19	100		
1/2"	12.5	95	5	CA=
3/8"	9.5	81	14	
No.4	4.75	53	28	66.45
No.8	2.36	33.55	19.45	
No.16	1.18	22.3	11.25	
No.30	0.6	16.05	6.25	FA=
No.50	0.3	12.25	3.8	
No.100	0.15	9.5	2.75	26.55
No.200	0.075	7	2.5	
Pan	-	0	7	7

Kadar Aspal Ditentukan dengan Cara Menghitung Nilai Pb

Pb = (0.035 x CA) + (0.045 x FA) + (0.18 x Filler) + K

= (0.035 x 66.45) + (0.045 x 26.55) + (0.18 x 7) + 0.75

= 5.53 ≈ 5.5 %

JMF

Fraksi	% Tertahan	Berat Jenis			% Penyerapan	BJ Terpakai	[2] / [7]
		Bulk	SSD	Apparent			
1	2	3	4	5	6	7	8
Kasar	66.45	2.6513	2.6518	2.6528	0.0220	2.6528	25.05
Halus	26.55	2.5377	2.6039	2.7177	2.6104	2.6277	10.10
Filler	7.00					3.1500	2.22
Total							37.38

Kadar Aspal (%)	BJ Aspal (gr/cm^3)	[9] / [10]	∑[8] x {(100-[9])/100}	[11] + [12]	BJ Teori Max 100 / [13]
9	10	11	12	13	14
4.50	1.0317	4.36	35.69	40.05	2.4966
5.00	1.0317	4.85	35.51	40.35	2.4781
5.50	1.0317	5.33	35.32	40.65	2.4600
6.00	1.0317	5.82	35.13	40.95	2.4421
6.50	1.0317	6.30	34.95	41.25	2.4245

Diameter Benda Uji = 10.16 cm

Tinggi Benda Uji = 6.35 cm

Volume Benda Uji = $\frac{1}{4} \times \pi \times d^2 \times t$

= $\frac{1}{4} \times \pi \times (10.16)^2 \times (6.35)$ = 514.8148 cm^3

Contoh Perhitungan untuk Kadar Aspal 4.5 % :

Berat Total = Volume Benda Uji x BJ Teori Max x 0.96

= 514.8148 x 2.4966 x 0.96 = 1233.9 gr

Berat Aspal = Kadar Aspal x Berat Total

= 4.53% x 1233.9 = 55.5 gr

Berat Agregat = Berat Total - Berat Aspal

= 1233.3 - 55.5 = 1178.3 gr

Catatan :

0.96 didapat dari : 100% - void = 100% - 4% = 96% = 0.96

Perhitungan Selanjutnya Ditabelkan.

Kadar Aspal	Berat (gr)		
	Total	Aspal	Agregat
4.50	1233.9	55.5	1178.3
5.00	1224.8	61.2	1163.5
5.50	1215.8	66.9	1148.9
6.00	1206.9	72.4	1134.5
6.50	1198.2	77.9	1120.3

JMF

Saringan	% Lolos	% Tertahan	Kadar Aspal (%)					Total Agregat	Total 3 Benda Uji
			4.50	5.00	5.50	6.00	6.50		
19	100	0	0	0	0	0	0	0	0
12.5	95.00	5.00	58.9	58.2	57.4	56.7	56.0	287.3	861.8
9.5	81.00	14.00	165.0	162.9	160.8	158.8	156.8	804.4	2413.2
4.75	53.00	28.00	329.9	325.8	321.7	317.7	313.7	1608.8	4826.3
2.36	33.55	19.45	229.2	226.3	223.5	220.7	217.9	1117.5	3352.6
1.18	22.30	11.25	132.6	130.9	129.3	127.6	126.0	646.4	1939.2
0.6	16.05	6.25	73.6	72.7	71.8	70.9	70.0	359.1	1077.3
0.3	12.25	3.80	44.8	44.2	43.7	43.1	42.6	218.3	655.0
0.15	9.50	2.75	32.4	32.0	31.6	31.2	30.8	158.0	474.0
0.075	7.00	2.50	29.5	29.1	28.7	28.4	28.0	143.6	430.9
Pan	0	7	82.5	81.4	80.4	79.4	78.4	402.2	1206.6
Berat Total Agregat (gr)			1178.3	1163.5	1148.9	1134.5	1120.3	5745.6	17236.9
Berat Aspal (gr)			55.5	61.2	66.9	72.4	77.9	333.9	1001.8
Berat Total Benda Uji (gr)			1233.9	1224.8	1215.8	1206.9	1198.2	6079.6	18238.7
BJ Teori Max			2.4966	2.4781	2.4600	2.4421	2.4245	-	-

Volume Benda Uji

Vol = Berat Jenuh - Berat dalam Air

= 1239.60 - 674.40

= 565.20 gr

Berat Jenis Padat (BJ Bulk) Campuran = Berat Isi

$$\text{BJ Bulk} = \frac{\text{Berat kering}}{\text{Vol Benda Uji}}$$

$$= \frac{1204.60}{565.2} = 2.131 \text{ Kg/m}^3$$

Berat Jenis Padat (BJ Bulk) Agregat Gabungan (Gsb)

$$\text{BJ Bulk Agg} = \frac{100}{\frac{\%\text{Agg Kasar}}{\text{BJ Bulk Agg Kasar}} + \frac{\%\text{ Agg Halus}}{\text{BJ Bulk Agg Halus}} + \frac{\%\ \textit{Filler}}{\text{BJ }\textit{Filler}} + \frac{\%\text{ ATK}}{\text{BJ ATK}}}$$

$$= \frac{100}{\frac{66.45}{2.6513} + \frac{26.55}{2.5377} + \frac{7}{3.15} + \frac{0}{0.5475}}$$

$$= 2.6492 \text{ Kg/m}^3$$

Berat Jenis Efektif Agregat Gabungan (Gse)

$$\text{BJ Eff Agg} = \frac{100}{\frac{\%\text{Agg Kasar}}{\text{BJ Eff Agg Kasar}} + \frac{\%\text{ Agg Halus}}{\text{BJ Eff Agg Halus}} + \frac{\%\ \textit{Filler}}{\text{BJ }\textit{Filler}} + \frac{\%\text{ ATK}}{\text{BJ ATK}}}$$

$$= \frac{100}{\frac{66.45}{2.6528} + \frac{26.55}{2.6277} + \frac{7}{3.15} + \frac{0}{0.5475}}$$

$$= 2.6756 \text{ Kg/m}^3$$

dengan Menggunakan Rumus Lain :

Catatan : % Aspal dari Berat Campuran

$$\text{BJ Eff Agg} = \frac{100 - \%\text{ Aspal}}{\frac{100}{\text{BJ Teori Max}} - \frac{\%\text{ Aspal}}{\text{BJ Aspal}}}$$

$$= \frac{100 - 4.5}{\frac{100}{2.4966} - \frac{4.5}{1.0317}}$$

$$= 2.6756 \text{ Kg/m}^3$$

Berat Jenis Teori Maksimum Campuran (Gmm)

Catatan : % Agregat & % Aspal dari Berat Campuran

$$\text{BJ Teori Max} = \frac{100}{\frac{\%\text{ Agregat}}{\text{BJ Eff Agg}} + \frac{\%\text{ Aspal}}{\text{BJ Aspal}}}$$

$$= \frac{100}{\frac{100 - 4.5}{2.6756} + \frac{4.5}{1.0317}}$$

$$= 2.4966 \text{ Kg/m}^3$$

Persen Rongga dalam Campuran (VIM)

$$VIM = 100 - 100 \times \frac{\text{Berat Isi}}{\text{BJ Teori Max}}$$

$$= 100 - 100 \times \frac{2.131}{2.4966}$$

$$= 14.6\ \%$$

Persen Rongga dalam Mineral Agregat (VMA)

Catatan : % Aspal dari Berat Campuran

$$VMA = 100 - \frac{(100 - \%\ \text{Aspal}) \times \text{BJ Bulk}}{\text{BJ Bulk Agregat}}$$

$$= 100 - \frac{(100 - 4.31) \times 2.131}{2.6492}$$

$$= 23.0\ \%$$

Persen Rongga Terisi Aspal (VFA)

$$VFA = 100 \times \frac{VMA - VIM}{VMA}$$

Contoh Perhitungan Kadar Aspal 4.5% ATK 0%

$$VFA = 100 \times \frac{23.0 - 14.6}{23.0}$$

$$= 36.4\ \%$$

Data Hasil Pengukuran & Pengujian Benda Uji Marshall Batas Tengah

Kadar Aspal %	Nomor Benda Uji	Tinggi Benda Uji			Tinggi Benda Uji rata rata	Berat Kering (gr)	Berat Dalam air	Berat Jenuh	Pembacaan Stabilitas	Flow
		1	2	3	(mm)	(gram)	(gram)	(gram)	(kg)	(mm)
4.50	1	74	74.5	75	74.50	1,204.60	674.40	1,239.90	73.0	1.6
	2	75.3	75.2	75	75.17	1,209.80	677.60	1,236.30	73.0	3.2
	3	74.7	73.8	73	73.83	1,208.00	683.30	1,237.00	74.0	1.4
Rata-rata					**74.50**	**1207.47**	**678.43**	**1237.73**	**73.33**	**2.07**
5.00	1	71	72.7	72.6	72.10	1194.20	676.50	1216.40	71.0	5.2
	2	72.4	73	73.2	72.87	1,195.40	674.50	1,220.90	71.0	1.9
	3	72.6	72	73	72.53	1,191.00	674.70	1,209.70	83.0	3.6
Rata-rata					**72.50**	**1193.53**	**675.23**	**1215.67**	**75.00**	**3.57**
5.50	1	72	71	72.8	71.93	1,187.00	664.90	1,202.70	80.0	2.3
	2	70	69.7	70.1	69.93	1,189.80	668.80	1,199.30	76.0	3.2
	3	70.7	70.5	70.4	70.53	1,191.60	665.60	1,201.30	80.0	4.6
Rata-rata					**70.80**	**1189.47**	**666.43**	**1201.10**	**78.67**	**3.37**
6.00	1	66	66.6	66.2	66.27	1,180.10	672.80	1,188.80	81.5	3.8
	2	67.6	67.3	67.5	67.47	1,194.30	680.60	1,203.30	82.0	3.9
	3	65.7	65.4	65.6	65.57	1,184.30	678.00	1,194.30	82.0	3.4
Rata-rata					**66.43**	**1186.23**	**677.13**	**1195.47**	**81.83**	**3.70**
6.50	1	64.3	64.2	64.5	64.33	1,170.70	671.30	1,178.00	80.0	3.5
	2	63.1	63.8	63.4	63.43	1,159.00	665.00	1,166.50	85.0	4.1
	3	63.6	64	63.5	63.70	1166.30	669.30	1173.40	94.0	4.3
Rata-rata					**63.82**	**1165.33**	**668.53**	**1172.63**	**86.33**	**3.97**

TABEL PENGUJIAN GRADASI BATAS TENGAH

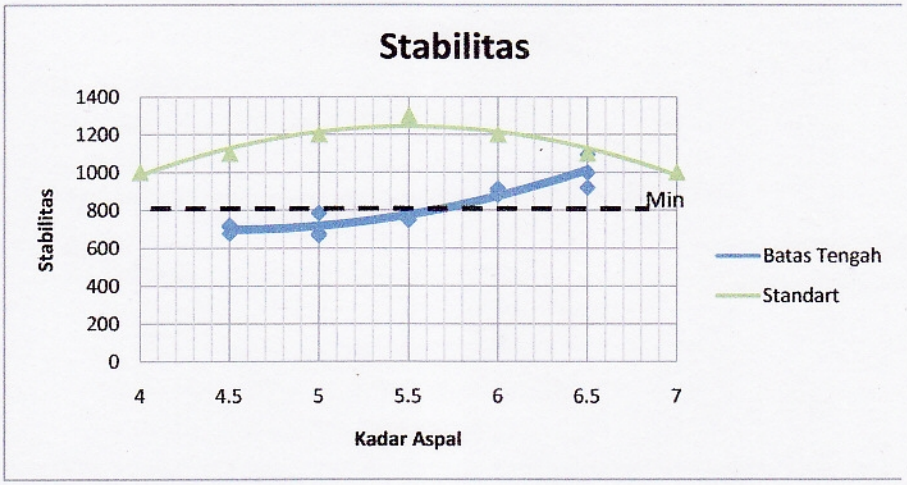
KADAR ASPAL (%)	NOMOR BENDA UJI	BERAT JENIS ASPAL	TINGGI BENDA UJI RERATA	BERAT JENIS (gr/cm3)		BERAT BENDA UJI			VOLUME BULK (cm3)	BERAT JENIS BULK GMB (gr/cm3)	% VOLUME		VMA
				GMM	GSE	DI UDARA (gr)	DI AIR (gr)	KONDISI SSD (gr)			ASPAL TERHADAP CAMPURAN	AGREGAT EFEKTIF TERHADAP	
A	B	C	D	E	F	G	H	I	J	K	L	M	N
	1	1.0317	74.50			1,204.60	674.40	1,239.90	565.50	2.1302	9.291	76.032	23.210
4.5	2	1.0317	75.17	2.497	2.676	1,209.80	677.60	1,236.30	558.7	2.1654	9.445	77.290	21.940
	3	1.0317	73.83			1,208.00	683.30	1,237.00	553.7	2.1817	9.516	77.871	21.352
RATA-RATA			74.50	2.497	2.676	1,207.47	678.43	1,237.73	559.30	2.1591	9.4173	77.064	22.168
	1	1.0317	72.10			1,194.20	676.50	1,216.40	539.9	2.2119	10.720	78.536	20.681
5	2	1.0317	72.87	2.478	2.676	1,195.40	674.50	1,220.90	546.40	2.1878	10.603	77.680	21.546
	3	1.0317	72.53			1,191.00	674.70	1,209.70	535	2.2262	10.789	79.043	20.169
RATA-RATA			72.50	2.478	2.676	1,193.53	675.23	1,215.67	540.43	2.2086	10.7037	78.420	20.799
	1	1.0317	71.93			1,187.00	664.90	1,202.70	537.8	2.2071	11.766	77.955	21.268
5.5	2	1.0317	69.93	2.460	2.676	1,189.80	668.80	1,199.30	530.5	2.2428	11.956	79.214	19.996
	3	1.0317	70.53			1,191.60	665.60	1,201.30	535.7	2.2244	11.858	78.564	20.653
RATA-RATA			70.80	2.460	2.676	1,189.47	666.43	1,201.10	534.67	2.2248	11.8603	78.578	20.639
	1	1.0317	66.27			1,180.10	672.80	1,188.80	516	2.2870	13.300	80.349	18.850
6	2	1.0317	67.47	2.442	2.676	1,194.30	680.60	1,203.30	522.70	2.2849	13.288	80.273	18.927
	3	1.0317	65.57			1,184.30	678.00	1,194.30	516.3	2.2938	13.340	80.588	18.609
RATA-RATA			66.43	2.442	2.676	1,186.23	677.13	1,195.47	518.33	2.2886	13.3095	80.403	18.795
	1	1.0317	64.33			1,170.70	671.30	1,178.00	506.70	2.3104	14.556	80.740	18.455
6.5	2	1.0317	63.43	2.424	2.676	1,159.00	665.00	1,166.50	501.5	2.3111	14.560	80.762	18.433
	3	1.0317	63.70			1,166.30	669.30	1,173.40	504.1	2.3136	14.577	80.851	18.343
RATA-RATA			63.82	2.424	2.676	1,165.33	668.53	1,172.63	504.10	2.3117	14.5644	80.784	18.410

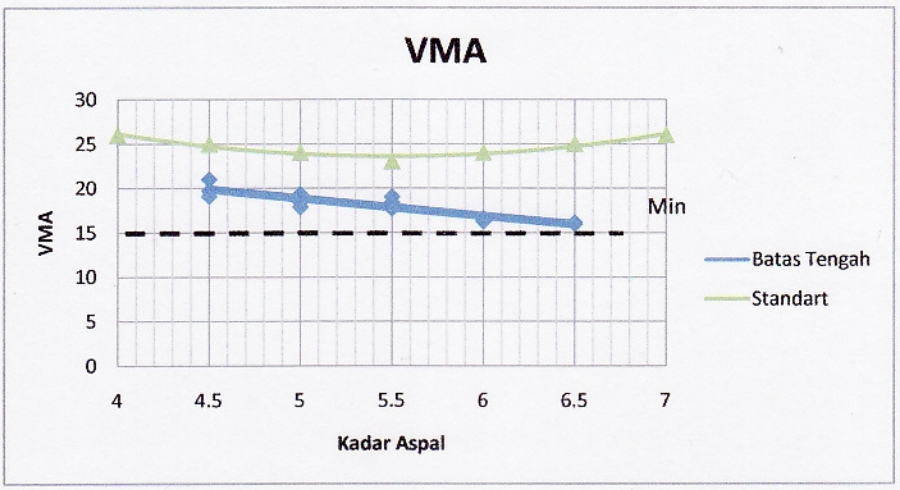
1	GSB = BERAT JENIS GABUNGAN		6	M =	(K x (100-A)) / F	Bj Teori Max =	4.5	2.4966
2	GSB =	2.649173	7	N =	100- ((K x (100-A)) / GSB		5.0	2.4781
3	F =	(100-A)/((100/E)-(A/C))	8	O =	(100 x (E-K)) / E		5.5	2.4600
5	L =	(A x K)/C	10				6.0	2.4421
							6.5	2.4245

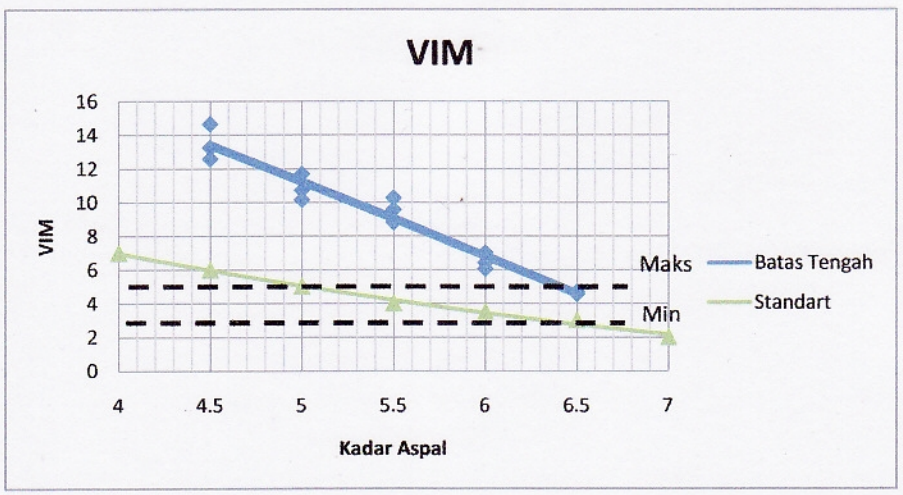
LANJUTAN **TABEL PENGUJIAN GRADASI BATAS TENGAH**

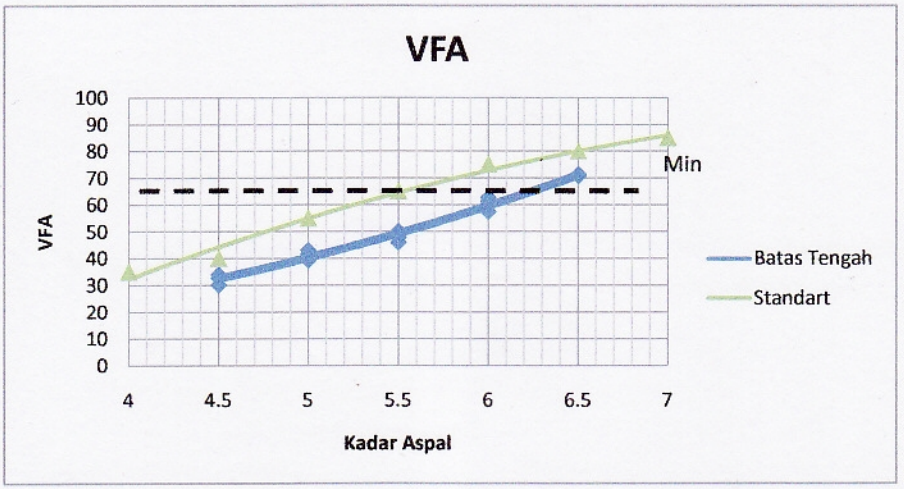
% PORI		STABILITAS				FLOW	MARSHALL QUOTIENT	KEPADATAN
VIM	VFA	BACA SEBELUM KOREKSI	ANGKA KALIBRASI ALAT	KORELASI TINGGI	NILAI SESUDAH KOREKSI	(mm)	(kg/mm)	(gr/cm3)
O	P	Q	R	S	T	U	V	W
14.677	36.7655	73.0	11.754	0.791	678.926	1.60	424.329	2.130
13.266	39.5372	73.0	11.754	0.830	712.175	3.20	222.555	2.165
12.613	40.9313	74.0	11.754	0.830	721.931	1.40	515.665	2.182
13.518	**39.078**	**73.3**	**11.754**	**0.817**	**704.344**	**2.07**	**387.516**	**2.159**
10.744	48.0483	71.0	11.754	0.811	677.016	5.20	130.195	2.212
11.717	45.6169	71.0	11.754	0.802	669.018	1.90	352.115	2.188
10.168	49.5860	83.0	11.754	0.806	786.156	3.60	218.377	2.226
10.8765	**47.7504**	**75.0**	**11.754**	**0.806**	**710.730**	**3.57**	**233.562**	**2.209**
10.279	51.6707	80.0	11.754	0.813	764.794	2.30	332.519	2.207
8.829	55.8444	76.0	11.754	0.838	748.887	3.20	234.027	2.243
9.578	53.6248	80.0	11.754	0.831	781.249	4.60	169.837	2.224
9.5620	**53.7133**	**78.7**	**11.754**	**0.828**	**764.976**	**3.37**	**245.461**	**2.225**
7.032	62.6973	81.5	11.754	0.938	898.678	3.80	236.494	2.287
6.439	65.9808	82.0	11.754	0.916	882.505	3.90	226.283	2.285
6.072	67.3703	82.0	11.754	0.951	916.841	3.40	269.659	2.294
6.5141	**65.3495**	**81.8**	**11.7540**	**0.935**	**899.341**	**3.70**	**244.146**	**2.289**
4.704	74.5138	80.0	11.754	0.979	920.730	3.50	263.066	2.310
4.678	74.6234	85.0	11.754	1.002	1000.755	4.10	244.087	2.311
4.572	75.0743	94.0	11.754	0.992	1095.976	4.30	254.878	2.314
4.6511	**74.7372**	**86.3**	**11.7540**	**0.991**	**1005.820**	**3.97**	**254.010**	**2.312**

Grafik Hasil Uji Marshall Batas Tengah





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60
50
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Batas Tengah
Standart
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4.5
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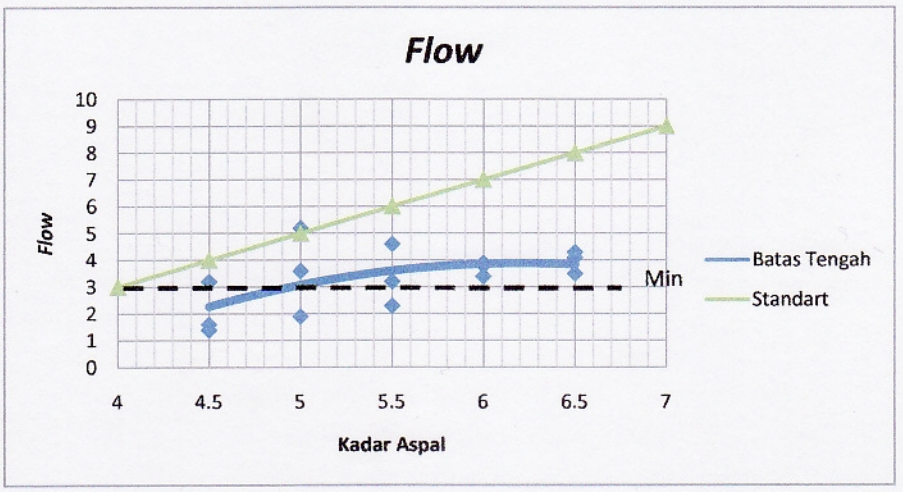
5.5
6
6.5
7
Kadar Aspal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Batas Tengah
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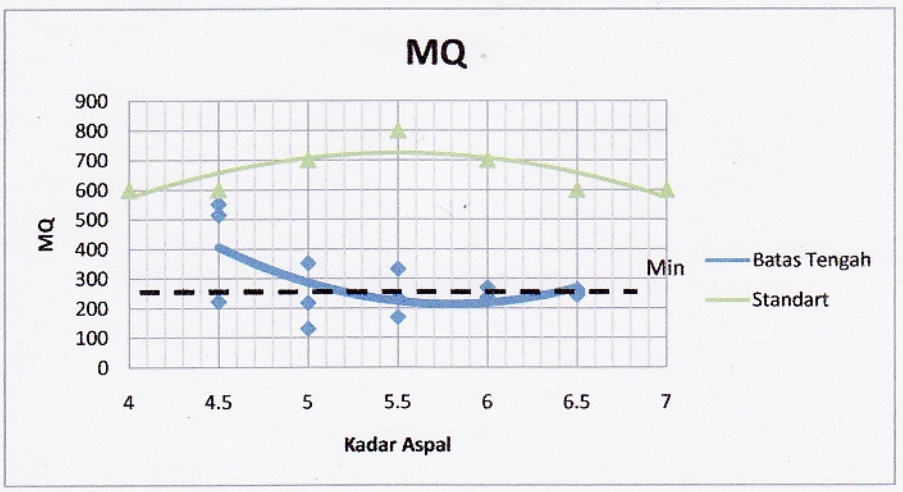
Kadar Aspal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Min
Batas Tengah
Standart
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5
5.5
6
6.5
7
Kadar Aspal

TABEL PERHITUNGAN JOB MIX FORMULA (JMF) UNTUK TAMBAHAN BATAS BAWAH

Tabel Pembagian Butir Agregat Halus dan Agregat Kasar Pada Gradasi Batas Bawah

Saringan	Diameter	% Lolos	%Tertahan	PB
3/4"	19	100		
1/2"	12.5	90	10	CA=
3/8"	9.5	72	18	
No.4	4.75	43	29	72
No.8	2.36	28	15	
No.16	1.18	19	9	
No.30	0.6	13	6	FA=
No.50	0.3	9	4	
No.100	0.15	6	3	24
No.200	0.075	4	2	
Pan	-		4	4

Kadar Aspal Ditentukan dengan Cara Menghitung Nilai Pb

Pb = (0.035 x CA) + (0.045 x FA) + (0.18 x Filler) + K

= (0.035 x 72) + (0.045 x 24) + (0.18 x 7) + 0.75

= 5.0700 ≈ 5.1 %

JMF

Fraksi	% Tertahan	Berat Jenis			% Penyerapan	BJ Terpakai	[2] / [7]
		Bulk	SSD	Apparent			
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Kasar	72.00	2.6513	2.6518	2.6528	0.0220	2.6528	27.14
Halus	24.00	2.5377	2.6039	2.7177	2.6104	2.6277	9.13
Filler	**4.00**					3.1500	1.27
Total							37.54

Kadar Aspal (%)	BJ Aspal (gr/cm^3)	[9] / [10]	Σ[8] x {(100-[9])/100}	[11] + [12]	BJ Teori Max 100 / [13]
9	**10**	**11**	**12**	**13**	**14**
4.10	1.0317	3.97	36.01	39.98	2.5013
4.60	1.0317	4.46	35.82	40.28	2.4829
5.10	1.0317	4.94	35.63	40.57	2.4647
5.60	1.0317	5.43	35.44	40.87	2.4468
6.10	1.0317	5.91	35.25	41.17	2.4291
6.60	1.0317	6.40	35.07	41.46	2.4117
7.10	1.0317	6.88	34.88	41.76	2.3946

Diameter Benda Uji = 10.16 cm

Tinggi Benda Uji = 6.35 cm

Volume Benda Uji = ¼ x π x d^2 x t

= ¼ x π x (10.16)^2 x (6.35) = 514.8148 cm^3

Contoh Perhitungan untuk Kadar Aspal 4.1% :

Berat Total = Volume Benda Uji x BJ Teori Max x 0.96

= 514.8148 x 2.5013 x 0.96 = 1236.2 gr

Berat Aspal = Kadar Aspal x Berat Total

= 4.1% x 1236.2 = 50.7 gr

Berat Agreg = Berat Total - Berat Aspal

= 1236.2 - 50.7 = 1185.5 gr

Catatan :

0.96 didapat dari : 100% - void = 100% - 4% = 96% = 0.96

Perhitungan Selanjutnya Ditabelkan.

Kadar Aspal	Berat (gr)		
	Total	Aspal	Agregat
4.10	1236.2	50.7	1185.5
4.60	1227.1	56.4	1170.6
5.10	1218.1	62.1	1156.0
5.60	1209.3	67.7	1141.5
6.10	1200.5	73.2	1127.3
6.60	1191.9	78.7	1113.3
7.10	1183.5	84.0	1099.4

JMF

Saringan	% Lolos	% Tertahan	Kadar Aspal (%)							Total Agregat
			4.10	4.60	5.10	5.60	6.10	6.60	7.10	
19	100	0	0	0	0	0	0	0	0	0
12.5	90	10	118.6	117.1	115.6	114.2	112.7	111.3	109.9	799.4
9.5	72	18	213.4	210.7	208.1	205.5	202.9	200.4	197.9	1438.9
4.75	43	29	343.8	339.5	335.2	331.0	326.9	322.8	318.8	2318.2
2.36	28	15	177.8	175.6	173.4	171.2	169.1	167.0	164.9	1199.1
1.18	19	9	106.7	105.4	104.0	102.7	101.5	100.2	98.9	719.4
0.6	13	6	71.1	70.2	69.4	68.5	67.6	66.8	66.0	479.6
0.3	9	4	47.4	46.8	46.2	45.7	45.1	44.5	44.0	319.7
0.15	6	3	35.6	35.1	34.7	34.2	33.8	33.4	33.0	239.8
0.075	4	2	23.7	23.4	23.1	22.8	22.5	22.3	22.0	159.9
Pan	0	4	47.4	46.8	46.2	45.7	45.1	44.5	44.0	319.7
Berat Total Agregat (gr)			1185.5	1170.6	1156.0	1141.5	1127.3	1113.3	1099.4	7993.7
Berat Aspal (gr)			50.7	56.4	62.1	67.7	73.2	78.7	84.0	310.2
Berat Total Benda Uji (gr)			1236.2	1227.1	1218.1	1209.3	1200.5	1191.9	1183.5	6091.2
BJ Teori Max			2.5013	2.4829	2.4647	2.4468	2.4291	2.4117	2.3946	-

Data Hasil Pengukuran & Pengujian Benda Uji Marshall Batas bawah

Kadar Aspal %	Nomor Benda Uji	Tinggi Benda Uji			Tinggi Benda Uji rata rata	Berat Kering (gr)	Berat Dalam air	Berat Jenuh	Pembacaan Stabilitas	Flow
		1	2	3	(mm)	(gram)	(gram)	(gram)	(kg)	(mm)
4.10	1	74	74	74	74.00	1,207.50	685.50	1,235.70	49.0	3.3
	2	73.5	72.5	73	73.00	1,202.60	675.60	1,226.50	65.0	2.3
	3	72	72.5	72.5	72.33	1,204.70	675.50	1,225.50	80.0	5.8
Rata-rata					**73.11**	**1204.93**	**678.87**	**1229.23**	**64.67**	**3.80**
4.60	1	73	73	73	73.00	1191.40	677.50	1222.90	48.0	3.6
	2	72	72	71.5	71.83	1,192.10	667.50	1,216.10	60.0	5.5
	3	72.5	72.5	72	72.33	1,198.10	673.00	1,222.30	55.0	2.8
Rata-rata					**72.39**	**1193.87**	**672.67**	**1220.43**	**54.33**	**3.97**
5.10	1	71	71.5	71.5	71.33	1,184.30	667.10	1,204.00	52.0	3.8
	2	70.5	71.5	71	71.00	1,189.10	665.80	1,208.10	58.0	2.0
	3	70	71	71.5	70.83	1,189.60	667.90	1,210.80	65.0	3.5
Rata-rata					**71.06**	**1187.67**	**666.93**	**1207.63**	**58.33**	**3.10**
5.60	1	66.6	65.9	66	66.17	1,130.90	638.10	1,137.50	116.0	7.8
	2	65.9	66	66	65.97	1,160.40	651.50	1,164.30	114.0	4.8
	3	65.3	66.1	65.9	65.77	1,139.60	638.50	1,147.50	98.0	5.9
Rata-rata					**65.97**	**1143.63**	**642.70**	**1149.77**	**109.33**	**6.17**
6.10	1	65.9	66.7	66.8	66.47	1,172.00	658.20	1,178.70	82.0	5.7
	2	66.1	65.6	65.7	65.80	1,172.20	661.80	1,176.20	100.0	5.8
	3	66	65.4	66.1	65.83	1157.30	650.50	1163.20	115.0	4.7
Rata-rata					**66.03**	**1167.17**	**656.83**	**1172.70**	**99.00**	**5.40**
6.6	1	67	66.9	66.4	66.77	1148.3	647.3	1163	85	7
	2	65.8	65.1	65	65.30	1152.1	646.8	1160.2	113	8
	3	66	65.9	66.1	66.00	1153.8	647.6	1164.5	98	7.1
Rata-rata					**66.02**	**1151.40**	**647.23**	**1162.57**	**98.67**	**7.37**
7.1	1	64	63.9	63.1	63.67	1146	646	1150.2	60	6
	2	64	63.2	63.4	63.53	1143.2	648.3	1147.8	102	7.5
	3	64	64.5	64.2	64.23	1141.4	642.3	1146.3	70	7.8
Rata-rata					**63.81**	**1143.53**	**645.53**	**1148.10**	**77.33**	**7.10**

TABEL PENGUJIAN GRADASI BATAS BAWAH

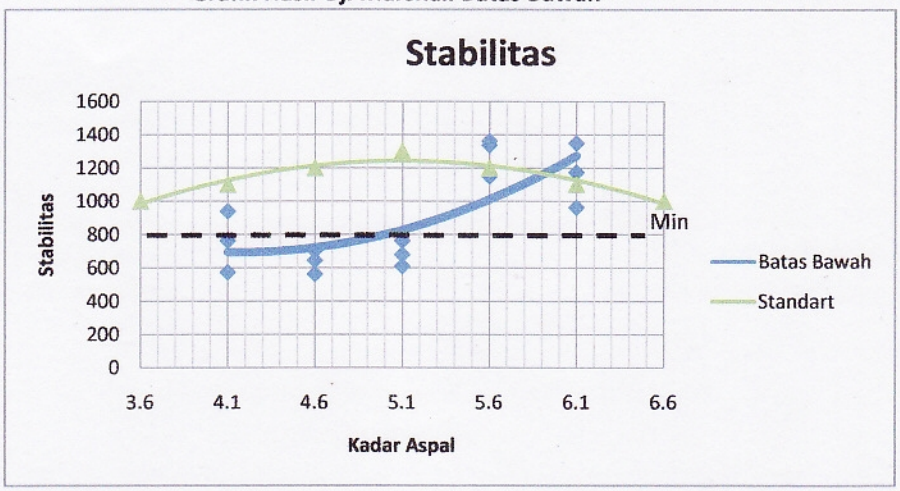
KADAR ASPAL (%)	NOMOR BENDA UJI	BERAT JENIS ASPAL	TINGGI BENDA UJI RERATA	BERAT JENIS (gr/cm3)		BERAT BENDA UJI			VOLUME BULK (cm3)	BERAT JENIS BULK GMB (gr/cm3)	% VOLUME		VMA
				GMM	GSE	DI UDARA (gr)	DI AIR (gr)	KONDISI SSD (gr)			ASPAL TERHADAP CAMPURAN	AGREGAT EFEKTIF TERHADAP	
A	B	C	D	E	F	G	H	I	J	K	L	M	N
	1	1.0317	74.00			1,207.50	685.50	1,235.70	550.20	2.19	8.72	79.02	20.55
4.10	2	1.0317	73.00	2.5013	2.6635	1,202.60	675.60	1,226.50	550.90	2.18	8.68	78.60	20.98
	3	1.0317	72.33			1,204.70	675.50	1,225.50	550.00	2.19	8.70	78.86	20.71
	RATA-RATA		**73.11**	**2.5013**	**2.6635**	**1,204.93**	**678.87**	**1,229.23**	**550.37**	**2.19**	**8.70**	**78.83**	**20.75**
	1	1.0317	73.00			1,191.40	677.50	1,222.90	545.40	2.18	9.74	78.24	21.34
4.60	2	1.0317	71.83	2.4829	2.6635	1,192.10	667.50	1,216.10	548.60	2.17	9.69	77.83	21.75
	3	1.0317	72.33			1,198.10	673.00	1,222.30	549.30	2.18	9.72	78.12	21.45
	RATA-RATA		**72.39**	**2.4829**	**2.6635**	**1,193.87**	**672.67**	**1,220.43**	**547.77**	**2.18**	**9.72**	**78.06**	**21.51**
	1	1.0317	71.33			1,184.30	667.10	1,204.00	536.90	2.21	10.90	78.59	20.98
5.10	2	1.0317	71.00	2.4647	2.6635	1,189.10	665.80	1,208.10	542.30	2.19	10.84	78.13	21.45
	3	1.0317	70.83			1,189.60	667.90	1,210.80	542.90	2.19	10.83	78.07	21.51
	RATA-RATA		**71.06**	**2.4647**	**2.6635**	**1,187.67**	**666.93**	**1,207.63**	**540.70**	**2.20**	**10.86**	**78.26**	**21.31**
	1	1.0317	66.17			1,130.90	638.10	1,137.50	499.40	2.26	12.29	80.26	19.31
5.60	2	1.0317	65.97	2.4468	2.6635	1,160.40	651.50	1,164.30	512.80	2.26	12.28	80.20	19.37
	3	1.0317	65.77			1,139.60	638.50	1,147.50	509.00	2.24	12.15	79.35	20.22
	RATA-RATA		**65.97**	**2.4468**	**2.6635**	**1,143.63**	**642.70**	**1,149.77**	**507.07**	**2.26**	**12.24**	**79.94**	**19.63**
	1	1.0317	66.47			1,172.00	658.20	1,178.70	520.50	2.25	13.31	79.38	20.19
6.10	2	1.0317	65.80	2.4291	2.6635	1,172.20	661.80	1,176.20	514.40	2.28	13.47	80.34	19.23
	3	1.0317	65.83			1,157.30	650.50	1,163.20	512.70	2.26	13.35	79.58	19.99
	RATA-RATA		**66.03**	**2.4291**	**2.6635**	**1,167.17**	**656.83**	**1,172.70**	**515.87**	**2.26**	**13.38**	**79.77**	**19.80**
	1	1.0317	66.77			1,148.30	647.30	1,163.00	515.70	2.23	14.24	78.08	97.09
6.60	2	1.0317	65.30	2.4117	2.6635	1,152.10	646.80	1,160.20	513.40	2.24	14.36	78.69	97.06
	3	1.0317	66.00			1,153.80	647.60	1,164.50	516.90	2.23	14.28	78.27	97.08
	RATA-RATA		**66.02**	**2.4117**	**2.6635**	**1,151.40**	**647.23**	**1,162.57**	**515.33**	**2.23**	**14.29**	**78.35**	**97.08**
	1	1.0317	63.67			1,146.00	646.00	1,150.20	504.20	2.27	15.64	79.28	97.04
7.10	2	1.0317	63.53	2.3946	2.6635	1,143.20	648.30	1,147.80	499.50	2.29	15.75	79.83	97.02
	3	1.0317	64.23			1,141.40	642.30	1,146.30	504.00	2.26	15.59	78.99	97.05
	RATA-RATA		**63.81**	**2.3946**	**2.6635**	**1,143.53**	**645.53**	**1,148.10**	**502.57**	**2.28**	**15.66**	**79.36**	**97.04**

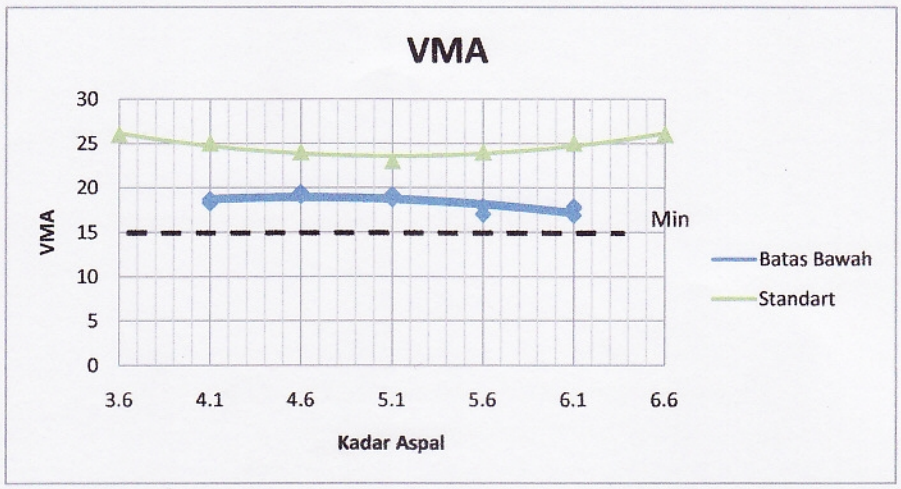
1	GSB = BERAT JENIS GABUNGAN		6	M =	(K x (100-A)) / F		Bj Teori Max =	4.1	2.5013
2	GSB =	2.649173	7	N =	100- ((K x (100-A)) / GSB			4.6	2.4829
3	F =	(100-A)/((100/E)-(A/C))	8	O =	(100 x (E-K)) / E			5.1	2.4647
5	L =	(A x K)/C	10					5.6	2.4468
								6.1	2.4291
								6.6	2.4117
								7.1	2.3946

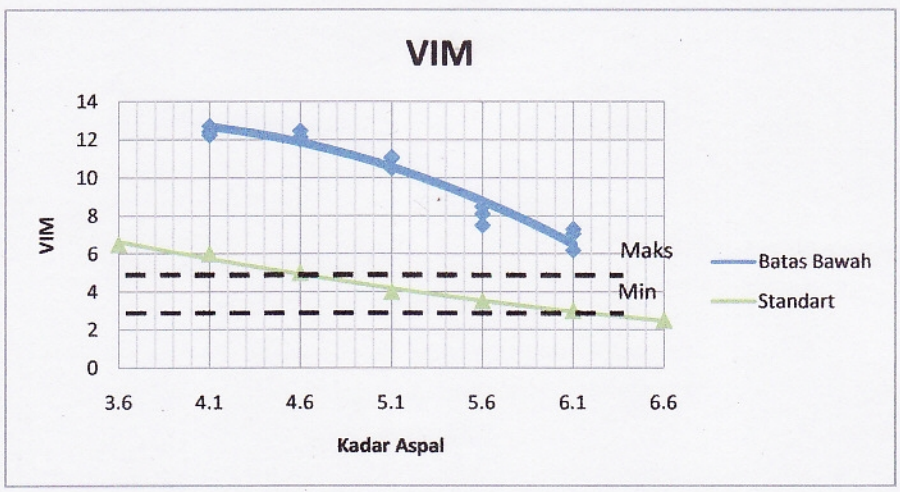
LANJUTAN **TABEL PENGUJIAN GRADASI BATAS BAWAH**

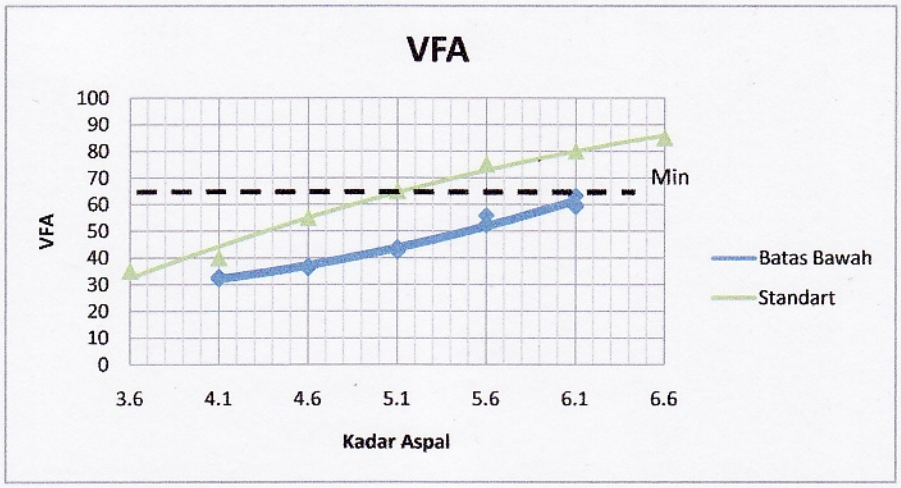
% PORI		STABILITAS				FLOW	MARSHALL QUOTIENT	KEPADATAN
VIM	VFA	BACA SEBELUM KOREKSI	ANGKA KALIBRASI ALAT	KORELASI TINGGI	NILAI SESUDAH KOREKSI	(mm)	(kg/mm)	(gr/cm3)
O	P	Q	R	S	T	U	V	W
12.26	40.35	49.0	11.75	0.80	459.32	3.3	139.19	2.19
12.73	39.33	65.0	11.75	0.83	637.42	2.3	277.14	2.18
12.43	39.97	80.0	11.75	0.82	769.50	5.8	132.67	2.19
12.47	**39.88**	**64.67**	**11.75**	**0.82**	**622.08**	**3.80**	**183.00**	**2.19**
12.02	43.67	48.0	11.75	0.80	451.35	3.6	125.38	2.18
12.48	42.61	60.0	11.75	0.81	574.48	5.5	104.45	2.17
12.15	43.36	55.0	11.75	0.81	522.56	2.8	186.63	2.18
12.22	**43.21**	**54.33**	**11.75**	**0.81**	**516.13**	**3.97**	**138.82**	**2.18**
10.50	49.94	52.0	11.75	0.82	501.70	3.8	132.03	2.21
11.04	48.56	58.0	11.75	0.83	562.43	2.0	281.21	2.19
11.10	48.40	65.0	11.75	0.83	631.90	3.5	180.54	2.19
10.88	**48.97**	**58.33**	**11.75**	**0.82**	**565.34**	**3.10**	**197.93**	**2.20**
8.12	57.93	116.0	11.75	0.94	1,281.66	3.8	337.28	2.26
7.52	61.18	114.0	11.75	0.94	1,264.58	3.6	351.27	2.26
8.50	57.98	98.0	11.75	0.95	1,091.42	4.0	272.85	2.24
8.04	**59.03**	**109.33**	**11.75**	**0.94**	**1,212.55**	**3.80**	**320.47**	**2.26**
7.31	63.81	82.0	11.75	0.93	892.34	3.9	228.81	2.25
6.19	67.81	100.0	11.75	0.94	1,107.81	4.6	240.83	2.28
7.08	64.61	115.0	11.75	0.94	1,272.86	4.7	270.82	2.26
6.86	**65.41**	**99.00**	**11.75**	**0.94**	**1,091.01**	**4.40**	**246.82**	**2.26**
8.33	91.42	85.0	11.75	0.93	927.90	3.8	244.19	2.23
6.95	92.84	113.0	11.75	0.96	1,270.09	3.6	352.80	2.24
7.45	92.33	98.0	11.75	0.94	1,086.38	4.0	271.59	2.23
7.58	**92.19**	**98.67**	**11.75**	**0.94**	**1,094.79**	**3.80**	**289.53**	**2.23**
5.08	94.76	60.0	11.75	1.00	702.30	3.9	180.08	2.27
4.42	95.44	102.0	11.75	1.00	1,197.91	4.6	260.41	2.29
5.43	94.41	70.0	11.75	0.98	807.70	7.8	103.55	2.26
4.98	**94.87**	**77.33**	**11.75**	**0.99**	**902.64**	**5.43**	**181.35**	**2.28**

Grafik Hasil Uji Marshall Batas Bawah





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60
50
40
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20
10
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VFA
Min
Batas Bawah
Standart
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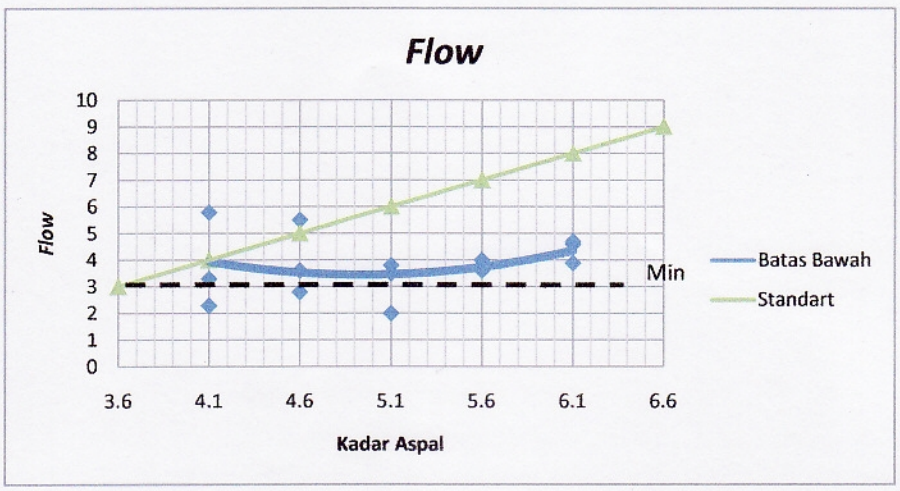
4.1
4.6
5.1
5.6
6.1
6.6
Kadar Aspal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Flow
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Batas Bawah
Standart
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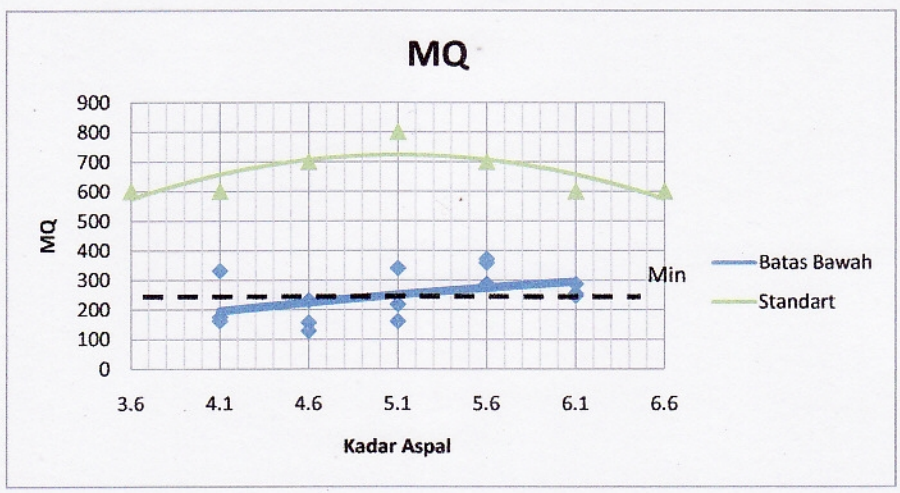
5.1
5.6
6.1
6.6
Kadar Aspal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300
200
100
0
MQ
Min
Batas Bawah
Standart
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4.1
4.6
5.1
5.6
6.1
6.6
Kadar Aspal

TABEL PERHITUNGAN JOB MIX FORMULA (JMF) DENGAN KAO

Tabel Pembagian Butir Agregat Halus dan Agregat Kasar Pada Gradasi Batas Tengah

Saringan	Diameter	% Lolos	%Tertahan	PB
3/4"	19	100		
1/2"	12.5	95	5	CA=
3/8"	9.5	81	14	
No.4	4.75	53	28	66.45
No.8	2.36	33.55	19.45	
No.16	1.18	22.3	11.25	
No.30	0.6	16.05	6.25	FA=
No.50	0.3	12.25	3.8	
No.100	0.15	9.5	2.75	26.55
No.200	0.075	7	2.5	
Pan	-	0	7	7

Kadar Aspal Optimum = 6.75%

JMF

Fraksi	% Tertahan	Berat Jenis			% Penyerapan	BJ Terpakai	[2] / [7]
		Bulk	SSD	Apparent			
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Kasar	66.45	2.6513	2.6518	2.6528	0.0220	2.6528	25.05
Halus	26.55	2.5377	2.6039	2.7177	2.6104	2.6277	10.10
Filler	**7.00**					3.1500	2.22
Total							37.38

Kadar Aspal (%)	BJ Aspal (gr/cm^3)	[9] / [10]	Σ[8] x {(100-[9])/100}	[11] + [12]	BJ Teori Max 100 / [13]
9	**10**	**11**	**12**	**13**	**14**
6.75	1.0317	6.54	34.85	41.39	2.4158

Diameter Benda Uji = 10.16 cm

Tinggi Benda Uji = 6.35 cm

Volume Benda Uji = ¼ x π x d^2 x t

= ¼ x π x (10.16)^2 x (6.35) = 514.8148 cm^3

Perhitungan untuk Kadar Aspal Optimum 6.75 % :

Berat Total = Volume Benda Uji x BJ Teori Max x 0.96

= 514.8148 x 2.4158 x 0.96 = 1193.9 gr

Berat Aspal = Kadar Aspal x Berat Total

= 6.75% x 1193.9 = 80.6 gr

Berat Agregat = Berat Total - Berat Aspal

= 1193.9 - 80.6 = 1113.3 gr

Catatan :

0.96 didapat dari : 100% - void = 100% - 4% = 96% = 0.96

JMF

Saringan	% Lolos	% Tertahan	Kadar Aspal (%) 6.75	Total 15 Benda uji
19	100	0	0	0
12.5	95.00	5.00	55.7	835
9.5	81.00	14.00	155.9	2338
4.75	53.00	28.00	311.7	4676
2.36	33.55	19.45	216.5	3248
1.18	22.30	11.25	125.2	1879
0.6	16.05	6.25	69.6	1044
0.3	12.25	3.80	42.3	635
0.15	9.50	2.75	30.6	459
0.075	7.00	2.50	27.8	417
Pan	0	7	77.9	1169
Berat Total Agregat (gr)			1113.3	16700.0
Berat Aspal (gr)			80.6	1208.8
Berat Total Benda Uji (gr)			1193.9	17908.8
BJ Teori Max			2.4158	-

Data Hasil Pengukuran & Pengujian Benda Uji Marshall Batas Tengah (KAO = 6.75%)

Variasi Tumbukan	Nomor Benda Uji	Tinggi Benda Uji			Tinggi Benda Uji rata rata	Berat Kering (gr)	Berat Dalam air	Berat Jenuh	Pembacaan Stabilitas	Flow
		1	2	3	(mm)	(gram)	(gram)	(gram)	(kg)	(mm)
2x55	1	65	65.1	64.9	65.00	1,149.50	654.50	1,158.20	94.0	4.8
	2	65.3	65.4	65	65.23	1,153.30	651.70	1,161.20	79.0	3.5
	3	65	64.9	65	64.97	1,148.40	649.70	1,157.50	81.0	4.1
Rata-rata					**65.07**	**1150.40**	**651.97**	**1158.97**	**84.67**	**4.13**
2x65	1	64.6	64.2	63.9	64.23	1147.60	654.70	1154.20	95.0	5.0
	2	64	64.1	63.9	64.00	1,149.80	657.10	1,157.10	85.0	5.0
	3	64.1	63.9	63.7	63.90	1,141.20	648.50	1,148.10	93.0	4.5
Rata-rata					**64.04**	**1146.20**	**653.43**	**1153.13**	**91.00**	**4.83**
2x75	1	63.6	63.5	63.3	63.47	1,145.90	654.40	1,152.00	108.0	4.0
	2	63.2	63.3	63.5	63.33	1,148.10	655.70	1,154.60	111.0	4.4
	3	64.4	63.5	63.8	63.90	1,151.50	655.20	1,158.20	105.0	4.3
Rata-rata					**63.57**	**1148.50**	**655.10**	**1154.93**	**108.00**	**4.23**
2x85	1	62.8	63.2	63.5	63.17	1,140.70	650.90	1,146.10	91.0	5.0
	2	64.7	64.3	64.1	64.37	1,143.70	648.40	1,150.00	91.0	5.0
	3	63.4	63.6	63.4	63.47	1,141.60	651.10	1,146.90	102.0	4.5
Rata-rata					**63.67**	**1142.00**	**650.13**	**1147.67**	**94.67**	**4.83**
2x95	1	61.8	62	62.2	62.00	1,162.10	670.00	1,165.90	122.0	5.9
	2	62.5	61.8	62.5	62.27	1,136.40	652.50	1,141.00	101.0	5.7
	3	64.4	65	64.7	64.70	1176.50	671.20	1181.00	118.0	5.4
Rata-rata					**62.99**	**1158.33**	**664.57**	**1162.63**	**113.67**	**5.67**

TABEL PENGUJIAN GRADASI BATAS TENGAH

Variasi Jumlah Tumbukan	KADAR ASPAL (%)	NOMOR BENDA UJI	BERAT JENIS ASPAL	TINGGI BENDA UJI RERATA	BERAT JENIS (gr/cm3)		BERAT BENDA UJI			VOLUME BULK (cm3)	BERAT JENIS BULK (gr/cm3)	% VOLUME		VMA
					GMM	GSE	DI UDARA (gr)	DI AIR (gr)	KONDISI SSD (gr)			ASPAL TERHADAP CAMPURAN	AGREGAT EFEKTIF TERHADAP CAMPURAN	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
		1	1.0317	65.00			1,149.50	654.50	1,158.20	503.70	2.2821	14.931	79.535	19.670
2x55	6.75	2	1.0317	65.23	2.4158	2.676	1,153.30	651.70	1,161.20	509.5	2.2636	14.810	78.890	20.322
		3	1.0317	64.97			1,148.40	649.70	1,157.50	507.8	2.2615	14.796	78.817	20.395
	RATA-RATA			**65.07**	**2.4158**	**2.676**	**1,150.40**	**651.97**	**1,158.97**	**507.00**	**2.2691**	**14.8456**	**79.081**	**20.129**
		1	1.0317	64.23			1,147.60	654.70	1,154.20	499.5	2.2975	15.032	80.071	19.129
2x65	6.75	2	1.0317	64.00	2.4158	2.676	1,149.80	657.10	1,157.10	500.00	2.2996	15.045	80.145	19.055
		3	1.0317	63.90			1,141.20	648.50	1,148.10	499.6	2.2842	14.945	79.609	19.596
	RATA-RATA			**64.04**	**2.4158**	**2.676**	**1,146.20**	**653.43**	**1,153.13**	**499.70**	**2.2938**	**15.0073**	**79.942**	**19.260**
		1	1.0317	63.47			1,145.90	654.40	1,152.00	497.6	2.3029	15.067	80.258	18.940
2x75	6.75	2	1.0317	63.33	2.4158	2.676	1,148.10	655.70	1,154.60	498.9	2.3013	15.056	80.203	18.996
		3	1.0317	63.90			1,151.50	655.20	1,158.20	503	2.2893	14.978	79.784	19.419
	RATA-RATA			**63.57**	**2.4158**	**2.676**	**1,148.50**	**655.10**	**1,154.93**	**499.83**	**2.2978**	**15.0335**	**80.082**	**19.118**
		1	1.0317	63.17			1,140.70	650.90	1,146.10	495.2	2.3035	15.071	80.281	18.917
2x85	6.75	2	1.0317	64.37	2.4158	2.676	1,143.70	648.40	1,150.00	501.60	2.2801	14.918	79.465	19.741
		3	1.0317	63.47			1,141.60	651.10	1,146.90	495.8	2.3025	15.065	80.247	18.951
	RATA-RATA			**63.67**	**2.4158**	**2.676**	**1,142.00**	**650.13**	**1,147.67**	**497.53**	**2.2954**	**15.0178**	**79.998**	**19.203**
		1	1.0317	62.00			1,162.10	670.00	1,165.90	495.90	2.3434	15.332	81.672	17.513
2x95	6.75	2	1.0317	62.27	2.4158	2.676	1,136.40	652.50	1,141.00	488.5	2.3263	15.220	81.075	18.115
		3	1.0317	64.70			1,176.50	671.20	1,181.00	509.8	2.3078	15.099	80.429	18.767
	RATA-RATA			**62.99**	**2.4158**	**2.676**	**1,158.33**	**664.57**	**1,162.63**	**498.07**	**2.3258**	**15.2170**	**81.059**	**18.132**

1	GSB = BERAT JENIS GABUNGAN	6	M =	(K x (100-A)) / F	Bj Teori Max =	6.75	2.4158
2	GSB = 2.649173	7	N =	100- ((K x (100-A)) / GSB		6.75	2.4158
3	F = (100-A)/((100/E)-(A/C))	8	O =	(100 x (E-K)) / E		6.75	2.4158
5	L = (A x K)/C	10				6.75	2.4158
						6.75	2.4158

% PORI		STABILITAS				FLOW	MARSHALL QUOTIENT	KEPADATAN
VIM	VFA	BACA SEBELUM KOREKSI	ANGKA KALIBRASI ALAT	KORELASI TINGGI	NILAI SESUDAH KOREKSI	(mm)	(kg/mm)	(gr/cm3)
O	P	Q	R	S	T	U	V	W
5.534	71.8670	94.0	11.754	0.963	1063.443	4.80	221.551	2.282
6.301	68.9970	79.0	11.754	1.000	928.566	3.50	265.305	2.264
6.386	68.6874	81.0	11.754	1.000	952.074	4.10	232.213	2.262
6.074	**69.850**	**84.7**	**11.754**	**0.988**	**981.361**	**4.13**	**239.689**	**2.269**
4.897	74.3998	95.0	11.754	0.982	1096.158	5.00	219.232	2.297
4.810	74.7571	85.0	11.754	0.988	986.601	5.00	197.320	2.300
5.446	72.2068	93.0	11.754	0.990	1082.191	4.50	240.487	2.284
5.0511	**73.7879**	**91.0**	**11.754**	**0.986**	**1054.984**	**4.83**	**219.013**	**2.294**
4.675	75.3155	108.0	11.754	1.001	1270.490	4.00	317.622	2.303
4.741	75.0416	111.0	11.754	1.004	1310.130	4.40	297.757	2.301
5.238	73.0268	105.0	11.754	0.990	1221.828	4.30	284.146	2.289
4.8848	**74.4613**	**108.0**	**11.754**	**0.998**	**1267.483**	**4.23**	**299.842**	**2.298**
4.648	75.4297	91.0	11.754	1.008	1078.527	5.00	215.705	2.304
5.617	71.5465	91.0	11.754	0.978	1046.439	5.00	209.288	2.280
4.688	75.2616	102.0	11.754	1.001	1199.907	4.50	266.646	2.303
4.9844	**74.0793**	**94.7**	**11.7540**	**0.996**	**1108.291**	**4.83**	**230.546**	**2.295**
2.996	82.8907	122.0	11.754	1.038	1487.763	5.90	252.163	2.343
3.705	79.5495	101.0	11.754	1.031	1223.758	5.70	214.694	2.326
4.472	76.1719	118.0	11.754	1.013	1404.694	5.40	260.129	2.308
3.7242	**79.5374**	**113.7**	**11.7540**	**1.027**	**1372.072**	**5.67**	**242.329**	**2.326**

Data Hasil Pengukuran & Pengujian Benda Uji Marshall Batas Bawah (KAO = 7.1%)

Variasi Tumbukan	Nomor Benda Uji	Tinggi Benda Uji			Tinggi Benda Uji rata rata	Berat Kering (gr)	Berat Dalam air	Berat Jenuh	Pembacaan Stabilitas	Flow
		1	2	3	(mm)	(gram)	(gram)	(gram)	(kg)	(mm)
2x55	1	64	64.3	64.9	64.40	1,107.80	628.20	1,119.40	68.0	5.1
	2	69.8	72.4	71.3	71.17	1,123.90	638.10	1,143.00	32.0	4.3
	3	64.7	65	63.6	64.43	1,117.30	634.10	1,126.40	115.0	10.5
Rata-rata					**66.67**	**1116.33**	**633.47**	**1129.60**	**71.67**	**6.63**
2x65	1	64.6	65.1	64.6	64.77	1132.80	644.80	1141.30	75.0	5.5
	2	65	65.9	65.7	65.53	1,135.80	641.60	1,146.30	85.0	5.0
	3	64.7	64.5	64.7	64.63	1,121.50	639.10	1,131.30	110.0	6.4
Rata-rata					**64.98**	**1130.03**	**641.83**	**1139.63**	**90.00**	**5.63**
2x75	1	63.7	64	64.2	63.97	1,126.30	641.70	1,135.90	88.0	6.7
	2	63.7	64	63.6	63.77	1,140.40	654.80	1,147.40	95.0	3.7
	3	63.7	63.4	63.3	63.47	1,134.70	649.10	1,143.00	88.0	4.9
Rata-rata					**63.73**	**1133.80**	**648.53**	**1142.10**	**90.33**	**5.10**
2x85	1	65.6	65.9	66	65.83	1,131.50	642.50	1,138.60	65.0	4.4
	2	64	64.3	63.5	63.93	1,132.00	645.90	1,140.10	75.0	5.3
	3	63.2	64.6	63.9	63.90	1,138.60	650.60	1,145.80	93.0	5.4
Rata-rata					**64.56**	**1134.03**	**646.33**	**1141.50**	**77.67**	**5.03**
2x95	1	63.5	63.4	64.5	63.80	1,135.70	647.10	1,140.50	111.0	4.5
	2	63.8	64	63.9	63.90	1,132.90	646.20	1,138.50	105.0	5.2
	3	63.9	64	64.2	64.03	1134.30	648.40	1140.10	108.0	4.3
Rata-rata					**63.91**	**1134.30**	**647.23**	**1139.70**	**108.00**	**4.67**

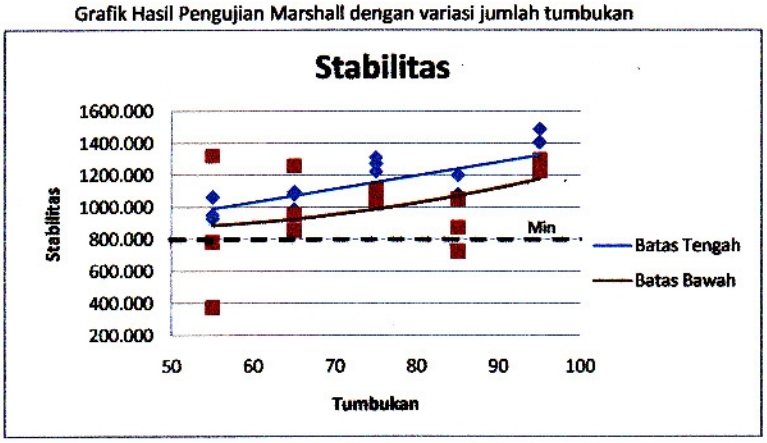
TABEL PENGUJIAN GRADASI BATAS BAWAH

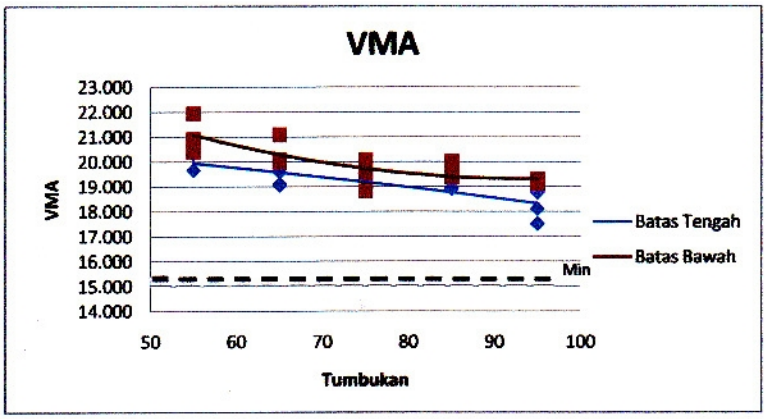
Variasi Jumlah Tumbukan	KADAR ASPAL (%)	NOMOR BENDA UJI	BERAT JENIS ASPAL	TINGGI BENDA UJI RERATA	BERAT JENIS (gr/cm3)		BERAT BENDA UJI			VOLUME BULK (cm3)	BERAT JENIS BULK (gr/cm3)	% VOLUME		VMA
					GMM	GSE	DI UDARA (gr)	DI AIR (gr)	KONDISI SSD (gr)			ASPAL TERHADAP CAMPURAN	AGREGAT EFEKTIF TERHADAP CAMPURAN	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
		1	1.0317	64.40			1,107.80	628.20	1,119.40	491.20	2.26	15.52	78.66	20.91
2x55	7.10	2	1.0317	71.17	2.3946	2.6635	1,123.90	638.10	1,143.00	504.90	2.23	15.32	77.64	21.94
		3	1.0317	64.43			1,117.30	634.10	1,126.40	492.30	2.27	15.62	79.16	20.41
	RATA-RATA			**66.67**	**2.3946**	**2.6635**	**1,116.33**	**633.47**	**1,129.60**	**496.13**	**2.25**	**15.49**	**78.49**	**21.09**
		1	1.0317	64.77			1,132.80	644.80	1,141.30	496.50	2.28	15.70	79.58	19.99
2x65	7.10	2	1.0317	65.53	2.3946	2.6635	1,135.80	641.60	1,146.30	504.70	2.25	15.49	78.49	21.08
		3	1.0317	64.63			1,121.50	639.10	1,131.30	492.20	2.28	15.68	79.47	20.10
	RATA-RATA			**64.98**	**2.3946**	**2.6635**	**1,130.03**	**641.83**	**1,139.63**	**497.80**	**2.27**	**15.62**	**79.18**	**20.39**
		1	1.0317	63.97			1,126.30	641.70	1,135.90	494.20	2.28	15.68	79.49	20.08
2x75	7.10	2	1.0317	63.77	2.3946	2.6635	1,140.40	654.80	1,147.40	492.60	2.32	15.93	80.75	18.82
		3	1.0317	63.47			1,134.70	649.10	1,143.00	493.90	2.30	15.81	80.13	19.43
	RATA-RATA			**63.73**	**2.3946**	**2.6635**	**1,133.80**	**648.53**	**1,142.10**	**493.57**	**2.30**	**15.81**	**80.12**	**19.44**
		1	1.0317	65.83			1,131.50	642.50	1,138.60	496.10	2.28	15.70	79.55	20.02
2x85	7.10	2	1.0317	63.93	2.3946	2.6635	1,132.00	645.90	1,140.10	494.20	2.29	15.76	79.89	19.68
		3	1.0317	63.90			1,138.60	650.60	1,145.80	495.20	2.30	15.82	80.20	19.37
	RATA-RATA			**64.56**	**2.3946**	**2.6635**	**1,134.03**	**646.33**	**1,141.50**	**495.17**	**2.29**	**15.76**	**79.88**	**19.69**
		1	1.0317	63.80			1,135.70	647.10	1,140.50	493.40	2.30	15.84	80.28	19.28
2x95	7.10	2	1.0317	63.90	2.3946	2.6635	1,132.90	646.20	1,138.50	492.30	2.30	15.84	80.26	19.30
		3	1.0317	64.03			1,134.30	648.40	1,140.10	491.70	2.31	15.88	80.46	19.10
	RATA-RATA			**63.91**	**2.3946**	**2.6635**	**1,134.30**	**647.23**	**1,139.70**	**492.47**	**2.30**	**15.85**	**80.34**	**19.23**

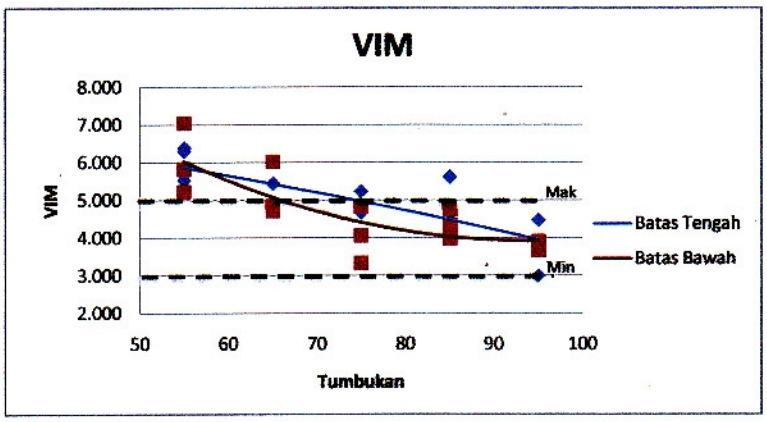
1	GSB = BERAT JENIS GABUNGAN		6	M =	(K x (100-A)) / F	Bj Teori Max =	7.1	2.3946
2	GSB =	2.649173	7	N =	100- ((K x (100-A)) / GSB		7.1	2.3946
3	F =	(100-A)/((100/E)-(A/C))	8	O =	(100 x (E-K)) / E		7.1	2.3946
5	L =	(A x K)/C	10				7.1	2.3946
							7.1	2.3946

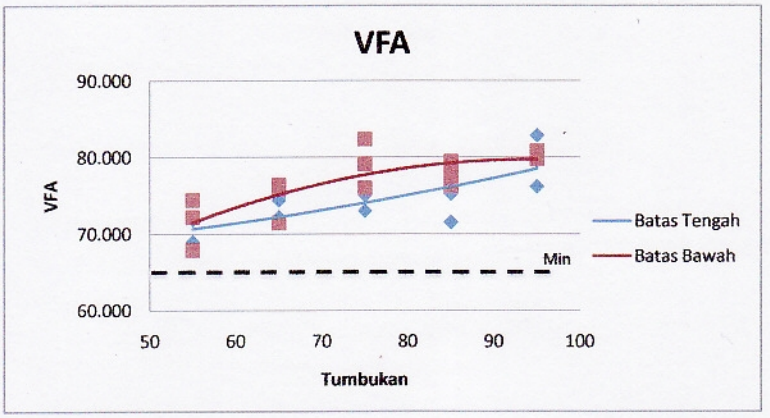
% PORI		STABILITAS				FLOW	MARSHALL QUOTIENT	KEPADATAN
VIM	VFA	BACA SEBELUM KOREKSI	ANGKA KALIBRASI ALAT	KORELASI TINGGI	NILAI SESUDAH KOREKSI	(mm)	(kg/mm)	(gr/cm3)
O	P	Q	R	S	T	U	V	W
5.82	72.18	68.0	11.75	0.98	781.29	5.1	153.19	2.26
7.04	67.91	32.0	11.75	0.99	373.93	4.3	86.96	2.23
5.22	74.42	115.0	11.75	0.98	1,320.17	10.5	125.73	2.27
6.03	**71.50**	**71.67**	**11.75**	**0.98**	**825.13**	**6.63**	**121.96**	**2.25**
4.72	76.39	75.0	11.75	0.97	853.63	5.5	155.21	2.28
6.02	71.45	85.0	11.75	0.95	951.01	5.0	190.20	2.25
4.85	75.88	110.0	11.75	0.97	1,256.31	6.4	196.30	2.28
5.20	**74.57**	**90.00**	**11.75**	**0.96**	**1,020.32**	**5.63**	**180.57**	**2.27**
4.83	75.97	88.0	11.75	0.99	1,022.28	6.7	152.58	2.28
3.32	82.35	95.0	11.75	0.99	1,109.19	3.7	299.78	2.32
4.06	79.12	88.0	11.75	1.00	1,035.21	4.9	211.27	2.30
4.07	**79.14**	**90.33**	**11.75**	**0.99**	**1,055.56**	**5.10**	**221.21**	**2.30**
4.75	76.26	65.0	11.75	0.95	722.94	4.4	164.31	2.28
4.34	77.92	75.0	11.75	0.99	872.00	5.3	164.53	2.29
3.98	79.45	93.0	11.75	0.96	1,049.40	5.4	194.33	2.30
4.36	**77.88**	**77.67**	**11.75**	**0.97**	**881.45**	**5.03**	**174.39**	**2.29**
3.88	79.90	111.0	11.75	0.99	1,294.91	4.5	287.76	2.30
3.90	79.80	105.0	11.75	0.99	1,221.83	5.2	234.97	2.30
3.66	80.83	108.0	11.75	0.99	1,252.51	4.3	291.28	2.31
3.81	**80.17**	**108.00**	**11.75**	**0.99**	**1,256.41**	**4.67**	**271.34**	**2.30**

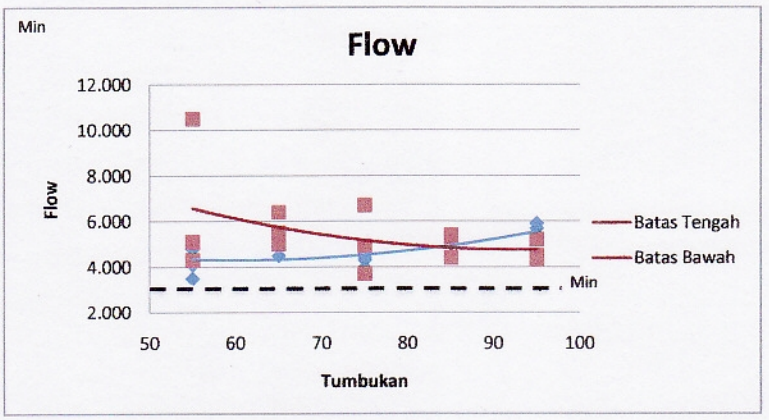
Grafik Hasil Pengujian Marshall dengan variasi jumlah tumbukan

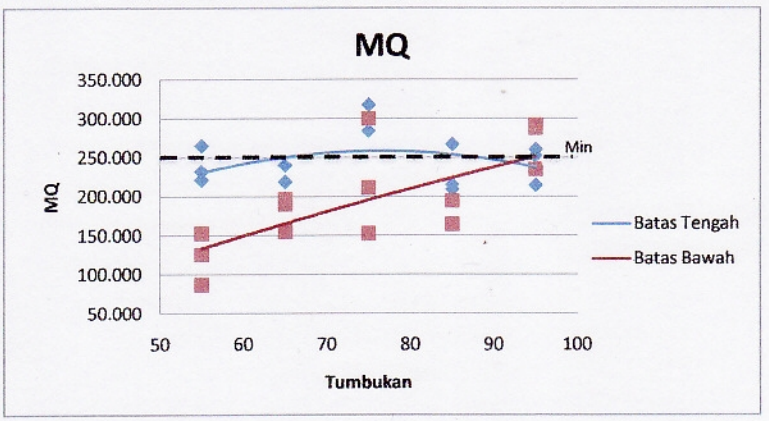







VFA
90.000
80.000
70.000
60.000
VFA
50
60
70
80
90
100
Tumbukan
Min
Batas Tengah
Batas Bawah


Min
Flow
12.000
10.000
8.000
6.000
4.000
2.000
Flow
50
60
70
80
90
100
Tumbukan
Min
Batas Tengah
Batas Bawah


MQ
350.000
300.000
250.000
200.000
150.000
100.000
50.000
MQ
50
60
70
80
90
100
Tumbukan
Min
Batas Tengah
Batas Bawah

Lampiran C

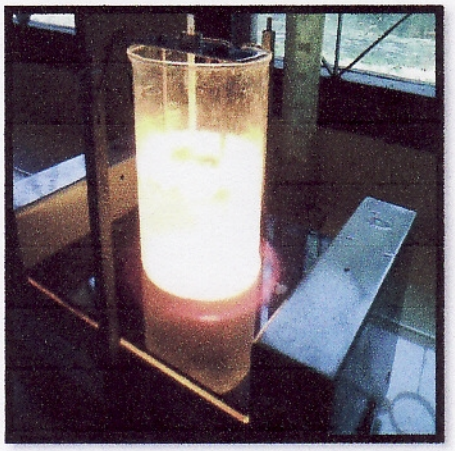
VARIASI JUMLAH TUMBUKAN TERHADAP
KARAKTERISTIK AC-WC GRADASI KASAR DENGAN
SUHU IDEAL PENCAMPURAN ASPAL

LABORATORIUM INTI JALAN RAYA
FAKULTAS TEKNIK JURUSAN TEKNIK SIPIL
UNIVERSITAS LAMPUNG
Jl. Prof. Dr. Sumantri Brojonegoro No. 1 Bandar Lampung

FOTO-FOTO DALAM PELAKSANAAN PENELITIAN

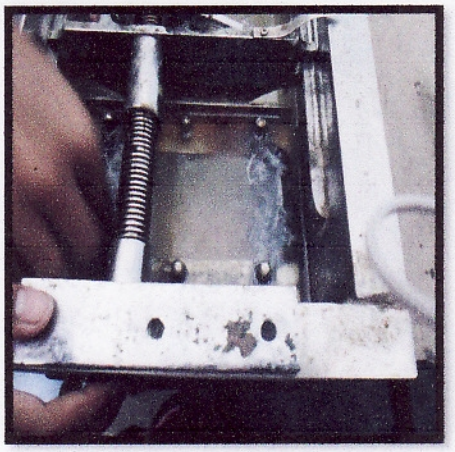
Nama : Andi Syah Putra S
NPM : 0915011038
Judul Skripsi : VARIASI JUMLAH TUMBUKAN TERHADAP KARAKTERISTIK AC-WC GRADASI KASAR DENGAN SUHU IDEAL PENCAMPURAN ASPAL

Penetrasi Bitumen



Titik Lembek Bitumen

Berat Jenis Aspal



Daktilitas Bitumen

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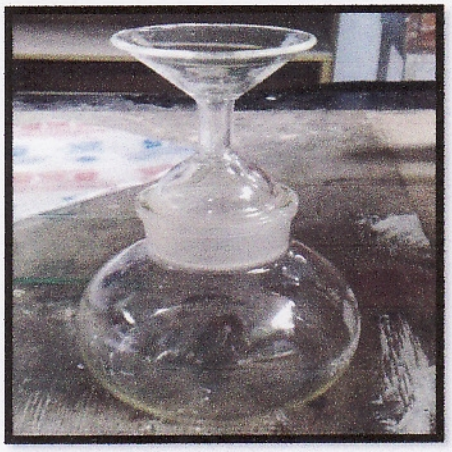
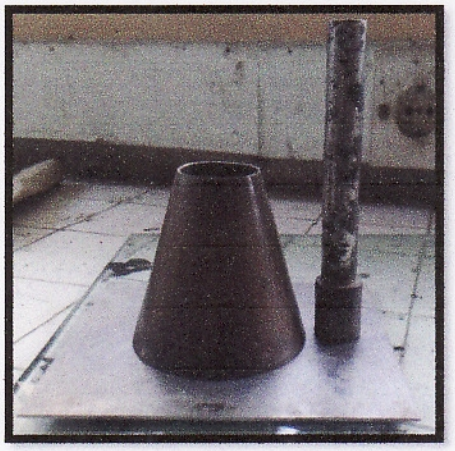
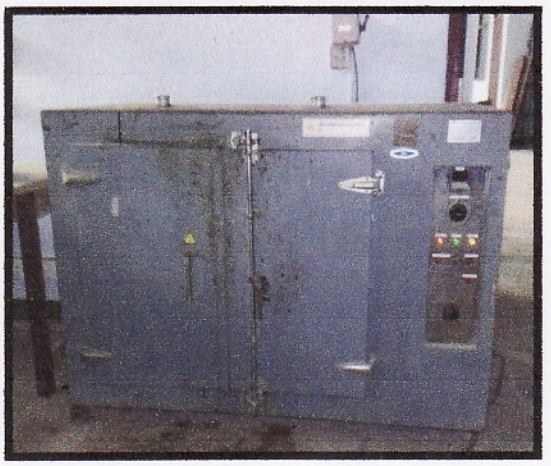
Jl. Prof. Dr. Sumantri Brojonegoro No. 1 Bandar Lampung





Piknometer dan Kerucut Abram



Oven

Pemanas Aspal

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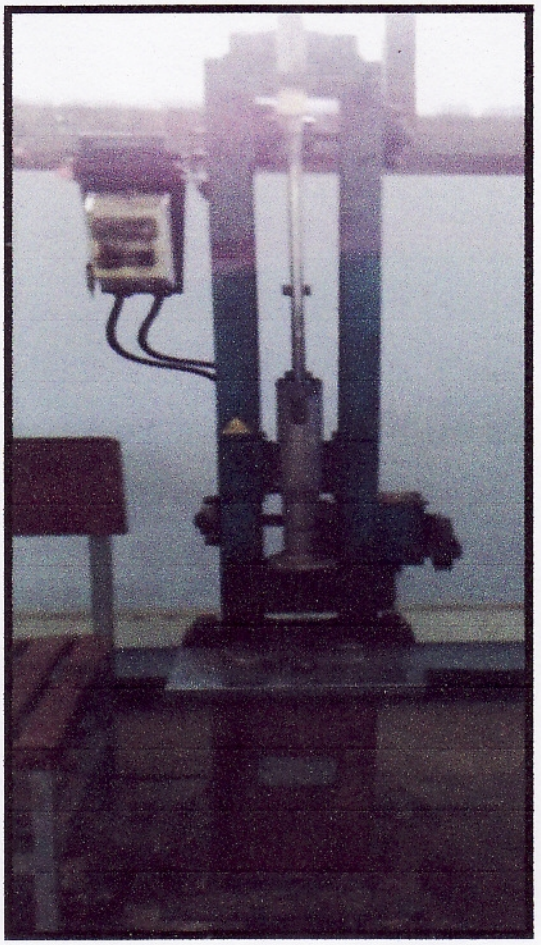
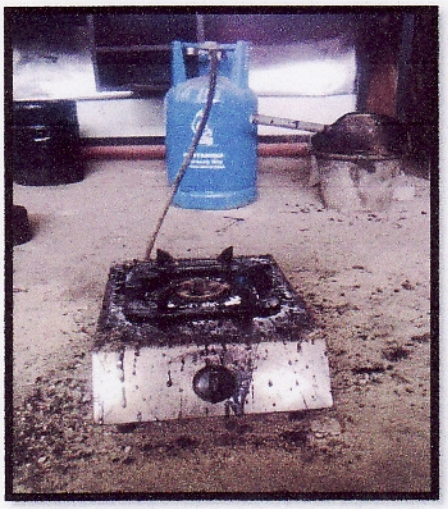


Alat pemadat



Kompor dan Gas untuk pencampuran

LABORATORIUM INTI JALAN RAYA
FAKULTAS TEKNIK JURUSAN TEKNIK SIPIL
UNIVERSITAS LAMPUNG
Jl. Prof. Dr. Sumantri Brojonegoro No. 1 Bandar Lampung

Mold dan *Ejecktor*

Memasukkan campuran

Menusuk-nusuk campuran

LABORATORIUM INTI JALAN RAYA
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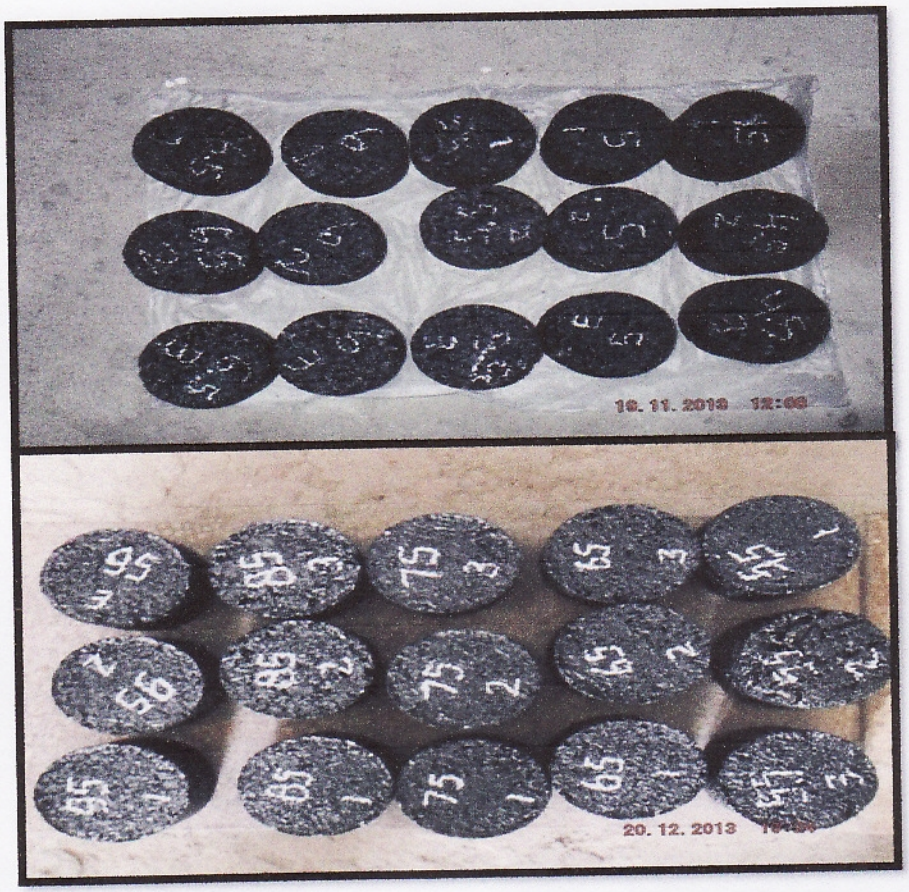
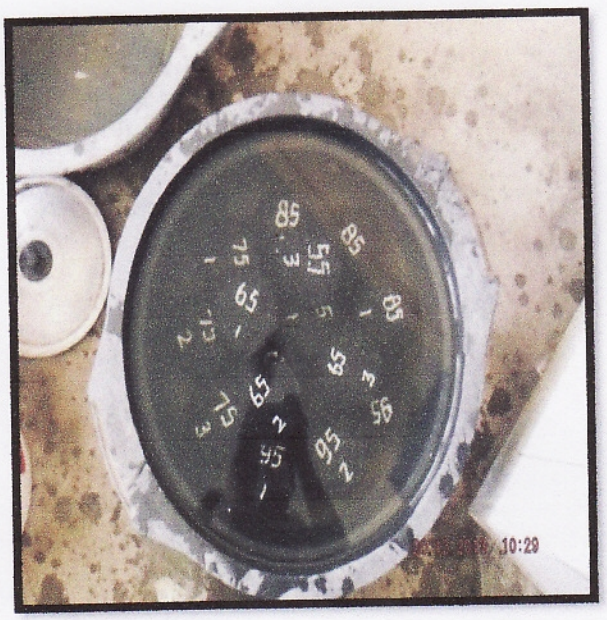
UNIVERSITAS LAMPUNG
Jl. Prof. Dr. Sumantri Brojonegoro No. 1 Bandar Lampung



Benda Uji



Merendam Benda Uji

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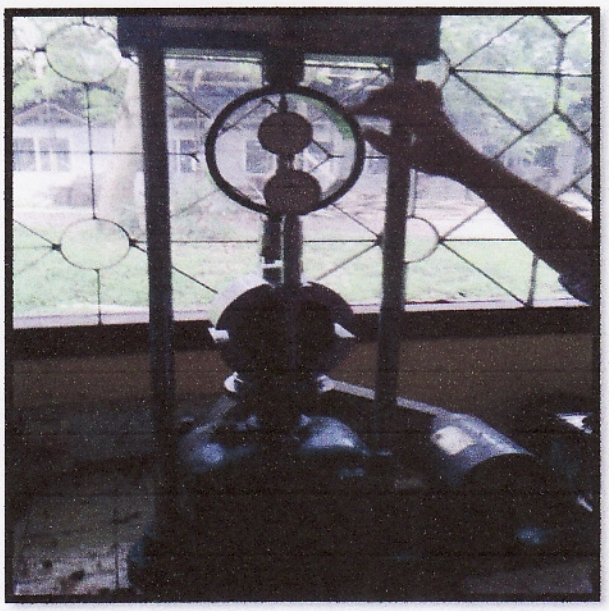
Waterbath



Alat Uji *Marshall*

Lampiran D

VARIASI JUMLAH TUMBUKAN TERHADAP
KARAKTERISTIK AC-WC GRADASI KASAR DENGAN
SUHU IDEAL PENCAMPURAN ASPAL

KEMENTERIAN PENDIDIKAN NASIONAL
FAKULTAS TEKNIK
UNIVERSITAS LAMPUNG
Prof. Dr. Sumantri Brojonegoro No.1 Gedung Meneng Bandar Lampung 35145

KARTU ASISTENSI

Nama : **Andi Syah Putra S**
NPM : **0915011038**
Jurusan : **Teknik Sipil**
Judul Skripsi : **VARIASI JUMLAH TUMBUKAN TERHADAP KARAKTERISTIK *AC-WC* GRADASI KASAR DENGAN SUHU OPTIMUM PENCAMPURAN ASPAL**
Pembimbing I : **Ir. Priyo Pratomo, M.T.**
Pembimbing II : **Ir. Syukur Sebayang, M.T.**

No.	Tanggal	Keterangan	Paraf
		Lengkapi Daf Pus. Perbaiki Bagan Alir + prosedur / penelitian lain	
	18/10/2013	ACC Seminar	

Bandar Lampung, 2013

Dosen Pembimbing I,

Ir. Priyo Pratomo, S.T, M.T.
NIP. 195309261985031003

KEMENTERIAN PENDIDIKAN NASIONAL
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35145

KARTU ASISTENSI

Nama : **Andi Syah Putra S**
NPM : **0915011038**
Jurusan : **Teknik Sipil**
Judul Skripsi : **VARIASI JUMLAH TUMBUKAN TERHADAP KARAKTERISTIK LAPISAN ASPAL BETON (LASTON) DENGAN SUHU OPTIMUM ASPAL SAAT PENCAMPURAN**
Pembimbing I : **Ir. Priyo Pratomo, M.T.**
Pembimbing II : **Ir. Syukur Sebayang, M.T.**

No.	Tanggal	Keterangan	Paraf
	22/10-2013	- Perbaiki tujuan penelitian - Latar belakang lebih spesifik. - Daftar pustaka → di cantumkan sesuai dgn jurnal.	
	25/10-2013	Acc Seminar Proposal	

Bandar Lampung, 2013

Dosen Pembimbing II,

Ir. Syukur Sebayang, M.T.
NIP. 195003091986031001

KEMENTERIAN PENDIDIKAN NASIONAL
FAKULTAS TEKNIK
UNIVERSITAS LAMPUNG
Prof. Dr. Sumantri Brojonegoro No.1 Gedung Meneng Bandar Lampung 35145

KARTU ASISTENSI

Nama : **Andi Syah Putra S**
NPM : **0915011038**
Jurusan : **Teknik Sipil**
Judul Skripsi : **VARIASI JUMLAH TUMBUKAN TERHADAP KARAKTERISTIK *AC-WC* GRADASI KASAR DENGAN SUHU IDEAL PENCAMPURAN ASPAL**
Pembimbing I : **Ir. Priyo Pratomo, M.T.**
Pembimbing II : **Ir. Syukur Sebayang, M.T.**

No.	Tanggal	Keterangan	Paraf
		- Buat analisis tata hasil	Perbaiki
		- Perbaiki penomoran Tabel & Gambar	
		- Lengkapi	

Bandar Lampung, 2014

Dosen Pembimbing II,

Ir. Syukur Sebayang, M.T.
NIP. 195003091986031001

KEMENTERIAN PENDIDIKAN NASIONAL
FAKULTAS TEKNIK
UNIVERSITAS LAMPUNG
Prof. Dr. Sumantri Brojonegoro No.1 Gedung Meneng Bandar Lampung 35145

KARTU ASISTENSI

Nama : **Andi Syah Putra S**
NPM : **0915011038**
Jurusan : **Teknik Sipil**
Judul Skripsi : **VARIASI JUMLAH TUMBUKAN TERHADAP KARAKTERISTIK *AC-WC* GRADASI KASAR DENGAN SUHU IDEAL PENCAMPURAN ASPAL**
Pembimbing I : **Ir. Priyo Pratomo, M.T.**
Pembimbing II : **Ir. Syukur Sebayang, M.T.**

No.	Tanggal	Keterangan	Paraf
	13/1 2014	Tabel perbaiki urutannya Hasil dipertajam Kesimpulan dan saran Konsultasi Pb II	
	15/1 2014	ACC seminar perbaiki sesuai catatan	
	3/2 2014	ACC kompre	

Bandar Lampung, **2014**

Dosen Pembimbing I,

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Pembimbing I : **Ir. Priyo Pratomo, M.T.**
Pembimbing II : **Ir. Syukur Sebayang, M.T.**

No.	Tanggal	Keterangan	Paraf
		- Kebutuhan kompilasi Skripsi dgn hasil penelitian	
	11-2014	- Abstrak perbaiki	
		- Lampiran	
		- Pembahasan	
		- Hasil	
		Lanjut.	
		Perbaiki Skripsi kompre	

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