



Lampiran 17. Tabel Hasil Pengujian Marshall dalam Mencari KAO Campuran Beraspal Pen 60/70



UNIVERSITAS ISLAM INDONESIA

LABORATORIUM JALAN RAYA
JURUSAN TEKNIK SIPIL
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HASIL PENGUJIAN KADAR ASPAL OPTIMUM (KAO) DENGAN METODE MARSHALL

Tinggi Pengujian : 7 Aspal 500

Tipe Campuran : SUPERPAVE 19 MM

Uraian Bahan Uji : Pen 60/70

Dibuatkan di : Mantri

Diperiksa oleh : Mikhael Pratiwi S.T., M.T., Ph.D

SAMPIL	Tinggi (mm)	A (%)	B (%)	C (g/mm)	D (g/mm)	E (g/mm)	F (g/mm)	G (g/mm)	H (g/mm)	I (g/mm)	J (g/mm)	K (g/mm)	VMA (%)	VPWA (%)	VITM (%)	Masa	P	Q	R	S	T
5A	5,6267	5,26316	5	1176,98	1189,23	671,43	517,8	2,27104	2,43075	10,6472	82,4546	6,89819	17,245377	58,328683	7,25120191	110	2344,8	0,93813	2199,713423	3,8	578,8719533
5B	6,6187	5,26316	5	1172,5	1183,33	671,13	512,2	2,189145	2,45875	10,6472	82,4546	6,89819	17,245377	60,6837096	6,898191252	124	2643,23	0,93963	2483,641789	4,6	539,9221281
5C*	6,2927	5,26316	5	1198,8	1179,62	663,43	516,17	2,268376	2,45973	10,232	81,3623	7,09536	18,437844	57,1224723	7,095562592	63	1383,56	0,94483	1708,663819	4,2	311,3963759
5.3A*	6,5113	5,82011	3,5	1169,14	1178,81	672,33	506,28	2,309273	2,44221	11,8149	82,7419	5,44316	17,238063	58,4601639	7,225668131	2694,01	1311,86	0,93278	2341,677666	4,0	559,1110467
5.3B	6,4060	5,82011	3,5	1178,7	1184,4	676,75	507,65	2,315178	2,44221	11,8451	82,9334	5,29149	17,040582	69,4666322	5,2914867	122	2626,59	0,98651	2555,48589	6,2	413,7882468
5.3C	6,5033	5,82011	3,5	1161,38	1170,49	665,09	503,4	2,279942	2,44221	11,7569	82,3359	5,99722	17,664137	66,5289995	5,997230316	124	2643,23	0,96162	2341,902909	6,2	479,8843401
5A*	6,3167	6,38298	6	1159,73	1165,71	659,58	495,83	2,18927	2,42598	13,0545	83,3609	3,38459	16,639663	78,4567854	3,38459157	92	1962,1	1,00413	1977,444133	4,6	429,879594
6B	6,3029	6,38298	6	1162,57	1172,73	664,39	506,34	2,246993	2,42598	12,7666	81,81	5,2254	18,490016	69,0351603	5,225468378	111	2166,11	0,9921	2348,368273	2,9	809,7821632
6C	6,4033	6,38298	6	1173,76	1181,05	674,08	506,97	2,315245	2,42598	12,9123	82,5169	4,56078	17,483076	73,9131946	4,560776143	91	1939,79	0,98667	1913,923429	5,1	375,2791037
6D	6,4100	6,38298	6	1170,31	1182,36	678,16	504,2	2,321123	2,42598	12,9551	82,7264	4,31851	17,273613	74,9993897	4,318510197	79	1681,99	0,983	1638,73127	4,12	402,6046772
6.3A*	6,4233	6,45187	6,5	1166,35	1169,81	660,67	505,14	2,279039	2,40978	13,7802	80,7944	5,42331	19,20581	71,791326	5,423310216	102	2174,27	0,99167	2334,405473	4,82	442,8227127
6.3B	6,3333	6,45187	6,5	1154,31	1166,73	665,1	494,09	2,338118	2,40978	14,1229	82,2321	3,09899	17,619781	82,090019	3,040073642	113	2408,7	1,00398	2633,224918	4,81	568,9958255
6.3C	6,1133	6,45187	6,5	1165,64	1171,24	672,37	498,87	2,338165	2,40978	14,1402	82,9047	2,95513	17,095288	82,717949	2,955136547	89	1497,15	1,06396	2018,491417	5,22	386,6845626
6.3D	6,4893	6,45187	6,5	1164,68	1172,95	668,88	503,37	2,312783	2,40978	13,9803	82,6262	3,98344	17,973769	77,837879	3,983440267	82	1747,94	0,98517	1722,012388	6,13	280,9133809
7A	6,2290	7,32688	7	1157,38	1165	664,57	500,43	2,312771	2,39188	15,0599	81,5518	3,38027	18,448169	81,8314973	3,380264071	84	1700,57	1,0325	1848,766472	5,17	357,5956623
7B	6,1967	7,32688	7	1155,32	1163,39	663,33	498,07	2,319995	2,39188	15,1069	81,8066	3,08849	18,193414	83,0351494	3,088488991	87	1854,53	1,06604	1976,997901	5,83	345,9110799
7C*	6,4123	7,32688	7	1159,94	1163,34	663,36	509,95	2,316834	2,39388	14,8957	79,5794	5,72493	20,4028698	71,964834	5,724947228	104	2216,9	0,98417	2181,799512	5,54	391,8261064
7D	6,3200	7,32688	7	1162,00	1166,00	666,00	502,00	2,316834	2,39388	14,8957	79,5794	5,72493	20,4028698	71,964834	5,724947228	104	2216,9	0,98417	2181,799512	5,54	391,8261064

Tinggi) - Tebal Benda Uji

A - % Aspal Terhadap Batuan

B - % Aspal Terhadap Campuran

C - Berat Kering Sebelum dituangkan

D - Berat Basah Jenuh (SSD)

E - Berat didalam Air

F - Volume (a), (d-c)

G - Berat (s) (density), (c/f)

H - B.J Maksimum, (100 : (% Agr/B.J Agr + % Asp/B.J Asp))

I - (b x g) : B.J Asp

J - (100 - b) x g : B.J Agregat

K - Jumlah Kandungan Rongga, (100-i-j)

L - Rongga Terhadap Agregat (VMA), (100 - Rongga Terisi Aspal (VPWA), (100 x (I-J))

M - Rongga Dalam Campuran (VITM), (100 - (100 x (g/h)))

N - Pembacaan Arloji Stabilitas

O - x Kalibrasi Proving Ring

P - x Koreksi Tebal Benda Uji (stabilitas)

Q - S

R - MQ

S - Suhu Pencampuran

T - Suhu Pendinginan

U - Suhu Waterbath

V - B.J Aspal

W - B.J Agregat

X - Kalibrasi Proving Ring

Y - B.J MIX ASPAL BAN K.

Z - Flow (Kedalaman Plastis)

AA - Marshall Quotient

AB - a 180°C

AC - a 140°C

AD - 60°C

AE - 1,075

AF - 2,6374

AG - 21,3163 kg

% Tertahan Kasar	61
% Tertahan Halus	34
% Filler	5
B.J Kasar Ciereng	2,64
B.J Halus Ciereng	2,63
B.J Filler Ciereng	2,63
kalibrasi alat	46,99449
convert	0,4535924
hasil	21,316344
	7,53067
	3,415854675

Mantri
Kantor Jalan Raya UII

Pencinta

Lampiran 18. Grafik Hasil Pengujian *Marshall* Campuran Beraspal Pen 60/70 Mencari KAO

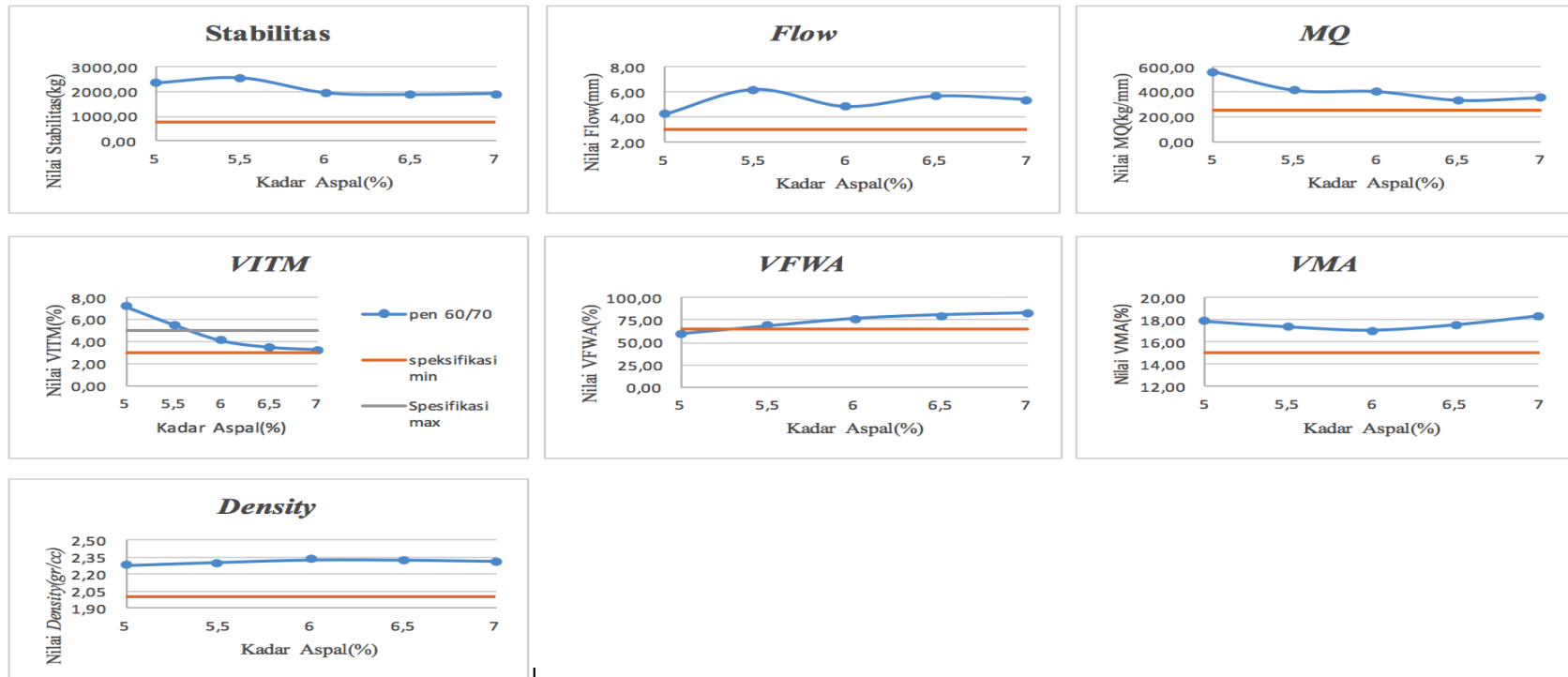


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HASIL PENGUJIAN MARSHALL KADAR ASPAL OPTIMUM UNTUK ASPAL PEN 60/70



Lampiran 19. Tabel Hasil Pengujian Marshall Standar Kondisi KAO Campuran Modifikasi Aspal Ban Karet



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HASIL CAMPURAN MODIFIKASI ASPAL DEGAN METODE MARSHALL STANDAR

Tanggal Pengujian : 7 Januari 2018
Tipe Campuran : SUPERPAVE 19 MM
: Dengan Bahan Ikut Modif Pen 60/70

Dikerjakan o: Mentari
Diperiksa ol: Miftahul Fauziah S.T., M.T., Ph.D


Table with columns: RENDAMAN, SAMPEL, Tinggi (cm), A (%), B (%), C (gram), D (gram), E (gram), F (gram), G (Density), H, I, J, K, L (VMA (%)), M (VFWA (%)), N (VTM (%)), O (Meas), P, Q (Koreksi), R (Stabilitas (kg)), S (Flow (cm)), T (MO (Kg/mm)). It contains two main sections: 4 HARI/ 96 JAM and 2 HARI/ 48 JAM, each with multiple rows of sample data.

Lanjutan Lampiran 19. Tabel Hasil Pengujian Marshall Standar Kondisi KAO Campuran Modifikasi Aspal Ban

Tingkat	Tebal Benda Uji	J	-(100 - b) x g : B.J Agregat	S	Flow (Kelelahan Plastik)																
						A	K	MQ	Marshall Quotient												
0M1	6.35	6.723586	6.30	1171.52	1176.08	668.88	507.2	2.309779	2.41562	13.55913	82.05917	4.381498	17.94062918	75.5777899	4.381498	76	1620.042	0.999833	1619.772099	3.300	490.8400301
0M2	6.35	6.723586	6.30	1180.98	1182.21	676.83	505.38	2.336816	2.41562	13.71784	83.0199	3.262254	16.990988	80.78778	3.262254	72	1534.777	0.999083	1533.169854	3.200	479.1780791
0M3	6.56	6.723586	6.30	1165.62	1171.11	662.01	509.08	2.28966	2.41562	13.44102	81.36459	5.214386	18.65540981	72.0489135	5.214386	71	1513.46	0.94025	1438.165733	3.300	628.4267921
								312083					17.8187126	76.1381678	1.790526		1516.091		1510.334806	3.331	371.1453094
6M1	6.34	6.723586	6.30	1183.48	1187.57	667.49	520.08	2.279419	2.41562	13.3809	80.98075	3.638345	19.01924922	70.3545362	3.638345	79	1683.991	1.002917	1688.902778	3.900	433.0519943
6M2	6.40	6.723586	6.30	1176.25	1180.06	670.69	509.37	2.309225	2.41562	13.55588	82.03869	4.404435	17.96031318	75.4768494	4.404435	76	1620.042	0.987417	1599.636377	3.100	516.0182505
6M3	6.43	6.723586	6.30	1177.79	1183.71	673.74	509.96	2.309573	2.41562	13.55792	82.05206	4.390021	17.94794346	75.5402561	4.390021	75	1598.726	0.980083	1566.884473	3.900	461.764574
								299406					18.30016803	77.7905172	4.810933		1631.263		1618.281725	3.633	350.7754081
8M1	6.53	6.723586	6.30	1166.06	1170.12	655.04	515.09	2.263843	2.41562	13.28947	80.42738	6.28315	19.57261819	67.8982658	6.28315	85	1811.889	0.956875	1733.751478	4.500	385.2781059
8M2	6.55	6.723586	6.30	1177.32	1181.8	669.64	512.16	2.298735	2.41562	13.4943	81.667	4.838706	18.33300318	73.6065812	4.838706	81	1726.624	0.95225	1644.177536	4.100	401.0189113
8M3	6.56	6.723586	6.30	1171.44	1175.56	668.62	506.94	2.310806	2.41562	13.56516	82.09585	4.33899	17.90414896	75.7642491	4.33899	81	1726.624	0.94925	1619.860977	4.100	399.9660919
								291128					18.60324678	77.324132	4.53614		1755.036		1672.500661	3.733	305.3710368
10M1	6.43	6.723586	6.30	1170.17	1179.2	668.15	511.05	2.289737	2.41562	13.44148	81.34733	5.211197	18.65267289	72.0619298	5.211197	77	1641.358	0.980083	1608.668061	3.800	423.3337002
10M2	6.47	6.723586	6.30	1167.32	1177.9	663.32	514.58	2.268491	2.41562	13.31676	80.59252	6.090723	19.40747841	68.6166178	6.090723	72	1534.777	0.970917	1490.140309	3.000	496.7134364
10M3	6.45	6.723586	6.30	1173.1	1181.61	670.26	511.35	2.294315	2.41562	13.46952	81.51706	5.013413	18.48293127	72.8754505	5.013413	75	1598.726	0.974833	1558.491165	3.350	465.2212432
								2284547					18.847269457	71.7816681	4.338633		1591.62		1552.63179	3.383	361.7561266

Tinggi	=	Tebal Benda Uji	J	-(100 - b) x g : B.J Agregat	S	=	Flow (Kelelahan Plastik)
A	=	% Aspal Terhadap Bituman	K	-Jumlah Kandungan Rongga, (100-i)	MQ	=	Marshall Quotient
B	=	% Aspal Terhadap Campuran	L	-Rongga Terhadap Agregat (VMA), (100 - j)	Suhu Pencampuran	=	= 160°C
C	=	Berat Kering Sebelum direndam	M	-Rongga Terisi Aspal (VFWA), (100 x (s/l))	Suhu Pemadatan	=	= 140°C
D	=	Berat Basah Jenis (SSD)	N	-Rongga Dalam Campuran (VTM), (100 - (100 x (g/h)))	Suhu Waterbath	=	60°C
E	=	Berat didalam Air	O	-Pembacaan Arloji Stabilitas	B.J Aspal modif 10%	=	1,073196
F	=	Volume (sk) (d-c)	P	=o x Kalibrasi Proving Ring	B.J Agregat	=	2,637436
G	=	Berat Isi (density), (e-f)	R	=p x Koreksi Tebal Benda Uji (stabilitas)	Kalibrasi Proving Ring	=	21,31634 kg
H	=	B.J Maksimum, (100 : (% Agr/B.J Agr + % Asp/B.J Asp))					
I	=	(0 x g) : B.J Asp					

%Terahan Kasar	61	100
%Terahan Halus	34	
% Filler	5	
B1 Kasar Celereg	2,64402097	
B1 Halus Celereg	2,62713553	
B1 Filler Celereg	2,62713553	
kalibrasi elat	46,99449	
corvet	0,4535924	
hasil	21,3163435	
	7,53067	
	3,41585468	

Mengetahui,
 Kepala Jalan Ray U1 Peneliti,


Lampiran 20. Grafik Hasil Pengujian Marshall Standar Kondisi KAO Campuran Modifikasi Aspal Ban Karet

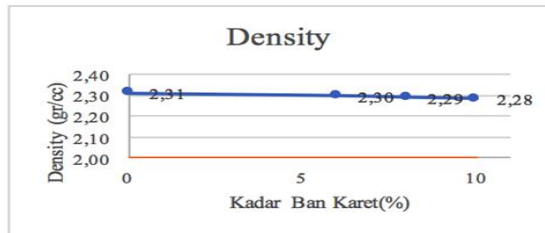
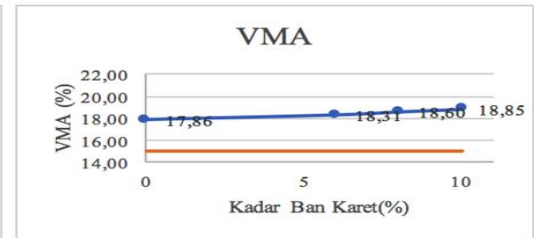
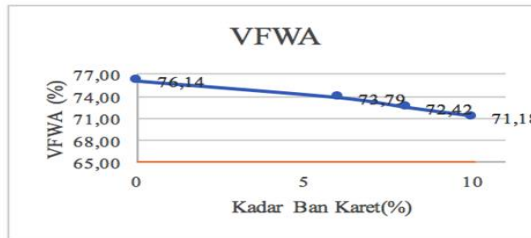
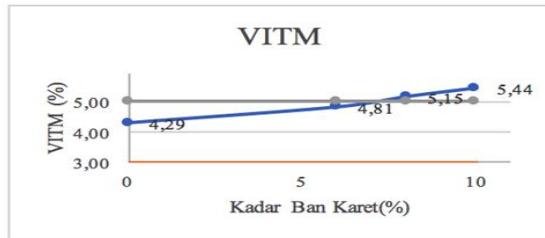
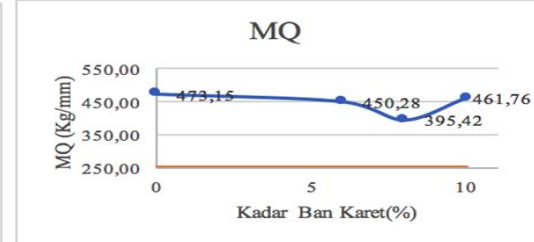
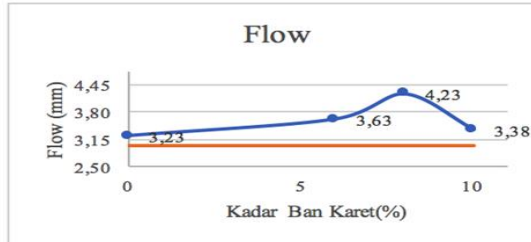
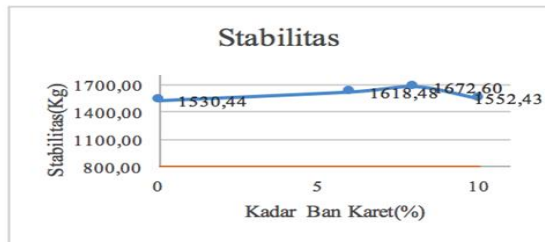


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HASIL PENGUJIAN MARSHALL STANDAR PADA 0 JAM RENDAMAN CAMPURAN MODIFIKASI KAO PEN 60/70 DENGAN BAN KARET



Lampiran 21. Grafik Hasil Perbandingan Pengujian *Marshall Standar* Kondisi KAO dengan Durasi Rendama

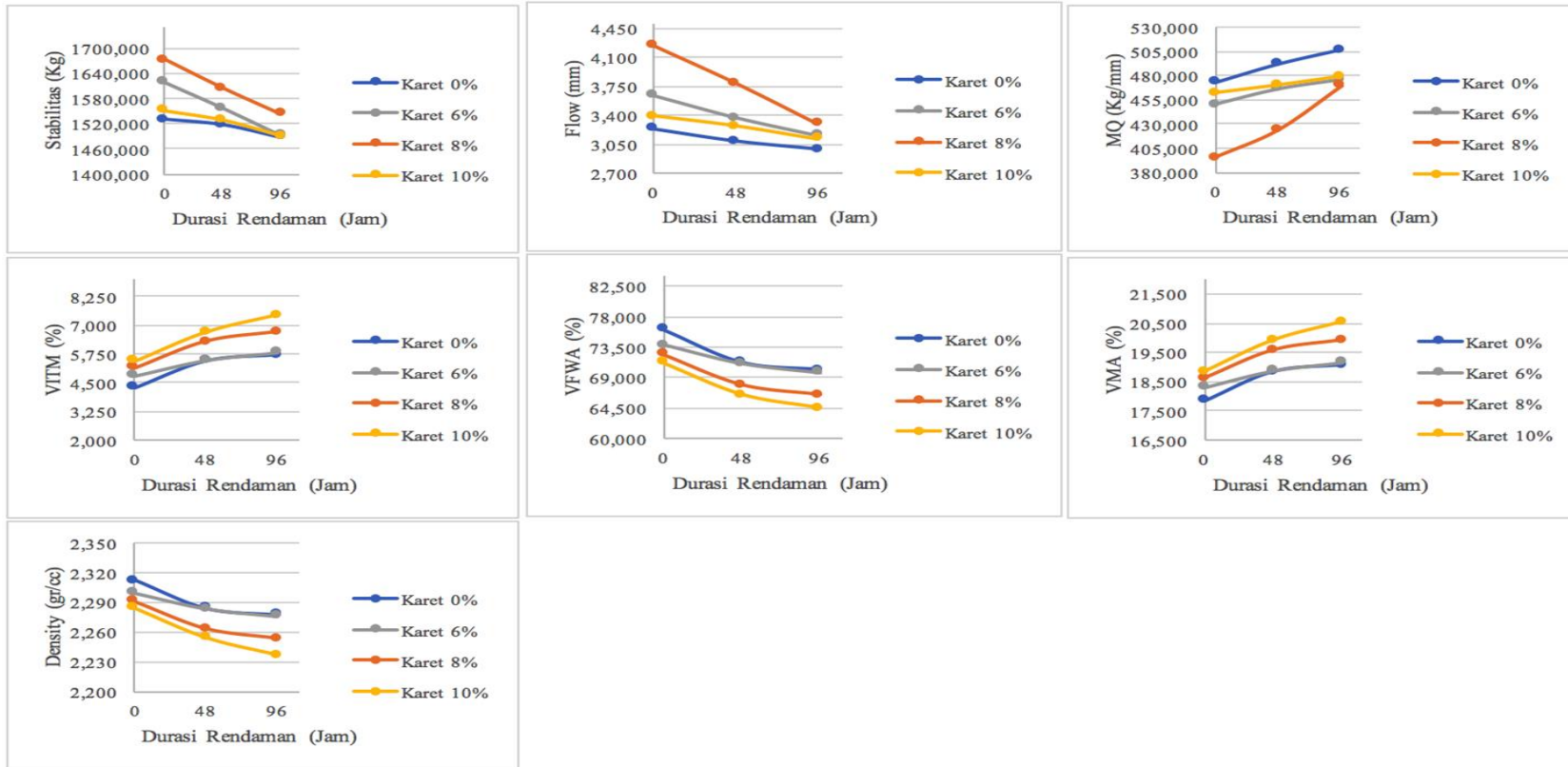


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HASIL PENGUJIAN MARSHALL STANDAR CAMPURAN MODIFIKASI KAO PEN 60/70 DENGAN BAN KARET



Lampiran 22. Grafik Hasil Perbandingan Pengujian *Marshall Standar* Kondisi KAO dengan Kadar Ban Karet

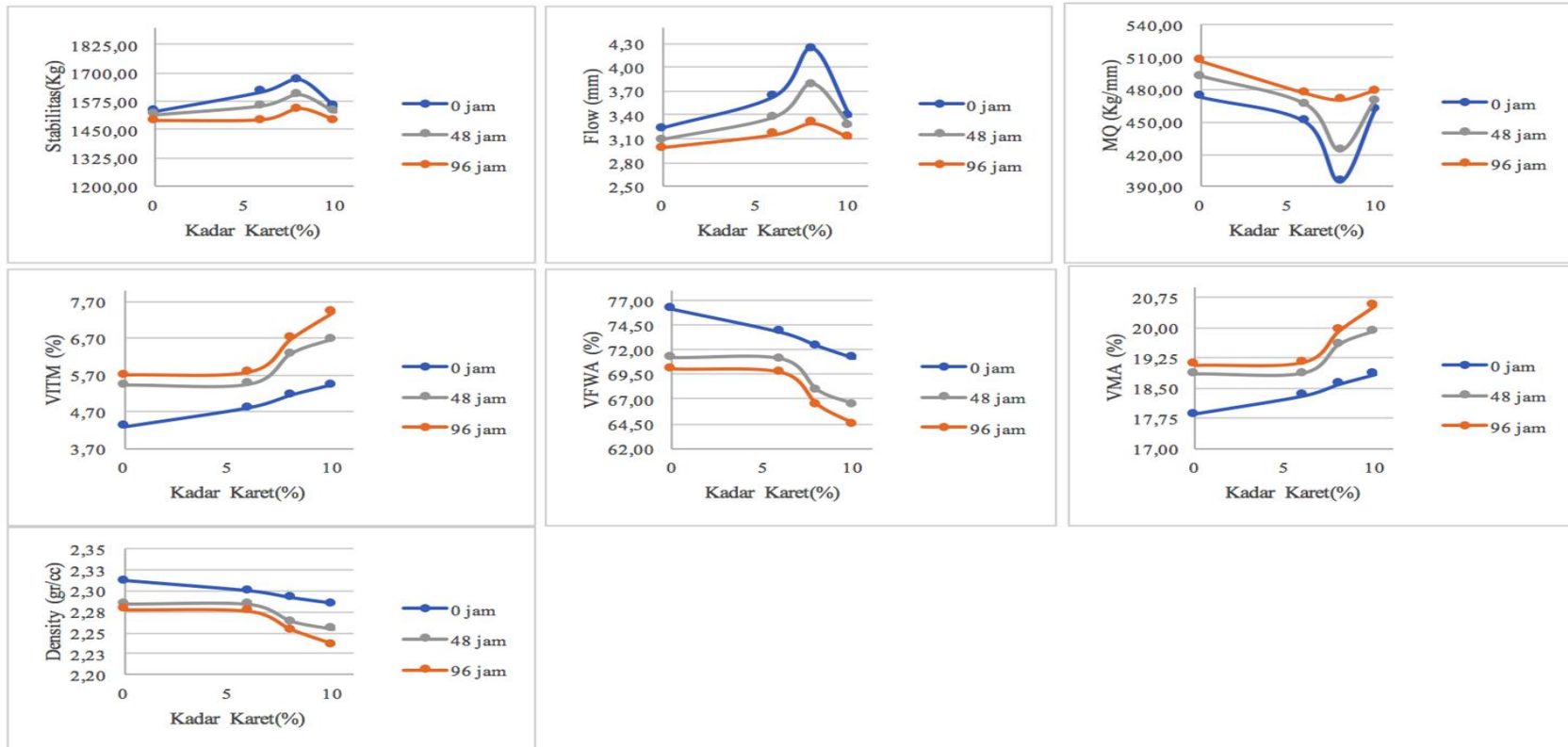


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HASIL PENGUJIAN MARSHALL STANDAR CAMPURAN MODIFIKASI KAO PEN 60/70 DENGAN BAN KARET



Lanjutan Lampiran 23. Tabel Hasil Pengujian Marshall 24 Jam Kondisi KAO Campuran Modifikasi Aspal Ban Karet

DILAKUKAN	OM.4	6.51	6.72359	6.30	1170.94	1181.47	673.96	507.61	2.30677	2.41562	13.5415	81.9525	4.50603	180475	75.0323861	4.50603	70	1492.14	0.96075	1433.577392	3.010	476.271559
	OM.5	6.39	6.72359	6.30	1165.49	1177.32	678.68	498.64	2.33734	2.41562	13.7209	83.0384	3.24066	16.96155	80.8941143	3.24066	72	1534.78	0.991	1520.963742	3.250	467.988844
	OM.6	6.34	6.72359	6.30	1166.24	1179.95	678.6	501.35	2.3262	2.41562	13.6555	82.6427	3.70175	17.85727	78.6731993	3.70175	71	1513.46	1.00333	1518.505257	3.100	489.640405
									2.32844					17.45543	78.3998986	3.81615		1733.46		1491.032463	3.120	478.033603
	OM.4	6.37	6.72359	6.30	1178.72	1187.14	676.88	510.26	2.31004	2.41562	13.5607	82.0686	4.37078	17.93143	75.6250223	4.37078	78	1662.67	0.99467	1653.807195	3.990	414.488019
	OM.5	6.35	6.72359	6.30	1177.73	1181.91	676.87	507.06	2.32266	2.41562	13.6348	82.5171	3.8481	17.48287	77.9892984	3.8481	76	1620.04	1.0005	1620.852127	3.800	491.167511
	OM.6	6.48	6.72359	6.30	1182.59	1192.13	676.98	515.15	2.29562	2.41562	13.476	81.5564	4.96754	18.44357	73.0662732	4.96754	70	1492.14	0.96833	1444.892817	3.280	440.516193
									2.30944					17.95262	75.560198	4.38848		1591.62		1573.144046	3.523	348.723811
	SM.4	6.50	6.72359	6.30	1168.24	1184.44	670.11	514.33	2.27138	2.41562	13.3337	80.6952	5.97103	19.30476	69.069654	5.97103	79	1683.99	0.96267	1621.122133	3.830	423.269487
	SM.5	6.46	6.72359	6.30	1172.4	1189.1	672.98	516.12	2.27156	2.41562	13.3348	80.7017	5.96347	19.29827	69.0984213	5.96347	83	1769.26	0.97142	1718.685262	3.900	440.688529
	SM.6	6.24	6.72359	6.30	1120.08	1133.25	641.42	491.83	2.27737	2.41562	13.3689	80.8081	5.72306	19.09195	70.0212117	5.72306	70	1492.14	1.02825	1534.297115	3.420	448.624887
									2.27344					19.23166	69.3972637	5.88585		1648.46		1624.701304	3.217	437.427634
	OM.4	6.48	6.72359	6.30	1173.32	1190.18	674.26	515.92	2.27423	2.41562	13.3504	80.7964	5.8532	19.20361	69.5203731	5.8532	69	1470.83	0.96713	1422.780664	3.030	469.564575
	OM.5	6.52	6.72359	6.30	1172.65	1190.79	671.83	518.96	2.25962	2.41562	13.2647	80.2772	6.43814	19.72279	67.2534461	6.43814	70	1492.14	0.95763	1428.914441	3.170	450.751653
	OM.6	6.43	6.72359	6.30	1177.12	1190.9	671.4	519.4	2.26587	2.41562	13.3014	80.4994	6.19917	19.50055	68.2102588	6.19917	76	1620.04	0.9805	1583.451285	3.540	448.715052
								2.26657					19.47566	68.3286927	6.17017		1527.67		1489.048797	3.247	516.347094	

Tinggi	-	Tebal Benda Uji	J	(100 - b) x g : B.J. Agregat	S	-	Flow (Kelebihan Plastik)
A	-	% Aspal Terhadap Batuan	K	-Jumlah Kandungan Rongga, (100-i-j)	MQ	-	Marshall Quotient
B	-	% Aspal Terhadap Campuran	L	-Rongga Terhadap Agregat (VMA), (100 - j)	Suhu Pencampuran	-	= 160°C
C	-	Berat Kering Sebelum direndam	M	-Rongga Terisi Aspal (VFWA), (100 x (i/j))	Suhu Pemasatan	-	= 140°C
D	-	Berat Basah Jenuh (SSD)	N	-Rongga Dalam Campuran (VITM), (100 - (100 x (g/h)))	Suhu Waterbath	-	60°C
E	-	Berat didalam Air	O	-Pembacaan Arloji Stabilitas	B.J. Aspal modif 10%	-	1.0732
F	-	Volume (isi), (δ-e)	P	-p x Kalibrasi Proving Ring	B.J. Agregat	-	2.63744
G	-	Berat Isi (density), (g/?)	R	-p x Koneksi Tebal Benda Uji (stabilitas)	Kalibrasi Proving Ring	-	21.3163 kg
H	-	B.J Maksimum, (100 : (% Agr.B.J. Agr - % Asp.B.J. Asp))					
I	-	(b x g) : B.J. Asp					

Mengetahui
K. H. Jalal Raya UIR
Peneliti,



%Tertahan Kasar	61	100
%Tertahan Halus	34	
% Filler	5	
BJ Kasar Ciereng	2,64402093	
BJ Halus Ciereng	2,62713351	
BJ Filler Ciereng	2,62713351	
kalibrasi stat	46,99449	
convert	0,4535924	
hasil	21,3163435	
	7,53067	
	3,41585468	

Lampiran 24. Grafik Hasil Pengujian Marshall 24 Jam Kondisi KAO Campuran Modifikasi Aspal Ban Karet

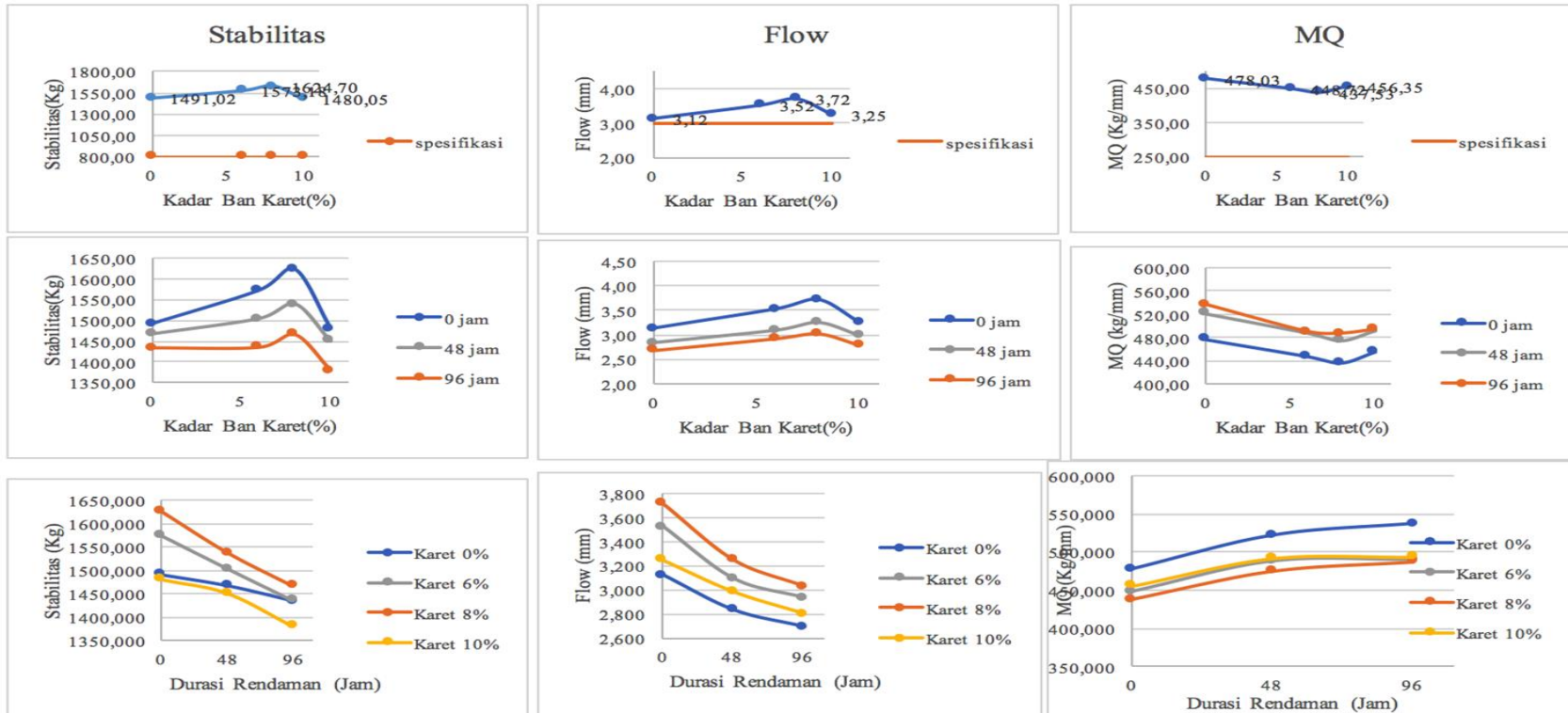


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HASIL PENGUJIAN MARSHALL 24 JAM CAMPURAN MODIFIKASI KAO PEN 60/70 DENGAN BAN KARET



Lampiran 25. Tabel Hasil Pengujian *Indirect Tensile Strength* Campuran Modifikasi Aspal Ban Karet



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HASIL PENGUJIAN *INDIRECT TENSILE STRENGTH* (ITS) KONDISI KAO

Lama Rendaman	Persen Karet	SAMPEL	KAO	Stabilitas	Stabilitas	Stabilitas Kalibrasi Alat	Angka Koreksi	Beban Puncak	Diameter	Tebal	A0	Indirect Tensile Strength (kg/cm ²)	Rata - Rata
			(%)	(lb)	(Kg)		Kg	(cm)	(cm)				
4 HARI / 96 JAM	0,00	0M.24	6,3	55	24,97	1092,7041	0,938	1024,683	10	6,629	0,159	16,2432	17,5937
		0M.23	6,3	55	24,97	1092,7041	0,997	1089,79	10	6,361	0,159	17,2753	
		0M.22	6,3	59	26,786	1172,1735	1,037	1215,153	10	6,203	0,159	19,2626	
	6,00	6M.24	6,3	55	24,97	1092,7041	0,966	1055,552	10	6,486	0,159	16,7326	15,7922
		6M.23	6,3	50	22,7	993,3674	0,992	985,0893	10	6,383	0,159	15,6156	
		6M.22	6,3	50	22,7	993,3674	0,954	948,0512	10	6,540	0,159	15,0285	
	8,00	8M.24	6,3	46	20,884	913,8980	0,952	869,8024	10	6,554	0,159	13,7881	14,0477
		8M.23	6,3	48	21,792	953,6327	0,954	909,5272	10	6,543	0,159	14,4178	
		8M.22	6,3	45	20,43	894,0306	0,983	879,2046	10	6,416	0,159	13,9371	
	10,00	10M.24	6,3	37	16,798	735,0918	0,940	690,8944	10	6,617	0,159	10,9520	11,5765
		10M.23	6,3	40	18,16	794,6939	0,969	770,1246	10	6,474	0,159	12,2080	
		10M.22	6,3	39	17,706	774,8265	0,942	729,8382	10	6,606	0,159	11,5694	
2 HARI / 48 JAM	0,00	0M.30	6,3	52	23,608	1033,1021	1,006	1039,301	10	6,493	0,159	16,4750	17,4579
		0M.29	6,3	58	26,332	1152,3061	1,027	1182,842	10	6,320	0,159	18,7504	
		0M.28	6,3	56	25,424	1112,5714	0,972	1081,79	10	6,385	0,159	17,1485	
	6,00	6M.30	6,3	46	20,884	913,8980	0,998	911,9179	10	6,288	0,159	14,4557	15,1103
		6M.29	6,3	46	20,884	913,8980	1,099	1004,05	10	6,374	0,159	15,9162	
		6M.28	6,3	45	20,43	894,0306	1,056	943,6679	10	6,458	0,159	14,9590	
	8,00	8M.30	6,3	43	19,522	854,2959	0,962	821,6191	10	6,428	0,159	13,0243	13,3522
		8M.29	6,3	45	20,43	894,0306	0,976	872,4249	10	6,567	0,159	13,8297	
		8M.28	6,3	43	19,522	854,2959	0,975	832,8673	10	6,207	0,159	13,2026	
	10,00	10M.30	6,3	37	16,798	735,0918	0,976	717,5109	10	6,220	0,159	11,3740	11,2670
		10M.29	6,3	39	17,706	774,8265	0,975	755,585	10	6,344	0,159	11,9775	
		10M.28	6,3	37	16,798	735,0918	0,897	659,1936	10	6,487	0,159	10,4495	
0 HARI / 0 JAM	0,00	0M.7	6,3	50	22,7	993,3674	1,013	1006,281	10	6,532	0,159	15,9515	17,2767
		0M.8	6,3	53	24,062	1052,9694	1,051	1106,605	10	6,248	0,159	17,5419	
		0M.9	6,3	59	26,786	1172,1735	0,987	1156,74	10	6,419	0,159	18,3366	
	6,00	6M.7	6,3	43	19,522	854,2959	0,976	833,3657	10	6,515	0,159	13,2105	13,9549
		6M.8	6,3	48	21,792	953,6327	0,984	938,7719	10	6,457	0,159	14,8814	
		6M.9	6,3	45	20,43	894,0306	0,972	868,8488	10	6,442	0,159	13,7730	
	8,00	8M.7	6,3	38	17,252	754,9592	0,945	713,1533	10	6,460	0,159	11,3049	11,5847
		8M.8	6,3	36	16,344	715,2245	0,940	671,9981	10	6,482	0,159	10,6525	
		8M.9	6,3	39	17,706	774,8265	1,042	807,2724	10	6,474	0,159	12,7969	
	10,00	10M.7	6,3	37	16,798	735,0918	0,962	707,2809	10	6,575	0,159	11,2118	11,2343
		10M.8	6,3	38	17,252	754,9592	0,983	742,1249	10	6,370	0,159	11,7641	
		10M.9	6,3	35	15,89	695,3571	0,973	676,6984	10	6,486	0,159	10,7270	

Lampiran 26. Hasil Pengujian *Cantabro* Campuran Apal Modifikasi



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HASIL PENGUJIAN *CANTABRO* CAMPURAN MODIFIKASI

Durasi Rendaman Air Laut	Persen Karet	SAMPSEL	Berat Benda Uji		Berat Sebelum Di Abrasi (Mo-Mi)	Kehilangan Berat L	Rata - Rata Kehilangan Berat (%)
			Mo	Mi			
4 HARI / 96 JAM / PEN	0,00	0M.12	1175,82	1060,16	115,66	9,83654	9,4170
		0M.11	1174,45	1068,78	105,67	8,997403	
		0M.10	1174,87	1075,9	98,97	8,423911	
	6,00	6M.12	1176,99	1076,67	100,32	8,523437	7,5884
		6M.11	1181,16	1097,03	84,13	7,122659	
		6M.10	1184,28	1099,97	84,31	7,119093	
	8,00	8M.12	1184,17	1096,48	87,69	7,405187	7,1723
		8M.11	1186,33	1085,08	101,25	8,534725	
		8M.10	1134,69	1071,41	63,28	5,576854	
	10,00	10M.12	1136,93	1086,32	50,61	4,451461	4,9416
		10M.11	1183,01	1116,57	66,44	5,616182	
		10M.10	1188,91	1132,35	56,56	4,757299	
2 HARI / 48 JAM / PEN	0,00	0M.	1172,66	1090,49	82,17	7,007146	8,1516
		0M.	1175,19	1081,3	93,89	7,989346	
		0M.	1175,16	1064,01	111,15	9,458287	
	6,00	6M.	1185,29	1099,88	85,41	7,205831	6,8938
		6M.	1185,54	1107,51	78,03	6,581811	
		6M.	1175,79	1098,26	77,53	6,593865	
	8,00	8M.	1174,4	1080,68	93,72	7,980245	6,2442
		8M.	1179,78	1112,33	67,45	5,717168	
		8M.	1179,28	1119,9	59,38	5,035276	
	10,00	10M.	1172,09	1098,29	73,8	6,296445	4,7367
		10M.	1185,36	1130,27	55,09	4,647533	
		10M.	1188,25	1149,44	38,81	3,266148	
0 HARI / 0 JAM / PEN	0,00	0M.7	1167	1117,04	49,96	4,281063	5,9280
		0M.8	1164,52	1099,78	64,74	5,559372	
		0M.9	1157,15	1065,23	91,92	7,943655	
	6,00	6M.7	1167,01	1097,35	69,66	5,969101	4,7699
		6M.8	1173,72	1131,81	41,91	3,570698	
		6M.9	1175,1	1128,22	46,88	3,989448	
	8,00	8M.7	1178,11	1123,74	54,37	4,615019	4,3143
		8M.8	1172,59	1117,89	54,7	4,664887	
		8M.9	1121,53	1080,45	41,08	3,662853	
	10,00	10M.7	1177,84	1138,11	39,73	3,373124	3,6686
		10M.8	1176,73	1137,31	39,42	3,349961	
		10M.9	1176,32	1125,94	50,38	4,282848	

Lampiran 27. Hasil Pengujian Permeabilitas Campuran Apal Modifikasi



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HASIL PENGUJIAN PERMEABILITAS KONDISI KAO

Sampel	Tinggi				Angka Koreksi	Diameter (cm)	Berat Kering	Volume Rembesan (cm ³)	γ_{Air} (dyne/cm ³)	L (tinggi Sampel) (cm)	T (Lama Waktu) (Detik)	P (Tekanan Air) 1:1 (kgcm/det ² /cm ²)	T (Lama Waktu) (Detik)	P (Tekanan Air) 2:2 (kgcm/det ² /cm ²)	A (luas Penampang) (cm ²)	K (Koefisien Permeabilitas) (cm/detik)	K (Koefisien Permeabilitas) (cm/detik)	Kategori
	h1	h2	h3	hrata2														
0	UM.36	6,44	6,465	6,603	6,592	0,975	10	1177,52		6,59	88	1000	42	2000	364,1734204	0,000205696	0,000215491	Drainasi Jelek
	UM.35	6,436	6,425	6,6	6,619	0,979	10	1169,74		6,62	105	1000	56	2000	365,0216804	0,000172697	0,000161903	Drainasi Jelek
	UM.34	6,541	6,545	6,201	6,184	0,954	10	1180,52		6,18	133	1000	51	2000	351,3557224	0,000132334	0,000172553	Drainasi Jelek
	6M.36	6,484	6,541	6,505	6,501333	0,959	10	1180,52		6,50	135	1000	46	2000	361,3250431	0,000133282	0,000195576	Drainasi Jelek
6	6M.35	6,226	6,208	6,459	6,418	1,034	10	1118,6		6,42	168	1000	56	2000	358,7070492	0,0001065	0,00015975	Drainasi Jelek
	6M.34	6,536	6,52	6,483	6,457333	0,956	10	1172,26		6,46	143	1000	49	2000	359,9427423	0,000125454	0,00018306	Drainasi Jelek
	8M.36	6,485	6,475	6,441	6,448667	0,968	10	1184,87		6,45	163	1000	52	2000	359,6704709	0,000109996	0,000172398	Drainasi Jelek
	8M.35	6,524	6,536	6,444	6,435	0,958	10	1168,49		6,44	159	1000	46	2000	359,2411199	0,000112659	0,000194704	Drainasi Jelek
8	8M.34	6,563	6,582	6,54	6,542	0,948	10	1166,59		6,54	141	1000	43	2000	362,6026241	0,000127956	0,000209788	Drainasi Jelek
	10M.36	6,504	6,495	6,522	6,515667	0,963	10	1172,62		6,52	67	1000	30	2000	361,775338	0,00026881	0,000300171	Drainasi Jelek
	10M.35	6,49	6,48	6,203	6,212333	0,966	10	1165,73		6,21	66	1000	30	2000	352,2458403	0,000267218	0,000293939	Drainasi Jelek
	10M.34	6,609	6,575	6,543	6,533	0,945	10	1171,36		6,53	63	1000	39	2000	362,3198807	0,000286207	0,000231167	Drainasi Jelek

Lampiran 28. Tabel Konstanta A0 ITS

Diameter (inci)	A0	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4
3,5	0,177	0,077	-0,2847	0,268	-0,9966	0,05056	-0,1545	-0,9765	-0,0204	-0,1545	0,05056
3,6	0,172	0,075	-0,2769	0,2683	-0,9968	0,04786	-0,1461	-0,9560	-0,0193	-0,1481	0,04786
3,7	0,168	0,073	-0,2694	0,2685	-0,9970	0,04537	-0,1384	-0,9422	-0,0183	-0,1384	0,04537
3,8	0,164	0,707	-0,2624	0,2688	-0,9971	0,04307	-0,1312	-0,9260	-0,0173	-0,1312	0,04307
3,9	0,16	0,69	-0,2557	0,269	-0,9973	0,04049	-0,1246	-0,9104	-0,0165	-0,1247	0,04094
4	0,156	0,067	-0,2494	0,2692	-0,9974	0,03896	-0,1185	-0,8954	-0,0156	-0,1185	0,03896
4,1	0,152	0,066	-0,2433	0,2694	-0,9975	0,03712	-0,1129	-0,8810	-0,0149	-0,1129	0,03712
4,2	0,49	0,064	-0,2375	0,2696	-0,9976	0,03541	-0,1076	-0,8671	-0,0142	-0,1076	0,03541
4,3	0,45	0,063	-0,2320	0,2998	-0,9977	0,03381	-0,1027	-0,8537	-0,0136	-0,1027	0,03381
4,4	0,142	0,613	-0,2268	0,2699	-0,9978	0,03232	-0,0981	-0,8409	-0,0130	-0,0981	0,03232
4,5	0,139	0,06	-0,2218	0,2701	-0,9979	0,03092	-0,0938	-0,8282	-0,0124	-0,0938	0,03092
4,6	0,136	0,059	-0,2170	0,2702	-0,9980	0,02961	-0,0898	-0,8161	-0,0118	-0,0898	0,02961
4,7	0,133	0,575	-0,2124	0,2703	-0,9981	0,02838	-0,0860	-0,8043	-0,0114	-0,0860	0,02839
4,8	0,131	0,056	-0,2080	0,2704	-0,9982	0,02723	-0,0825	-0,7930	-0,0109	-0,0825	0,02723
4,9	0,128	0,055	-0,2037	0,2706	-0,9983	0,02618	-0,0792	-0,7820	-0,0105	-0,0792	0,02615
5	0,126	0,054	-0,1997	0,2707	-0,9983	0,02512	-0,0760	-0,7714	-0,0100	-0,0761	0,02513
5,1	0,123	0,053	-0,1958	0,2708	-0,9984	0,02418	-0,0731	-0,7610	-0,0097	-0,0731	0,02416
5,2	0,121	0,052	-0,1920	0,2709	-0,9985	0,02325	-0,0703	-0,7510	-0,0093	-0,0703	0,02325
5,3	0,119	0,051	-0,1884	0,2709	-0,9985	0,02239	-0,0677	-0,7413	-0,0090	-0,0677	0,02240
5,4	0,116	0,05	-0,1849	0,271	-0,9986	0,02158	-0,0652	-0,7319	-0,0086	-0,0652	0,02156
5,5	0,114	0,049	-0,1816	0,2711	-0,9986	0,02081	-0,0629	-0,7227	-0,0083	-0,0629	0,02061
5,6	0,112	0,048	-0,1783	0,2712	-0,9987	0,02008	-0,0607	-0,7138	-0,0080	-0,0607	0,02008
5,7	0,11	0,048	-0,1752	0,2713	-0,9987	0,01539	-0,0586	-0,7051	-0,0078	-0,0586	0,01939
5,8	0,109	0,047	-0,1722	0,2713	-0,9988	0,02874	-0,0566	-0,6967	-0,0075	-0,0566	0,01874
5,9	0,107	0,046	-0,1693	0,2714	-0,9988	0,02811	-0,0547	-0,6884	-0,0072	-0,0547	0,01811
6	0,105	0,045	-0,1665	0,2714	-0,9988	0,01752	-0,0529	-0,6804	-0,0070	-0,0529	0,01752
6,1	0,103	0,045	-0,1638	0,2715	-0,9989	0,01695	-0,0512	-0,6727	-0,0068	-0,0512	0,01696
6,2	0,102	0,044	-0,1611	0,2716	-0,9989	0,01642	-0,0495	-0,6651	-0,0066	-0,0495	0,01642
6,3	0,1	0,043	-0,1586	0,2716	-0,9989	0,01590	-0,0480	-0,6577	-0,0064	-0,0480	0,01591
6,4	0,099	0,042	-0,1561	0,2717	-0,9990	0,01542	-0,0465	-0,6504	-0,0062	-0,0465	0,01542
6,5	0,097	0,042	-0,1537	0,2717	-0,9990	0,01495	-0,0451	-0,6434	-0,0060	-0,0451	0,01495

Lampiran 29. Hasil Analisis Kadar Aspal Modifikasi dengan Bahan Tambah Ban Karet 10% dengan Anova

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Berat Jenis	Between Groups	.000	1	.000	.000	.987
	Within Groups	.021	2	.010		
	Total	.021	3			
Penetrasi	Between Groups	65.610	1	65.610	1312.200	.001
	Within Groups	.100	2	.050		
	Total	65.710	3			
Daktalitas	Between Groups	4032.250	1	4032.250	71.684	.014
	Within Groups	112.500	2	56.250		
	Total	4144.750	3			
Titik Nyala	Between Groups	5329.000	1	5329.000		
	Within Groups	.000	2	.000		
	Total	5329.000	3			
Titik Bakar	Between Groups	6084.000	1	6084.000		
	Within Groups	.000	2	.000		
	Total	6084.000	3			
Kelarutan TCE	Between Groups	42.250	1	42.250		
	Within Groups	.000	2	.000		
	Total	42.250	3			
Titik Lembek	Between Groups	72.250	1	72.250	289.000	.003
	Within Groups	.500	2	.250		
	Total	72.750	3			

Lampiran 30. Hasil Analisis pada Kadar Penambahan Ban Karet *Anova*

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Stabilitas	.860	3	8	.500
Flow	1.419	3	8	.307
MQ	1.015	3	8	.435
Imersion	2.372	3	8	.146
ITS	3.980	3	8	.052
Permeabilitas1.1	1.794	3	8	.226
Permeabilitas2.2	1.765	3	8	.231
Cantabro	.822	3	8	.517

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Stabilitas	Between Groups	16311.842	3	5437.281	2.237	.161
	Within Groups	19442.532	8	2430.317		
	Total	35754.374	11			
Flow	Between Groups	.747	3	.249	3.216	.083
	Within Groups	.619	8	.077		
	Total	1.367	11			
MQ	Between Groups	1177.117	3	392.372	2.848	.105
	Within Groups	1102.352	8	137.794		
	Total	2279.469	11			
Imersion	Between Groups	12.644	3	4.215	4.449	.041
	Within Groups	7.578	8	.947		
	Total	20.221	11			
ITS	Between Groups	14.987	3	4.996	32.543	.000
	Within Groups	1.228	8	.154		
	Total	16.216	11			
Permeabilitas1.1	Between Groups	.000	3	.000	39.880	.000
	Within Groups	.000	8	.000		
	Total	.000	11			
Permeabilitas2.2	Between Groups	.000	3	.000	8.448	.007
	Within Groups	.000	8	.000		
	Total	.000	11			
Cantabro	Between Groups	17.555	3	5.852	2.975	.097
	Within Groups	15.737	8	1.967		
	Total	33.292	11			

Lampiran 31. Hasil Analisis Akibat Rendaman Air Laut Anova

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Stabilitas	2.935	2	9	.104
Flow	5.455	2	9	.028
MQ	.700	2	9	.522
IRS	.923	2	9	.432
ITS	.017	2	9	.984
Cantabro	.390	2	9	.688

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Stabilitas	Between Groups	16133.657	2	8066.828	3.796	.064
	Within Groups	19127.523	9	2125.280		
	Total	35261.180	11			
Flow	Between Groups	1.120	2	.560	4.268	.050
	Within Groups	1.181	9	.131		
	Total	2.300	11			
MQ	Between Groups	2852.515	2	1426.258	1.901	.205
	Within Groups	6753.437	9	750.382		
	Total	9605.952	11			
IRS	Between Groups	5.832	2	2.916	1.824	.216
	Within Groups	14.389	9	1.599		
	Total	20.221	11			
ITS	Between Groups	.762	2	.381	.222	.805
	Within Groups	15.454	9	1.717		
	Total	16.216	11			
Cantabro	Between Groups	14.373	2	7.187	3.419	.079
	Within Groups	18.919	9	2.102		
	Total	33.292	11			