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EFFECT OF 19MM AS AGGREGATE'S MAXIMUM SIZE TO MARSHALL PROPERTIES OF ASPHALT CONCRETE

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ABSTRACT

The purpose of this paper is to discuss the influence of 19 mm (3/4'') as aggregate's maximum size to marshal properties of asphalt concrete. In this research, marshal's properties, asphalt content-marshal parameter plot are analyzed for 19mm aggregate's maximum size. The 19 mm as aggregate's maximum size is feasible for asphalt concrete mixture because it has stability value 1557,90 kg, density 2,4 kg/cc, Void filled with asphalt (VFWA) 90,90%, Void in mix (VIM) 3,4%, Void in mineral aggregate (VMA) 15% and flow 3,5%. It is concluded that 19 mm as aggregate's maximum size can be used for asphalt concrete mixture.

Keywords: Marshal properties, aggregate's maximum size, compaction, Asphalt concrete

INTRODUCTION

On anticipated middle traffic loading, road pavement commonly use aggregate with 10mm maximum size and 50 blows of compaction. Since we know the advantage road construction, it will be good for academics for increasing the quality of road construction for by focusing on recover the influence of 19 mm (3/4") as aggregate's maximum size to marshal properties of asphalt concrete on variation of compaction 2x75 blow, 2x250 blow, 2x225 blow. Based upon the research topic, problem in this research is the influence of 19 mm (3/4") as aggregate's maximum size to marshal properties of asphalt concrete.

THEORIES

Road pavement

Road pavement is a construction laid on base or sub base land for occupying road traffics / cars and also sustain to weather situation (Sukirman, 1999). For satisfying a good road pavement, road construction shall:

a. Has enough total thickness and allowable stress.
b. Avoid the deformation caused by wheel load.
c. Resistant to deformation caused by variation of water content.
d. Has flat surface form, friction resistant and resistant to the effects of load and chemicals that influence.

The overall construction of flexible pavement consists of:

Surface Layer (Surface Course)

The functions of the surface layer are:

I. As the material pavement to withstand the load wheels, coating has high stability to hold the wheel during the service road.

II. Stability of water-resistant coating, so that rain water does not seep to underneath layer and weaken layers.
III. As the wear layer (wearing course), layer directly suffer attrition due to brake the vehicle to be worn.
IV. As layers are spreading the load to underneath layer, it can be carried by other layers that have a higher carrying capacity.

The Base Layer (Base Course)

Function of the base layer is as follows:

a. Resist forces latitude of wheel load and spread the load to the layer below it.
b. Impregnation layer for foundation layer below.
c. Supporting the surface layer.

Sub Base Course

Functions of the base layer are:

I. Part of construction of pavement to spread the wheel load to the ground base.
II. This layer should be quite strong, having CBR 20% and plasticity index (PI) 10%.
III. As barrier load layer.
IV. Liaison layer between resistant coating base and pavement layers.
V. Filter layer (retaining) the "flight" grains of fine soil.
VI. Reduce the thickness of expensive top layer.
VII. Infiltration layer, so that ground water is not collected to the foundation.

Sub Grade (Sub Grade)

Layer of sub grade is a layer with thickness of 50-100 cm above the base layer below.

Asphalt Concrete

Asphalt concrete (AC) is surface layer of flexural road construction. AC is made by mixing massive asphalt and aggregate in continuous gradation. Agregate precentage used in AC shall meet 90 – 95% of total weight. AC also shall meet requirements : water proof, 4 – 8% asphalt to total weight procentage and 4-6 cm thickness. The mix of asphalt concrete shall be high stability, long durability, Fleksibility and skind resistance.

Asphalt concrete quality depends on aggregate gradation and compaction process. Aggregate gradation may dependent on aggregate parameters. Compaction process can reduce void, increase material's touching surface, increase compaction value and influence internal friction. Stability of mixed bitumenous material will increase as increasion of compaction value. As the high compaction value reached during the construction, the wheel's track will be avoided (Oglesby,1996).

Compaction process shall meet (Bina Marga, 1983) :

a. For anticipated heavy traffic loading, compactions shall be 75 blows.
b. For anticipated middle traffic loading, compactions shall be 50 blow.
c. For anticipated light traffic loading, compactions shall be 35 blow.

With provision : one blow equals to 1 *whelled* load as 10 ton and the thickness is 5 to 15 cm.

Performance of asphalt concrete mixture is determined by testing specimens in four stages:

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I. Determination of the weight of the specimen volume.

II. Testing the value of stability, ie the ability to receive a load of asphalt mix until a fatigue plastic unit weight is expressed in kilograms or pounds (kg or lb).

III. Testing fatigue (flow) is a form of asphalt that occurs due to a load of concrete collapsed and expressed in units of mm or 0.01 "

IV. Marshall Coefficient calculation, which is the ratio between the values stability and flow.

MATERIAL AND METHOD

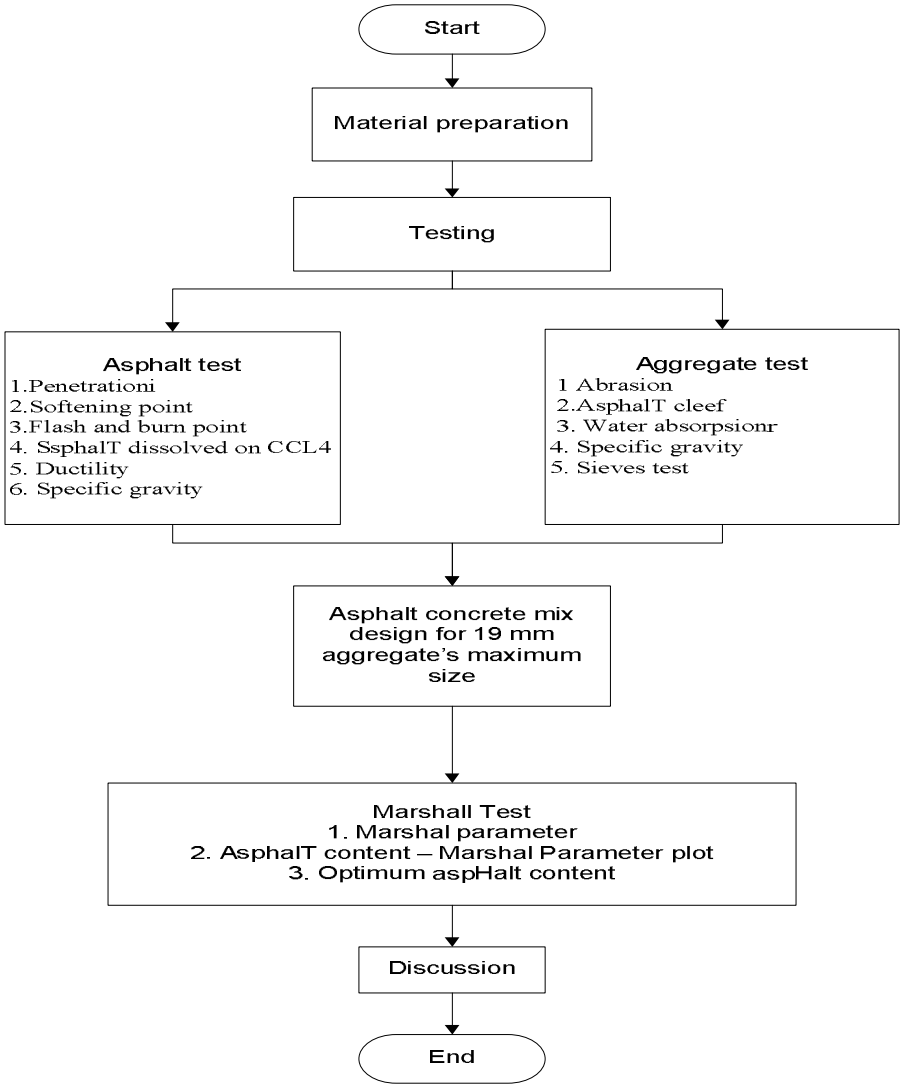

Figure 1. Method.

RESULT AND DISCUSSION

Asphalt Concrete Analysis

The results of asphalt concrete analysis are shown in Table 1 below. As shown in Table 1, the 7 test results are in OK status and AC materials can be used in this research.

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Table 1. Asphalt concrete analysis results.

No.	*Test*	*Value*	*Bina Marga requirement*	*Status*
1	Penetration	68	60-79	OK
2	Softening point	54	N.A.	OK
3	Flash point	348° C	N.A.	OK
4	Burn point	358°C	N.A.	OK
5	Asphalt dissolved in CCL4	99,02	> 99%	OK
6	Ductility	150	> 100	OK
7	Specific gravity	1,041	> 0,4 %	OK

Aggregate Analysis

The results of aggregate analysis are shown in Table 2 below. As shown in Table 2, the 6 test results are in OK status. So fine and coarse materials can be used in this research.

Table 2. Aggregate analysis results

	Test	*Value*	*Bina Marga 1993 requirement*	*Status*
1	Abrasion (Los Angeles Method)	24,52%	< 40%)	OK
2	Asphalt cleef	98 %	> 95%)	OK
3	Specific gravity of coarse aggregate	2,69	> 2,5	OK
4	Absorbsion of coarse aggregate	2,8%	< 3%	OK
5	Specific gravity of fine aggregate	2,6	> 2,5	OK
6	Absorbsion of fine aggregate	1,17%	< 3%	OK

Mix Design of Asphalt Concrete

In this research, only one kind of size is used for asphalt concrete mix design. The size is 19 mm aggregate's maximum size for mix design I .

Asphalt Concrete Bricket Mix Design

Bricket samples of asphalt concrete are made in 1200 grams and in 10,1 cm height. The sample use maximum size in 19 mm. The sample are also made in 5 type of asphaltic weight. The minimum asphaltic weight is 4.1% and increased with 0.5% for other types (Sukirman, 2007). The minimum asphaltic weight is 6.1% and increased with 0.5% for other types. The composition of bricket's aggregate are shown in Table 3.

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Table 3. Composition of bricket's aggregate for aggregate's maximum size in 19 mm

Bricket's weight (grams)			*1200*	*1200*	*1200*	*1200*	*1200*
Asphaltic procentage (%)			*4.1*	*4.6*	*5.1*	*5.6*	*6.1*
Asphalt weight (grams)			*50.4*	*56.4*	*62.4*	*68.4*	*74.4*
Aggregate weight (grams)			*1149.6*	*1143.6*	*1137.6*	*1132.6*	*1125.6*
Sieve			*I*	*II*	*III*	*IV*	*V*
Pass	*Retained*	*%*					
3/4"	1/2"	9.54	109.67	109.09	108.53	108.05	107.38
½"	3/8"	3.44	39.55	39.34	39.13	38.96	38.72
3/8"	# 4	29	333.38	331.64	329.64	328.45	326.42
# 4	# 8	14.41	165.66	164.79	163.93	163.21	162.19
# 8	# 30	22.38	256.13	255.94	254.59	253.48	251.91
# 30	# 50	6.27	71.85	71.7	71.33	71.01	70.57
# 50	# 100	5.74	65.99	65.64	59.95	65.01	64.6
# 100	# 200	3.1	35.64	35.45	35.26	35.11	34.89
# 200	Pan	5.83	67.02	66.67	66.32	66.03	65.62

Marshal Test

Marshal test are deployed according to AASHTO 1993. The results of marshall test are shown in Table 1 below.

Table 4. Result of Marshall Test

Marshall Behaviour	*2x75 blows*	*2x150 blows*	*2x225 blows*	*Bina Marga Specification*
Asphalt content	5,7%	5,5%	5,8%	
density (gr/cm^3)	2,23	2,35	2,4	-----
VIM (%)	3,6	3,27	3,4	3-5
VMA (%)	16,24	16,01	15,00	Min 14
VFWA (%)	77,74	78,10	90,90	72 – 85
Stability (kg)	1236,45	1200,6	1557,90	Min 640
Flow (mm)	3,8	3,4	3,5	2-4.5

Where : VIM is Void in mixture, VMA is Void in mineral aggregate, VFWA is Void filled with asphalt. It can be seen in Table 1 that the optimum asphalt content is 5.7%, 5.5% and 5.8% for 75 blows, 150 blows and 225 blows, respectively.

Effects of Aggregate Granule

Particle of 19 mm aggregate's maximum size have faluable gradation. It involves the reduction of VMA and VIM values. The reduction of VMA and VIM values inflicts increase of VFWA value. This process produces increase of stability.

Effects of compaction variations

As mentioned above that Particle of 19 mm aggregate's maximum size have faluable gradation. The increase of stability enhance density, VFMA and decrease flow,VMA and VIM.

CONCLUSION

After completing the research it can be found that the 19 mm as aggregate's maximum size is feasible for asphalt concrete mixture because it has stability value 1557,90 kg, density 2,4 kg/cc, VFWA 90,90%, VIM 3,4%, VMA 15% and flow 3,5%. It is concluded that 19 mm as aggregate's maximum size can be used for asphalt concrete mixture.

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