INFLUENCE OF ADDITION OF COAL ASH FILLER (FLY ASH) USES ASYSTEM WARM MIX WITH THE MARSHALLTEST ON AC-WC

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ABSTRACT

The use of AC-WC is the topsurface layer in pavement has the most delicate texture compared to other Laston types. Fly ash serves to substitute Portland Cement filler on road works especially mix AC-WC. The test specimens in this research were made with variations of asphalt content of 6%, 6.5%, and 7%. From the results of the research conducted on the mixture of AC-WC with the addition of variation of asphalt content and filler variation conducted in Civil Engineering of Pavement Laboratory inMercuBuana University isobtained the optimum asphalt content of portland cement filler is 6.45% the optimum asphalt content of fly ash filler is 6.5%.

Keyword*-AC-WC, Warm Mix, Marshall Test, Portland cement, Fly Ash*

I. INTRODUCTION

Pavement layer that is directly related to vehicle tires, is a waterproof layer, and resistant to weather.The use of coal fuel in power plants and industries, including the Asphalt Mixing Plant (AMP) unit, leaves a lot of coal ash waste and becomes a problem for the environment. Efforts to utilize this waste have been done for various purposes including for construction. Coal ash (fly ash) and bottom ash can be used as filler minerals for voids fillers and provide aggregate contact points on asphalt concrete mixtures.

II. PAVEMENT MATERIAL

The concrete asphalt layer is an asphalt layer on a road layer comprisingfrom asphalt, aggregate, and filler with a continuous gradationthen mixed, spread and compacted in a hot state soproducing a mixture with a strong binding force. Appropriate function on the functionpavement, Laston can be divided into three parts, namely the foundation layerAC-Base, layer between AC-BC (Asphalt Concrete-Binder Course) and AC-WC (Asphalt Concrete-Wearing Course).Asphalt Concrete Construction (LASTON) is intended to obtain asurface layer or intermediate layer (binder) on a capable road pavementcontributing measurable carrying capacity and functioning as a layerwaterproof that can protect the construction underneath it (BinaMarga, 1987).

The materials to be used in this research is:

1.1 Aggregate

Aggregate nature is one of the determinants of road pavement capability in carrying traffic load and weather resistance. Therefore, it is necessary to have a careful examination before it is decided that an aggregate can be used as pavement material. The aggregate properties that determine its quality as pavement material are gradation, hygiene, hardness & aggregate resistance, grain shape, surface texture, porosity, water-absorbing ability, specific gravity, and asphalt attachment.

1.2 Filler

Fillers may consist of limestone dust, dolomite dust, Portland cement, Fly Ash, high cement blast furnaces or other plastics minerals. This micro aggregate filler material must pass the no. 200 (0.075 mm).The function of the filler is to increase the viscosity of the bitumen material and to reduce the temperature susceptibility. Another advantage in the presence of fillers is that they are absorbed in bituminous materials, which increases the volume.

1.3 Portland Cement (filler)

The most important material and has the highest cost in the manufacture of concrete is Portland cement. Portland cement,limestone and other minerals are mixed and burned in a combustion device and subsequently obtained powdered materials. The powder will harden and there is a strong bond due to a chemical reaction with water 100% strength of cement can be seen on hardened samples as concrete cement at 28 days after reacting with water. The most important mineral

provisions for producing Portland cement are lime /line (CaO), silica (SiO2), alumina (A1203) and iron oxide (Fe2O3).

1.4 Aspalt

Some asphalt testing activities that can be carried out in laboratory useget the asphalt value itself:

a. Asphalt hardness testing is used using penetration testing
b. The test point of flame and burn point is useful to know the temperaturewhere the asphalt begins to burn, and the temperature at which the asphalt starts to burn
c. Ductility testing is used to determine the nature of cohesion and plasticityasphalt
d. Testing soft point to know the sensitivity of asphalt to temperature.
   In Indonesia, asphalt is used for pavement differentiated on asphalt pen60 and asphalt pen 70.

TABLE 2 BINA MARGA SPECIFICATION FOR VARIOUS VALUES PENETRATION OF BITUMEN ININDONESIA

Type of Asphalt (according to penetration)	0/70	0/100
Penetration (25 ° C, 100 gr, 5 sec)	0-79	0-99
Flash point, cleveland ° C	200	225
Ductality (25 ° C, 5cm / men, cm)	100	100
Solubility in CCI4,%		
TFOT, 3.2mm, 5 hours, 163 ° C	0.4	0.6
Losing weight%		
Penetration after loss weight% first	≥ 7 1	≥ 7 1
Type Weight (25 ° C)		

III. RESEARCH METHODS

Material testing is performed on the aggregate through analysis. Testing of aggregate is done to know the characteristicsthe aggregate which will then be used for purposesplanning of asphalt mixture with reference to standard SpecificationDepartment of Public Works (2010).

All the testing procedures performed in this study are standardized applicable is the Indonesian National Standard (SNI) Ministry of Public Works Directorate General of Highways.

SNI 03-1968-1990 : Testing Methods About Aggregate Sieve Analysis Smooth and Coarse
SNI 03-1969-1990 : Method of Testing Type Weight and Water Absorption Aggregate Coarse
SNI 03-1970-1990 : Method of Testing Type Weight and Water Absorption Fine Aggregate
SNI 03-2417-1991 : Test Method of Aggregate Wear with Machine Los Angeles Abrasion
SNI 06-2432-1991 : Ductility Testing Method of Asphalt Materials
SNI 06-2433-1991 : Flashing and Firming Point Testing Methods with Cleveland Open Cup Tool
SNI 06-2434-1991 : Asphalt and Asphalt Point Examination Method
SNI 03-1737-1991 : Procedures for the Implementation of Concrete Asphalt (LASTON) For Highway
SNI 06-2441-1991 : Heavy Asphalt Tester Weighing Method
SNI 06-2456-1991 : Testing Method of Penetrating Bitumenal Materials
SNI 03-6723-2002 : Specification of Filling Material For Powder Mixed
SNI 03-6819-2002 : Fine Aggregate Specification For Powdered Mixture
SNI 15-2351-1991 : Specific Gravity of Portland Cement AASHTO T-245-74: Pill Test Method Mixed With ToolMarshall

IV. RESULT AND ANALYSIS

4.1 Coarse Aggregate Examination

Before using coarse aggregate, some tests of the aggregate are as follows:

a. Gross aggregate type weights
   Coarse aggregate specific gravity meets the standard the greater the bulk density value on the coarse aggregate, the SSD/Saturates Surface Dry value and apparent specific gravityaremore huge.
b. Wear (Los Angeles)
   The wear value on crude aggregate is 15.1% then it meets the standard with a maximum requirement of 40%.

4.2 Fine Aggregate Inspection

Absorption in fine aggregate is only 0.08% and meets the standard requirement <3%, meaning the fine aggregate of water absorption is only small.

4.3 Specific gravity of Filler Examination (Cement and Fly Ash)

Weight value of 2.90 g / cc and 2.23 gr / cc fly ash. Then the value of filler weight on cement and fly ash meets the standard with requirement ≥ 1 gr / cc Examination of asphalt characteristics from

the laboratory results obtained value of asphalt type weight 1.29 gr / cm3 for pure asphalt.

4.4 Softening point of Aspalt

From the results of testing the softening point meets the standards. Pure asphalt with 48.5 ° C temperature of the left asphalt falling. While the right asphalt fell at a temperature of 50℃.

4.5 Aspalt mixed performance

Performance of AC-WC asphalt mixture using cement filler and fly ash. This is done to see the performance difference on cement filler and fly ash. The performance of this mixture is to find the optimum bitumen content (KAO) from Marshall test and then get some value that is VMA, VIM, VFB, Stability, Melted and MQ.

4.6 Mixed Planning Method

The mixed design is aimed at obtaining prescription of concrete asphalt mixture from the material present in the site so as to produce a mixture that meets the specified mix specifications. Currently, the most widely used mix design method in Indonesia is the mixed design method based on empirical testing, using Marshall Test.

4.7 Mixed Characteristics

The performance of this mixture is to find the optimum bitumen content (KAO) from Marshall Test and then get some value that is VMA, VIM, VFB, Stability, Melted, and MQ.

4.8 Marshall Test Results

TABLE I CONDITIONS OF AC-WC MIXED WITH FILLER PORTLAND CEMENT AND FLY ASH

Pure Asphalt Portland Cement Filler						
No	Information	Requirement		Asphalt Content (%)		
		Min	Max	6	6.5	7
1	VMA (%)	13	-	20.71	22.33	22.3
2	VIM (%)	2	6	2.43	3.17	1.85
3	VFB (%)	60	-	44.15	43.67	47.42
4	Stability (Kg)	700	-	1536.64	2042.12	1597.3
5	Melted (mm)	2	-	3.92	4.77	4.18
6	Stiffness (Kg/mm)	200	-	393.19	428.98	382.17
Pure Asphalt Fly Ash Filler						
No	Information	Requirement		Asphalt Content (%)		
		Min	Max	6	6.5	7
1	VMA (%)	13	-	21.22	22.27	23
2	VIM (%)	2	6	2.57	2.61	2.26
3	VFB (%)	60	-	42.81	43.84	45.52
4	Stability (Kg)	700	-	1609.43	1718.61	1663.91
5	Melted (mm)	2	-	5.07	5.01	5.04
6	Stiffness (Kg/mm)	200	-	317.82	343.66	328.02

After obtaining the value of asphalt content that meets the standard on VMA, VIM, VFB, Stability, Melt, and Stiffness, each KAO on pure asphalt filler of portland cement and pure filler fly ash can be determined graphically and obtained the result as below table .

TABLE II COMPARISON OF VALUE RESULTS ASPHALT OPTIMUM AT ALL FILLER VARIATIONS

No	Information	Requirement		Filler	
		Min	Max	Portland Cement	Fly Ash
1	KAO (%)			6.45	6.5
2	VMA (%)	13	-	22.2	22.27
3	VIM (%)	2	6	3.2	2.61
4	VFB (%)	60	-	43.8	43.84
5	Stability (Kg)	700	-	2020	1718.61
6	Melted (mm)	2	-	4.78	5.01
7	Stiffness (Kg/mm)	200	-	430	343.66

From the table, the optimum asphalt content (KAO) on the pure bitumen of portland cement filler showed 6.45% value and the optimum asphalt content (KAO) on pure asphalt filler fly ash showed 6.5% value.

V. CONCLUSION

1. The aggregate used and also the filler in this study meets the standard, both on coarse and fine aggregate and also on filler examination. The greatest stability value is in the portland cement filler, therefore the portland cement filler on the road pavement especially on the AC-WC mixture is able to withstand the traffic load is greater than the use of other filler variations with the optimum bitumen content obtained.

2. The optimum asphalt content (KAO) obtained in this study with variations of Portland cement filler and fly ash obtained VMA, Stability, Stiffness / MQ on all filler variations meet the standards. VIM in all filler variations exist that meet the standards some are not meeting the standard. VFB on all filler variations does not meet the standards. And the value obtained from the optimum asphalt content of the parameter is with a value of 6.5%.

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