

# The Effect of Variations of Cese Waste Waste Levels on Marshall Parameters in Ac-Wc Layer

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## Abstract

In the asphalt pavement mixture, filler is needed to support the performance of the pavement construction in order to withstand traffic loads. Various types of fillers have been widely used, including rock ash, portland cement and others. However, the limitation of natural resources encourages the use of waste materials in the construction of road pavements, a potential for the production of bagasse. In this study, sugar cane waste was used as a filler in the asphalt pavement mixture. The research method used is an experimental method, where the experiment is carried out to obtain a data set and analysis of test results. The test was carried out in 2 stages, namely testing the test object with Portland cement filler which was carried out to obtain Marshall parameters and KAO values and testing of the test object with bagasse ash filler to produce Marshall parameters and optimum filler content values. The results showed that the use of bagasse ash waste with a proportion of 5% to the weight of the filler increased stability. Tests carried out on the AC-WC layer mixture obtained the KAO value of 5.7% and the optimum filler content of 5.5%. The stability value with 7% bagasse ash filler obtained 1237.1 kg by immersing the test object for 30 minutes and 1156.4 kg with 7% bagasse ash filler by soaking the test object for 24 hours at 60 ° C, meeting the minimum requirements of 800 kg.

## Keywords

Bagasse Ash, Environmentally Friendly Materials, Bagasse Ash, Laston AC-WC Asphalt, Marshall.

## 1. Introduction

Roads as transportation system infrastructure that are routinely used to support human activities every day must have adequate quality. The increase in the number of public and private vehicles results in an ever-increasing use of roads which are proportional to the potential for road damage if they are not of adequate quality. One of the factors in the quality of road infrastructure is the pavement of the road.

According to Sukirman (2003), Asphalt is a material which at room temperature is solid to somewhat dense, and is thermoplastic. Asphalt will melt when heated to a certain temperature, and will freeze again when the temperature drops. The amount of asphalt in the pavement mixture ranges from 4 - 10% based on the weight of the mixture or 10 - 15% based on the volume of the mixture.

Asphalt Concrete (Laston) is a mixture of coarse aggregate, fine aggregate and filler with asphalt binder under high temperature conditions with a composition that is researched and regulated by technical specifications. Hot asphalt mixture is a flexible pavement mixture consisting of coarse aggregate, fine aggregate, filler and asphalt binder with a certain ratio and mixed in hot conditions (Hamzah, 2018).

Utilization of waste materials or industrial waste such as waste from burning coal (fly ash), bagasse and wood industry waste in Indonesia is generally still not optimally utilized. Therefore, processing is carried out so that it can be used into more useful materials. It is hoped that the use of bagasse and wood industrial waste can be used as a filler in the laston mixture. Bagasse ash is industrial waste from burning bagasse in sugar factories. Bagasse is produced from the process of pressing or grinding sugarcane stalks five times in the production process at the factory. Sugarcane waste that piles up every day creates problems for the factory. Sugarcane bagasse ash waste has a fruitful nature that requires a larger storage area. In addition, the less than optimal

utilization of bagasse waste makes bagasse ash just thrown away. To overcome this problem, the authors are interested in conducting research on the use of bagasse ash as a filler in the asphalt mixture (Samsuri, M, 2007).

## 2. Methodology

This research was conducted at the Civil Engineering Laboratory of the University of Mercu Buana Jatisampurna Bekasi both in testing aggregates, asphalt and Marshall. Standards for testing aggregate and asphalt characteristics are based on the standard SNI 8198:2015 (2015) method. The research steps were to prepare tools and materials in the form of aggregate, asphalt, filler (cement and bagasse ash). Furthermore, if it meets the specifications then designs the Laston mix design with a hot mix system with a variation of asphalt content of 5%; 5.5%; 6% and 6.5%. The design of the mixture for the specimen with asphalt content used 5%, 5.5%, 6% and 6.5%. Then soaking the test object for 30 minutes then marshall test, analysis of test results (VMA, VIM, VFA, Stability, Melt and MQ and determination of KAO. Then mix design with the hot mix system using KAO that has been obtained from previous research. Then soaking for 30 minutes with a temperature of 60 ° C and immersion for 24 hours with a temperature of 60 ° C after that the Marshall test and analysis of the test results to obtain the optimum filler content and IKS value. Analysis of the test results then conclusions and suggestions. Coarse aggregate (including rock and standard filler) used from Narogong. Asphalt used from Pertamina penetration is 60/70. The alternative filler used is bagasse ash from the burning of bagasse in Bogor. Types of aggregate inspection carried out include Density Testing and Coarse Aggregate Water Absorption, Density Testing and absorption of fine aggregate water, testing the adhesiveness of aggregate to asphalt, analysis of fine and coarse aggregate sieve , Aggregate wear with Los Angeles. Types of asphalt inspection include Penetration Testing, Asphalt Softening Point Testing, Flash Point Testing, Asphalt Ductility Testing, and Asphalt Specific Gravity Testing. Standard Marshall test with 2x75 collisions. This study is only based on the results of the Marshall test to determine the value of stability, flow, VMA, VIM, VFA and Marshall Quotient to obtain residual strength index (IKS).



Figure 1. Preparation for Making Test Objects

## 3. Result and Analysis

The results of research which include aggregate testing, asphalt testing with penetration of 60/70 and Marshall test results meet all the requirements stipulated by the SNI 8198:2015 (2015) specification.

Table 1. Recapitulation of Coarse Aggregate Test Results

No.	Information	Formula	The result	Unit
1	Surface dry specimen	BJ	5058	gr
2	Test object in water	BA	3066	gr
3	Oven dry specimen	BK	5000	gr
4	Bulk density	$\frac{BK}{BJ - BA}$	2.510	gr
5	SSD specific gravity	$\frac{BJ}{BJ - BA}$	2.53	gr
6	Artificial density	$\frac{BK}{BK - BA}$	2.588	gr
7	Absorption	$\frac{BJ - BK}{BK} \times 100\%$	2.44	%

Source: Research Results, 2020

Table 2. Recapitulation of Fine Aggregate Test Results

No.	Information	Formula	The result	Unit
1	Surface dry specimen	Bj	380	gr
2	Pycnometer + water weight	B	639	gr
3	Pycnometer + water + specimen weight	Bt	872	gr
4	Oven dry specimen weight	Bk	372	gr
5	Bulk density	$\frac{Bk}{B + Bj - Bt}$	2.531	gr
6	SSD specific gravity	$\frac{Bj}{B + Bj - Bt}$	2.585	gr
7	Artificial density	$\frac{Bk}{B + Bk - Bt}$	2.676	gr
8	Absorption	$\frac{BJ - BK}{BK} \times 100\%$	2.676	%

Source: Research Results, 2020

Table 3. Recapitulation of Portland Cement Filler Test Results

No.	Information	Formula	The result	Unit
1	Filler weight	Bt	64	gr
2	Reading scale to 1	V1	0.6	cc
3	2nd scale reading	V2	22.4	cc
4	density	$\frac{Bt}{V2 - V1}$	2.936	gr/cc

Source: Research Results, 2020

Table 4. Recapitulation of Sugarcane Dregs Ash Filler Test Results

No.	Information	formula	Test result	Unit
1	Filler weight	Bt	64	gr
2	Reading scale to 1	V1	0.5	cc
3	2nd scale reading	V2	25.5	cc
4	density	$\frac{Bt}{V2 - V1}$	2.215	gr/cc

Source: Research Results, 2020

Table 5. Recapitulation of 60/70 pen Asphalt Testing Results

No	Type Of Testing	Method	Terms		The Result	Information
			Min	Mak		
1	penetration , 25 <sup>0</sup> C; 100 gr; 5 detik;0,1 mm	SNI 2456 – 2011	60	70	664	Fulfill
2	soft spot , <sup>0</sup> C	SNI 2434 – 2011	48 <sup>0</sup> C	-	53	Fulfill
3	flash point , <sup>0</sup> C	SNI 2433 – 2011	175 <sup>0</sup> C	-	205 <sup>0</sup> C	Fulfill
4	ductility 25 <sup>0</sup> C; cm	SNI 2432 – 2011	100 cm	-	109,1	Fulfill
5	density	SNI 2441 – 2011	1	-	1.047	Fulfill

Source: Research Results, 2020

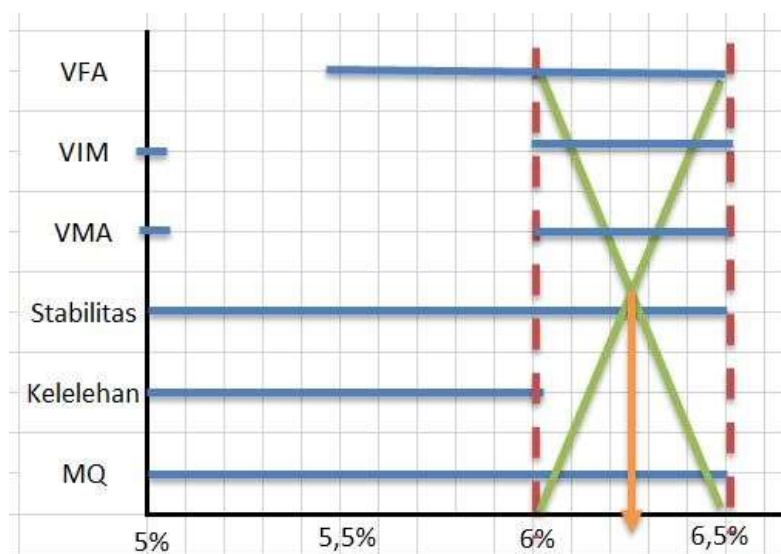


Figure 2. Optimum Asphalt Content with Portland Cement Filler

Source: Research Results, 2020

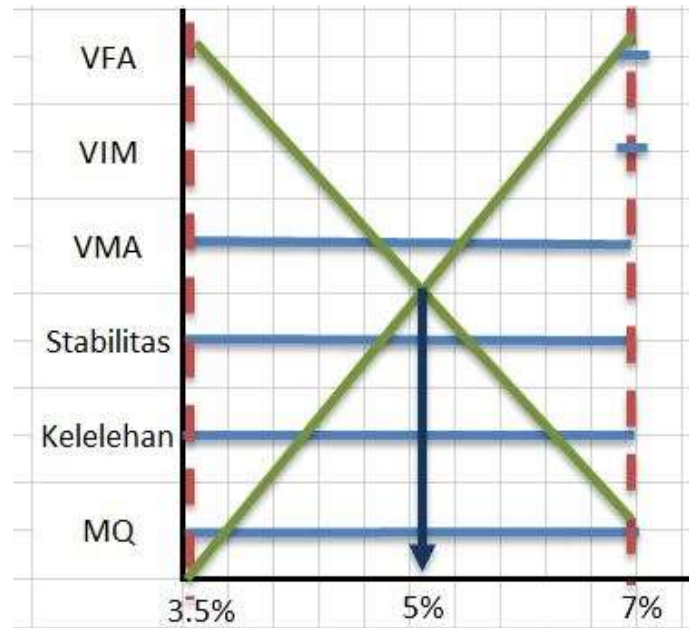


Figure 3. Optimum Asphalt Levels with Sugarcane Dust Filler  
 Source: Research Results, 2020

#### 4. Conclusion

Based on the analysis and discussion of research conducted at the Laboratory of the University of Mercu Buana Jatisampurna regarding the effect of bagasse ash as a filler on the AC-WC mixture, the following conclusions were drawn:

1. The aggregate used is of a fairly good quality because each test meets the SNI requirements used.
2. Asphalt pen 60/70 used has a fairly good quality because each test meets the SNI requirements used.
3. Based on the results of the study, the value of the optimal asphalt content (KAO) obtained from the test object using Portland cement filler at asphalt content of 5%; 5.5%; 6%; and 6.5% of the AC-WC asphalt mixture, namely 5.7%.
  - a. The use of bagasse ash filler with a content of 5% increased the stability value.
  - b. The stability value with asphalt content of 6.5% has decreased.
  - c. In bagasse ash filler, the value of stability by immersing the specimen for 30 minutes was higher than for 24 hours.

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#### Biography / Biographies

**Muhammad Isradi, ST, MT, IPM** served as Secretary of the Civil Engineering Study Program at Mercu Buana University. Mr. Isradi holds a Bachelor's degree in Civil Engineering from the University of Muhammadiyah Malang in 1992-1998, with the title of the thesis of One-Way Flat Plate Planning at the Ratu Plaza Madiun Building and a Masters in Civil Engineering in Brawijaya University of Malang in 1999-2001, with the title Model Analysis of Family Movement Awakening in Malang Sawojajar Housing Area. He has taught courses in Road Pavement Planning, Road Geometric Planning, Transportation Engineering, and Environmental Engineering.

**Imam Sindu Baskoro** is a student from Mercu Buana University, Kranggan with a Civil Engineering study Program. I am the second child of 2 siblings who graduated from SDN 11 Pagi Ciracas, the moved to As-

Salam Islamic boarding school Sukabumi, MAN 15 Kelapa Dua Wetan, until then I continued my education at Mercu Buana Kranggan University. There were several competitions that I participated in from elementary school to college, Arabic speeches and scout competitions. During junior high and high school I was quite active in the fields of Scouting, silat, Islamic spirituality, calligraphy, futsal and theater. When I entered Mercu Buana education I was active in the field of Assistant Lecturer in the Soil Mechanics course and had served for 1 year. In addition, I was a civil engineering laboratory assistant for 2 periods.