The Effect of Using Sugar Cane Drops as aSubtitute Some Asphalt for Ac-Bcand Ac-Wc Concrete Asphalt Layer

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Abstract-The road construction carried out at present faced with the improvement of the quality and cost of development. The development of research on material substitutes highway construction can be a solution to improve the quality of road construction materials. The aim of this research is to know the effect of the use of molasses as a partial replacement for Laston asphalt AC-BC and AC-WC.This study uses a 60/70 penetration bitumen, the bitumen content variation of 5%, 5.5%, 6%, 6.5% and 7% and variation levels of molasses as a partial replacement of asphalt 4%, 8%, and 12%. The combined aggregate grading is based on the specifications required by the 2010 revision of Highways 3, in order to obtain the composition of the asphalt mixture AC-BC and AC-WC using coarse aggregate to AC-BC 50%, Fine aggregate 44.2% and filler 5.8%, for coarse aggregate AC-WC 41%, Fine aggregate 52.1%, and filler 6.9%, Testing was conducted by Marshall.The result of research shows that use of molasses as a partial replacement of asphalt on Laston AC-BC value Marshall test highest levels of molasses 4%, the value of Marshall test such as the value of VFB, stability and flow is lower, while the value of VIM, VMA and MQ tend to be higher, compared to with the normal mix with OBC 6%. In the Laston AC-WC with the use of molasses as a partial replacement of asphalt, the value of Marshall test highest levels of molasses 4%, the value of Marshall test such as the value of VFB, stability and MQ lower, while the value of Flow, VIM and VMA tend to be higher, compared to with the normal mix with OBC 6%

Keywords: Aggregate, AC-BC, AC-WC, Asphalt, Marshall Conventionally, Cane Molasses.

Preliminary

Transportation Developing road undertaken at present faced with the improvement of the quality and cost of development. The development of research on material substitutes highway construction can be a solution to improve the quality of road construction materials.

Molasses which replaces the majority of bitumen in the asphalt mix is expected to reduce voids in the mixture and increases the stability or strength of asphalt mixture, so that the mixture is more dense and impermeable.

In the industrial world sugar production process of making sugar will be produced sugar 5%, bagasse 90% and the remainder in the form of drops of sugarcane (molasses) and water. Physical content of molasses containing silica that are glue.

Based on these data, the waste molasses will be used as a partial replacement of asphalt in this study, molasses is used as an alternative to improve the physical properties of the asphalt for the content of silica contained in the molasses has a binding force that enables quite the same as asphalt.

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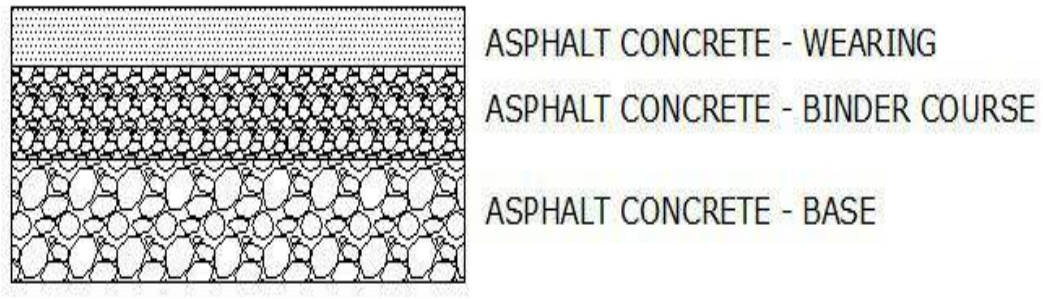
Theoretical Basis

2.1 Pavement

Road pavement materials is very important in road construction, the use of appropriate materials can produce a quality road construction and quality.

The general requirements of a road is to provide a surface layer that is always flat and strong, and ensures high security for a long service life and require minimal maintenance in a variety of weather. The surface layer itself can still be subdivided into two further layers, namely:



- **-Wearing Course Asphalt Concrete (AC-WC)**

  Asphalt Concrete -Wearing Course a pavement layer that lies on top and serves as the wear layer. Although it is non-structural, AC-WC can increase endurance pavement to decrease the overall quality that adds to the service lifetime of pavement construction.
- **Asphalt Concrete - Binder Course (AC-BC)**

  This layer is a layer of pavement which is located below the wear layer (Wearing Course) and on top of the base layer (Base Course). This layer is not directly related to the weather, but it must have sufficient thickness and rigidity to reduce stress / strain due to loads of traffic to be forwarded to the layer below, namely Baseandsubgrade(Land Basic). The most important characteristic in this mix is the stability.
- **Asphalt Concrete - Base (AC-Base)**

  This layer is located below the pavement binder layer (AC-BC), the pavement is not directly related to the weather, but it needs to have the stability to withstand traffic loads are transmitted through the wheels of the vehicle. The difference lies in the type of aggregate and asphalt content is used. According to the Department of Public Works (1983).

In all things according to the research mix design must meet sifa dansifat material properties-properties as required mix of public dalamspesifikasi Highways 2010 revision 3 (division 6) "Hot Asphalt Mixture" in Table 2.5 as follows:

Table 1. Conditions Attributes AC Laston Mixed

Qualities Mixed		**Laston (AC)**		
		Lapis Aus (WC)	**Between Lapis (BC)**	**Base (Base)**
The number of collisions per field	Min.	75		112 (1)
The ratio of the particles passes a sieve 0,075mm with effective asphalt content	Min.	1.0		
	Max.	1.4		
Voids in the mixture (%) (2)	Min.	3.0		
	Max.	5.0		
The voids in the aggregate	Min.	15	14	13

(VMA) (%)				
Cavity filled with asphalt (%)	Min.	65	65	65
Stability marshall (kg)	Min.	800		1800 (1)
Melting (mm)	Min.	2		3
	Max.	4		6 (1)
Marshall quotien (Kg / mm)	Min.	250		
Marshall stability remainder (%) after 24 hours of immersion, 60 ºC[3]	Min.	90		
Voids in the mixture (%) at densities Mambal (refusal) (4)	Min.	2		

Source: Highways 2010 General Specification Revision 3 (Division 6) "Hot Asphalt Mixture",

2.2. Molasses

Molasses is a by-product from the manufacture of sugar cane (Saccharum officinarum L). Viscous liquid molasses obtained from the phase separation and crystal sugar.

Molasses is a sugar factory waste which has benefits and is also very dangerous, depending on its use.Molasses still contains enough sugar to produce ethanol by fermentation, typically ranging between 5.5-6.5 pH molasses. Molasses still contains about 10-18% sugar have given satisfactory results in the manufacture of ethanol. (Anonima, 2011).

Molasses on originally was a term used for a variety of byproducts derived from plants with high sugar content, liquid, viscous and dark brown. However, the term is now more widely used as a byproduct of sugarcane or beet (Perez, 1983). In Indonesia, molasses cane sugar processing result is known as molasses. Molasses contains sucrose, glucose, fructose and raffinose in large numbers as well as a number of non-sugar organic materials (Baker, 1981; Valli et al., 2012).

2.3. Marshall method

Marshall method aims to determine the characteristics of a flexible method perkersanmarshallmarshall is composed of test parameters and calculation formulas and marshall.

Examination mixture was first introduced by Bruce Marshall and further developed by the US Corps Of Engineer. Marshall testing aims to measure the durability (stability) of a mixture of aggregate and asphalt to plastic melting (flow). Marshall tool is a tool press equipped with proving ring (ring testers) 22,2kn capacity (5000 lbs) and flowmeter. Proving ring is used to measure the value of stability and flow meter to measure the melting plastic. Cylindrical test specimen with a diameter of 10cm and a height of 7.5 cm.

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Research Methodology

3.1. Decision `Aggregate

Sampling was conducted to obtain material samples were examined in laboratory and can represent all the materials available. This aggregate sampling done manually by using tools such as spades, and sacks. Granular material obtained from Maulu river Tana Toraja. The location is situated in Tana Toraja district, sub rembon, with the boundaries of the west bordering Malimbong sub-district, sub-district north bordering the Saluputti, east by the subdistrict Rantetayo and south by sub-district Makale.

3.2. Cane Molasses Decision

Molasses as a partial replacement of the asphalt obtained from milking the rest of sugarcane juice, sugar mill Takalar, South Sulawesi. The location is in North Palobangkeng, Takalar, South Sulawesi.

3.3. Asphalt Decision

Laston mix asphalt used to test AC-BC and AC-WC obtained from testing and research centers asphalt PT. Sabar Jaya Tana Toraja. The oil that we use asphalt is asphalt with penetration 60/70.

Results And Discussion

4.1 Characteristics of Materials Testing Results

Aggregate materials used in this study is gravel as coarse aggregate, sand as fine aggregate from the river maulu and Bosowa cement as filler (filler) with standard testing based on the general specifications of Highways 2010 revision 3 (division 6) "Hot Asphalt Mixture".

a. Coarse Aggregates

Table 2. Characteristics of Coarse Aggregates

No.	types of Tests	Testing methods	Test result	Specification
1	Bulk specific gravity (bulk)	ISO 1969: 2008	2.70	Min. 2.5
2	Density SSD	ISO 1969: 2008	2.72	Min. 2.5
3	Apparent specific gravity (apparent)	ISO 1969: 2008	2.75	Min. 2.5
4	Absorption (absorption)	ISO 1969: 2008	0.68	Max. 3
5	The wear of Aggregate (Los Angeles)	ISO 2417: 2008	26.25	Max. 40
6	Resilience aggregate against collision	SNI 03-4426-1997	13:54	Max. 30
7	Levels of mud and clay	SNI 03-4141-1996	0.68	Max. 1

b. Fine aggregate

Table 3. Characteristics of Fine Aggregate

No.	types of Tests	Testing methods	Test result	Specification
1	Bulk Density	ISO 1969: 2008	2.63	Min. 2.5
2	Density SSD	ISO 1969: 2008	2.70	Min. 2.5
3	Apparent specific gravity	ISO 1969: 2008	2.83	Min. 2.5

	(apparent)			
4	Absorption (absorption)	ISO 1969: 2008	2.67	Max. 3
5	Levels of mud and clay	SNI 03-4141-1996	0.96	Max. 1

c. The filler (Filler)

Table 4. Testing Results Semen Bosowa Gravity Filler

No.	standard specification	Test result
1	-	3:16

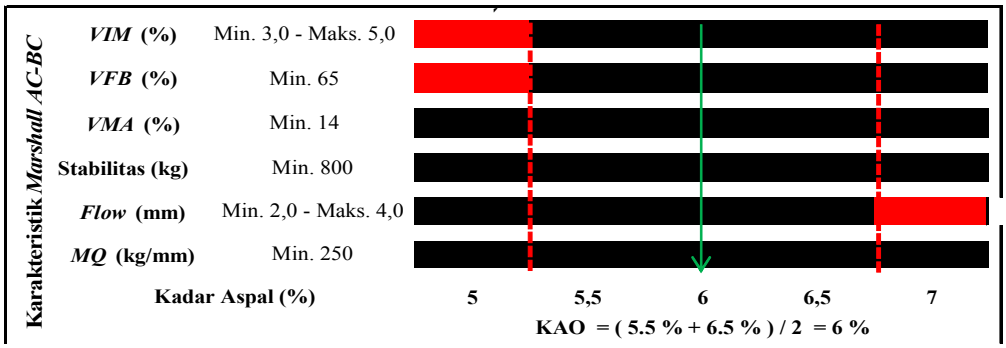
From the test results density cement filler Bosowa above, 3.16 g of test results obtained, the test results meet the specifications required filler based on the standard of Highways ie 2,5 min.

Asphalt Testing Results

60/70 penetration bitumen examination results, While the test results more 60/70 penetration bitumen in this study refers to the test data from PT. Sabar Jaya namely testing ductility 129.33 cm, specific gravity of 1.03 g / cc, the flash point of 290 ° C, the burning point of 300 ° C, the melting point of 50.75 ° C and a weight loss of 0.175%.

B. Determination of Optimum Asphalt Content (KAO) Mixed AC-BC

Figure 1. Diagram Determination of Optimum Asphalt Content Mix AC-BC



Information :

1. Value VIM qualified on asphalt content of 5.5%, 6%, 6.5% and 7% ..
2. Value VFB qualified on asphalt content of 5.5%, 6%, 6.5% and 7% ..
3. Value VMA qualified on asphalt content of 5%, 5.5%, 6%, 6.5% and 7%.
4. asphalt content 5%, 5.5%, 6%, dan6,5% and 7%, qualify the value of stability.
5. asphalt content 5%, 5.5%, 6% and 6.5%, qualify the value of flow.
6. asphalt content 5%, 5.5% 6%, 6.5% and 7%, qualify the value of MQ.
7. Value optimum bitumen content (OBC) is at a level of 6% bitumen, all meet the requirements of VIM, VFB, VMA, stability, flow and MQ.

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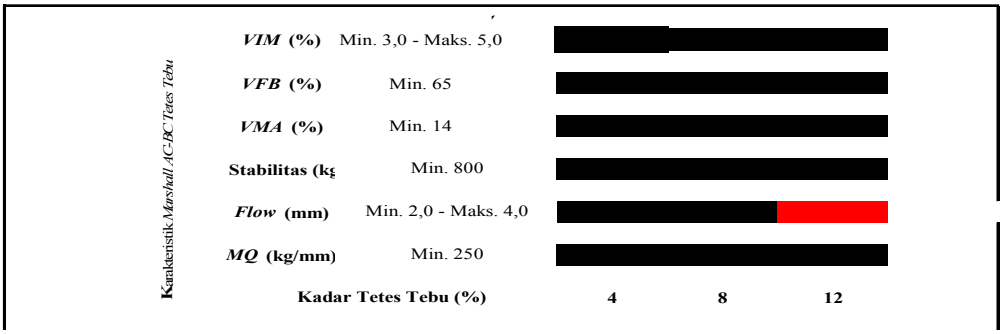
C. Diagram of Use Molasses Sugar Cane Testing Results As Substitute Most asphalt mixture AC-BC

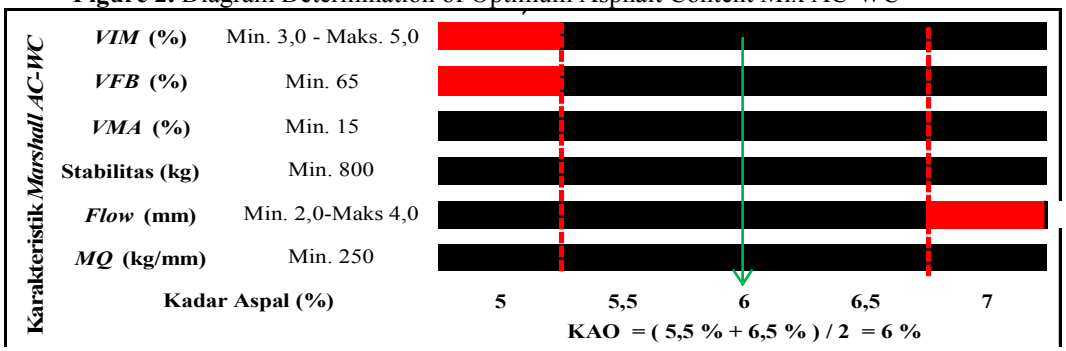


Information :

1. Values at levels of VIM eligible molasses 4%, 8% and 12% ..
2. Value VFB eligible molasses at levels of 4%, 8% and 12% ..
3. Value VMA qualified on asphalt content 4%, 8% and 12%.
4. Levels of molasses 4%, 8% and 12%, qualify the value of stability.
5. Levels of molasses 4%And 8% qualified flow value.
6. Levels of molasses 4%, 8% and 12%, qualify the value of MQ.

B.Determination of Optimum Asphalt Content (KAO) Mixed AC-WC

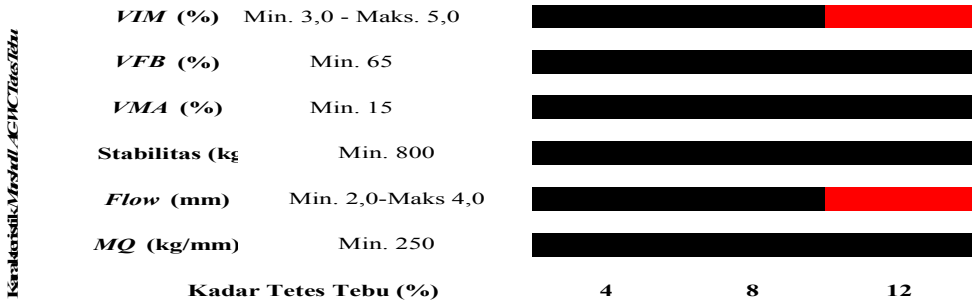
Figure 2. Diagram Determination of Optimum Asphalt Content Mix AC-WC



Information :

1. Value VIM qualified on asphalt content of 5.5%, 6%, 6.5% and 7%.
2. Value VFB qualified on asphalt content of 5.5%, 6%, 6.5%, and 7%
3. Value VMA qualified on asphalt content of 5%, 5.5%, 6%, 6.5% and 7%.
4. asphalt content 5%, 5.5%, 6%, 6.5% and 7%, qualify the value of stability.
5. asphalt content 5%, 5.5%, 6%, and 6.5% ,, qualify flow value.
6. asphalt content 5%, 5.5%, 6%, 6.5% and 7%, qualify the value of MQ.
7. Value optimum bitumen content (OBC) is at a level of 6% bitumen, all meet the requirements of VIM, VFB, VMA, stability, flow and MQ.

C. Diagram of Use Molasses Sugar Cane Testing Results As Substitute Most asphalt mixture AC-WC



Information :

1. Values at levels of VIM qualify molasses 4%, and 8%.
2. The value of VFB qualify molasses at levels of 4%, 8% and 12% ..
3. Value VMA qualified on the asphalt content of 4%, 8% and 12%.
4. Levels of molasses 4%, 8% and 12%, qualify the value of stability.
5. Levels of molasses 4%And 8% qualified flow value.
6. Levels of molasses 4%, 8% and 12%, qualify the value of MQ.

Conclusion

1. The results show the AC-BC Laston normal mix of 6% OBC values obtained with the test results Marshall VIM value of 4.02%, VFB 75.23%, 16.16% VMA, Stability 1646.16 kg, 3.00 mm and MQ flow 566.24kg / mm while the research results in a mixture of molasses as a partial replacement of asphalt, Marshall test score highest level of 4% molasses obtained the value of VIM 4.08%, VFB 75.19%, 16.22% VMA, Stability 1643.44 kg, flow 2.60 mm, MQ 644.47kg / mm. Compared with the normal mix with KAO 6%, the value of Marshall test mixture of molasses as a partial replacement of asphalt as the value VFB, stability and Flow lower, while the value of VIM, VMA and MQ tend to be higher.
2. The results show the AC-WC Laston normal mix of 6% OBC values obtained with the test results Marshall VIM value of 4.42%, VFB 72.76%, 16.10% VMA, Stability 1599.21 kg, 2.95 mm and MQ flow 557.49kg / mm while the research results in a mixture of molasses as a partial replacement of asphalt, Marshall test score highest level of 4% molasses obtained the value of VIM 4:56%, VFB 72.41%, VMA 16:53%, Stability 1590.40kg, flow 3:30 mm, MQ 482.16kg / mm. Compared with the normal mix with KAO 6%, the value of Marshall test mixture of molasses as a partial replacement of asphalt as the value VFB, stability and MQ lower, while the value of Flow, VIM and VMA tend to be higher.

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