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DURABILITY OF HRS-WC MIX WITH ANTISTRIPPING WETFIX-BE AND FLY ASH FILLER

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Abstract

Damage to flexible pavement can be caused by asphalt, which has weaknesses due to its low viscosity and resistance to heat, radiation, and oxidation. Furthermore, road damage is also caused by water ingress into the aggregate pores, which typically occurs during rain, when the pavement is traversed before it is sufficiently strong, or because the asphalt does not evenly cover the rock. Therefore, special considerations are needed when designing asphalt mixtures, including improving their quality. One way to do this is by modifying them with additives that are expected to increase the asphalt's bonding energy to the rock. One additive that can reduce peeling damage due to sunburn is Wetfix-Be, a liquid that works to improve the asphalt's bonding properties to the rock. The purpose of this study was to determine the effect of Wetfix-Be on fly ash filler and cement. This study tested the durability of the HRS-WC mixture and varied soaking times (30 minutes, 24 hours, and 48 hours). Furthermore, Wetfix-Be was added at 0.2%-0.5%. The mixture design varied in asphalt content from 5.5%, 6%, 6.5%, and 7%. The method used in this study was the Marshall Test, which examines the stability and flow, as well as the density and pore size of the resulting solid mixture. The test results obtained for cement filler with an optimum asphalt content of 6.5% and an optimum wetfix-be content of 0.31%, while for fly ash filler with an optimum asphalt content of 6.4% and an optimum wetfix-be content of 0.41%. The Residual Strength Index (SIKS) was >80% for both fillers. The fly ash filler achieved higher values than cement after 24 hours (91.8%) and 48 hours (91.39%).
Keywords: *Antistripping, Wetfix-Be, fly ash*

Abstrak

Kerusakan pada perkerasan lentur dapat disebabkan oleh aspal yang memiliki kelemahan karena viskositas rendah dan tidak tahan terhadap panas, radiasi dan oksidasi. Selain itu kerusakan jalan juga disebabkan masuknya air ke dalam pori-pori agregat yang biasanya terjadi pada saat hujan, perkerasan dilewati sebelum aspal cukup kuat atau karena kurang ratanya aspal menyelimuti batuan. Sehingga perlu adanya pertimbangan khusus dalam melakukan perencanaan campuran aspal termasuk peningkatan mutu aspal. Salah satunya dengan cara memodifikasinya dengan bahan aditif yang diharapkan dapat memperbesar energi perlekatan aspal terhadap batuan. Zat aditif yang dapat mengurangi kerusakan pengelupasan akibat terbakar sinar matahari salah satunya adalah Wetfix-Be yang berupa cair dan bekerja untuk memperbaiki sifat perlekatan aspal terhadap batuan. Tujuan penelitian ini adalah untuk mengetahui pengaruh Wetfix-Be pada *Filler Fly Ash* dan semen dengan uji Durabilitas campuran HRS-WC dan variasi lama perendaman (30 menit, 24 jam, 48 jam). Kemudian penambahan Wetfix-Be dengan kadar 0,2%-0,5%. Dan rancangan campuran

variasi kadar aspal 5,5%, 6%, 6,5%, dan 7%. Metode yang digunakan pada penelitian ini adalah *Marshall Test* yaitu pemeriksaan stabilitas dan kelelehan (*flow*), serta analisis kepadatan dan pori dari campuran padat yang terbentuk. Hasil pengujian didapatkan pada *filler* semen kadar aspal optimum 6,5% dengan kadar wetfix-be optimum 0,31%, sedangkan *filler fly ash* kadar aspal optimum 6,4% dengan kadar wetfix-be optimum 0,41%. IKS (Indeks Kekuatan Sisa) > 80% pada kedua *filler*. Pada *filler fly ash* didapat didapat nilai yang lebih tinggi dari semen pada perendaman 24 jam (91,8%) dan 48 jam (91,39%).
Kata kunci : Antistripping, Wetfix-Be, *fly ash*

I. INTRODUCTION

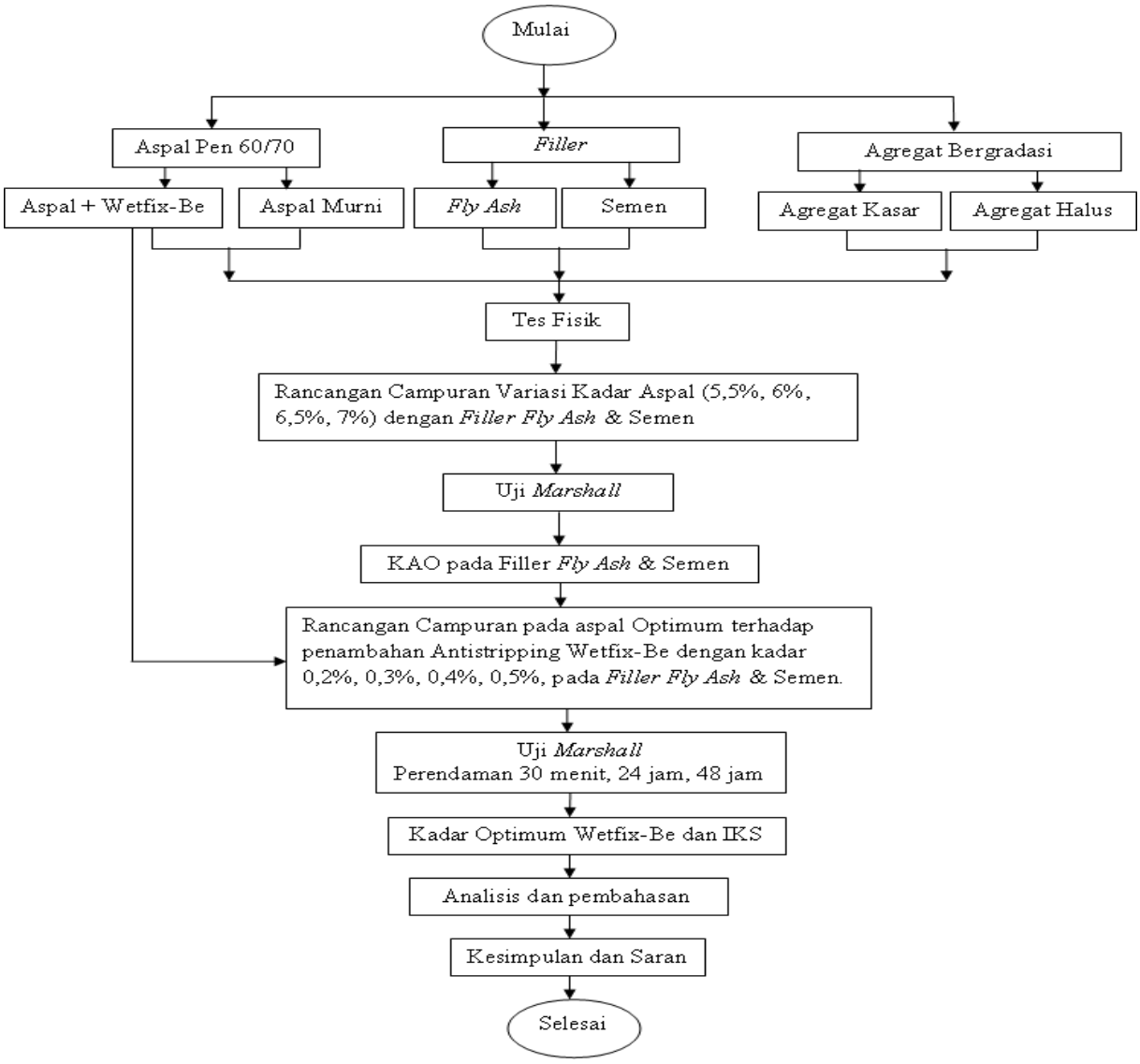
Pavement structure plays a crucial role in providing optimal, safe, comfortable, strong, and fast service. Damage to flexible pavement can be caused by asphalt that has weaknesses due to low viscosity and is not resistant to heat, radiation, and oxidation. The pavement appears to break into small pieces, such as peeling due to sunburn, or has parallel streaks. Loose grains can occur over the entire surface, with the worst locations being along traffic lanes.

On the other hand, the rapid growth in traffic volume will impact the need for road pavement structures and the use of materials. Especially in Indonesia, excessive traffic loads are common, requiring special considerations in asphalt mix planning, including improving asphalt quality. A common approach is to modify it with additives that are expected to increase the asphalt's bonding energy to the rock. One additive that can reduce peeling damage due to sunburn is Wetfix-Be, a liquid that works to improve the asphalt's bonding properties to the rock. This study will attempt to use Wetfix-Be in a non-structural HRS-WC mixture as a waterproofing layer. The addition of the Wetfix-Be additive is expected to alter the properties of the asphalt and aggregate, increasing their adhesion and bonding strength, while also reducing the negative effects of water and humidity. This will result in a highly adhesive asphalt pavement surface and reducing asphalt peeling.

This study was conducted in a laboratory setting, and no pavement cost analysis was conducted. The pavement mixture used was HRS-WC (Hot Rolled Sheet Wearing Course) with asphalt content of 5.5%, 6%, 6.5%, and 7%. The materials used were Pertamina Asphalt (60/70 Penetration), aggregate from PT. Adhimix Precast, and fly ash from coal combustion. The additive used was liquid Wetfix-Be from PT. Enceha Pacific with concentrations of 0.2%, 0.3%, 0.4%, and 0.5% of the asphalt weight.

II. RESEARCH METHODS

In the Durability Test the method used is the Marshall test method. The basic principle of the Marshall method is the examination of stability and flow, as well as density and pore analysis of the solid mixture formed. Resistance (stability) is the ability of an asphalt mixture to receive a load until fatigue occurs. Plasticity fatigue is the state of change in the shape of an asphalt mixture that occurs due to a limit load failure expressed in mm. Because HRS-WC is a medium traffic load, compaction with a pounder is 50 times the impact. Then the number of samples required is 96 samples with asphalt content and wetfix-be content of 3 samples each. Testing the characteristics of pavement materials refers to the Indonesian National Standard (SNI).



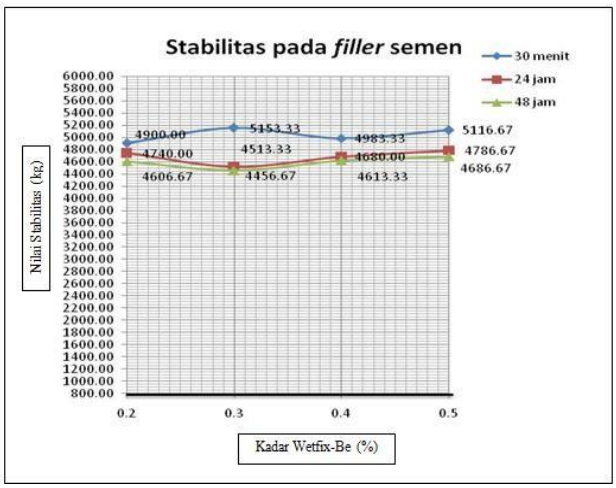
III. RESEARCH RESULTS

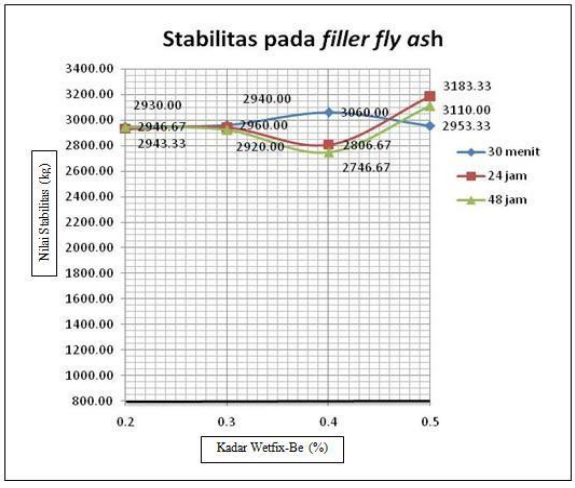
The characteristics of the pavement material, including coarse and fine aggregates, and fillers, met SNI standards. The asphalt characteristics were determined for both pure asphalt and asphalt with the addition of wetfix-BE antistripping. In the penetration test, the addition of wetfix-BE made the asphalt harder, so that a wetfix-BE content of 0.5% did not meet the requirements. In the ductility test, the addition of wetfix-BE made the asphalt more durable and flexible. In the softening point test, the higher the wetfix-BE content, the softer or more liquefied it became, causing the 0.4% and 0.5% content to fail. Meanwhile, in the viscosity test, the higher the wetfix-BE content, the more liquefied the asphalt. Furthermore, in the flash point and specific gravity tests, the higher the wetfix-BE content in the asphalt, the greater the specific gravity and flash point temperature.

Then the test results obtained on cement filler optimum asphalt content of 6.5% with optimum wetfix-be content of 0.31%, while fly ash filler optimum asphalt content of 6.4% with optimum wetfix-be content of 0.41%. So the following values are obtained.

Mark	Semen	Fly Ash	Unit
	Kadar Wetfix-Be 0,31%	Kadar Wetfix-Be 0,41%	
VMA	18,04	18,42	%
VIM	5,8	5,8	%
VFB	74,6	71,6	%
Stability	5150	3050	kg
Melting	3,5	3,8	mm
MQ	1475	812,5	kg/mm

The results of the IKS (Residual Strength Index) value can be seen from the stability graph with 24-hour and 48-hour immersion.





Filler Types	Average stability value			IKS		Condition
	30 minutes	24 hours	48 hours	24 hours	48 hours	
Semen	5150	4550	4450	88,35	86,41	min 80%
Fly Ash	3050	2800	2787,5	91,80	91,39	

The results of the IKS (Residual Strength Index) values were > 80% for both fillers. The fly ash filler obtained higher values than cement at 24 hours (91.8%) and 48 hours (91.39%).

IV. CONCLUSION

1. The characteristics of the pavement materials for coarse, fine, and filler aggregates meet standards. Meanwhile, the characteristics of the pavement materials for pure asphalt and those with wetfix-be content at 0%-0.4% meet standards. The wetfix-be content at 0.5% does not meet standards.
2. Characteristics of HRS-WC mixtures with cement and fly ash fillers.
   - The voids in mineral aggregates (VMA) value for cement and fly ash fillers that meet standards is at an asphalt content of 5.9%-6.6%.
   - The voids in mix (VIM) value for cement fillers that meet standards is at an asphalt content of 6.45%-7%, while for fly ash fillers it is at an asphalt content of 6.15%-7%.
   - The voids filled with bitumen (VFB) value for cement and fly ash fillers that meet standards is at an asphalt content of 5.9%-7%.
   - The meltability, stability, and Marshall Quotient (MQ) values for cement and fly ash fillers that meet the standards are at an asphalt content of 5.5%-7%.
3. The optimum wetfix-be content for the HRS-WC mixture with cement filler (6.5% KAO) was 0.31%, while for the HRS-WC mixture with fly ash filler (6.4% KAO) it was 0.41%.
4. The Residual Strength Index (SIKS) value after 24 hours of immersion for cement filler was 88.35%, and after 48 hours of immersion it was 86.41%. The SIKS for fly ash filler for the same immersion were 91.8% and 91.39%, respectively. The fly ash filler had a higher IKS value at the immersion time.

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