Material Selection Overlay Road To Climate Change Resilient

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Abstract .Background of Management and maintenance of asphalt concrete roads is an important part in the retention function of the road. The influence of rain and temperatures decrease the carrying capacity of the road. The problem of how the influence of heating and soaking the asphalt concrete mix. **Objectives** Knowing the value of the stability of the mixture of fatigue pekerasan 60/70 pen bitumen, asphalt and bitumen emulsion polymer to a long warming and immersion. **Methods** Experimental laboratory methods to a comparative study with the durability of asphalt material laston aus AC-WC layer using 60/70 pen bitumen, bitumen and polymer modified asphalt emulsion and compare the value of stability after standard soaking, soaking after a short heating temperature of 850C for 2 days, soaking with long heating 850C temperature for 5 days. **Results** showed Optimum Asphalt Content (KAO) at the highest emulsified asphalt concrete by 9.5% with a value of 445 kg stability. **Conclusion** The stability value decreases with increasing soaking time.

INTRODUCTION

Road is important for distributing goods and people. It is a transportation facility to connect between regions. Environment factors give some effects toward the damage of road pavement surfaces, one of them is rainy season. The rain causes soaked road and that make road getting damaged faster. Another factor is the increasing temperature that can affect the solidity of asphalt concrete pavement mix.

The changes in Indonesian climate create some impacts such as the increasing of rainfall and air temperature that directly give impact toward highway surfaces. The more frequent and deeper soaked by rain, the road will get brittle due to the reduction of asphalt adhesion feature. The increasing of temperature will make pavement mix become plastically and flexible, so the pavement mix will get bleeding and have faster aging. The routine maintenance is done by giving common additional layer using overlay in order to keep and maintain the quality of the road and also to anticipate the early damage on the surface area. Wearing course is the top surface that directly gets impact from the wheel burden, the rain, the solar thermal and also the surrounded environment. Wearing course mix which mostly used is the hot-mix asphalt (HMA), warm-mix asphalt (WMA), and cold-mix asphalt (CMA).

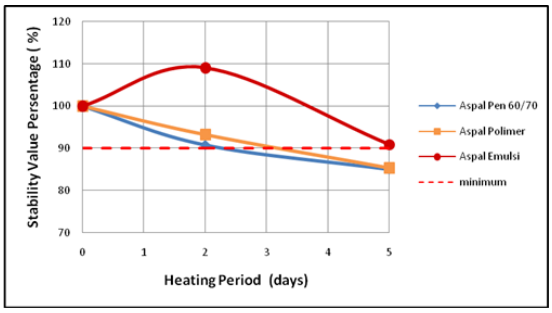
Commonly, HMA characteristic has a better engineering property, but it is not environmental friendly because its process needs more energy and also releases more CO2 emission. On the other hand, CMA is well-known as a environmental friendly mix because the process is easier and also consume less energy and also it does not release much CO2, but its engineering property is low [4)]. It needs to find out the proper overlay material selection for flexible pavement (HMA, CMA, WMA) that can stand from climate changes (dampness and temperature). This research is held on PU Bina Marga laboratory, Madiun Region.

RESEARCH METHOD

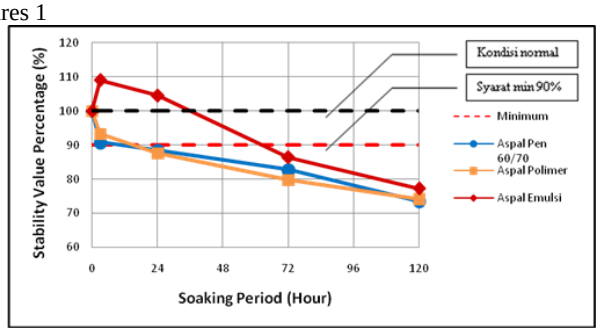
This experimental research is a laboratory research, that is to compare the material durability AC-WC(asphalt concrete-wearing course) mix, which used for overlay using 3 kinds of mixture : hot mix with 60/70 pen bitumen binder, warm mix with modification polymer bitumen binder and cold mix pavement with emulsion asphalt binder. The testing method of this research refers to the Bina Marga, Standar Nasional Indonesia, SK-SNI (Indonesian National Standard), The General Specification for Course and Bridge Sector and also AASHTO (American Association of State Highway and Transportation Official). This research was held on PU Bina Marga Laboratory, Caruban Madiun.

The data analysis was taken from the observation and examination, started from the asphalt concrete mix design, testing the basic material quality of aggregate and asphalt, making the tested material using marshall method. This research also wants to find out the characteristic of asphalt concrete in standard condition, the durability of asphalt concrete mix in soaked condition and the durability of soaked asphalt concrete mix after getting heated. After that, it will be formulized into some criteria based on theory to find the stability value and melting values of asphalt concrete mix in standard condition. It will be compared between standard condition and the condition after getting soaked. The soaking condition was divided into two process; soaked in standard condition and soaked in aging condition for each kinds of asphalt concrete pavement mix.

Figures 1



(a)

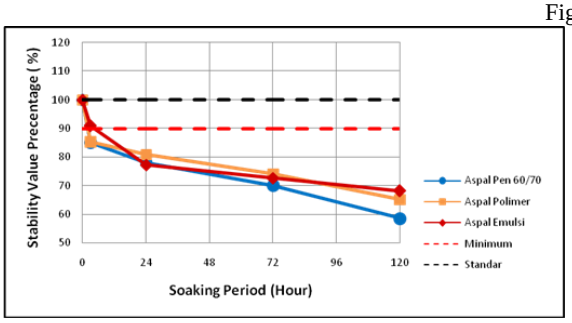


(b)

Figure 1(a) The relation of the Marshall stability value percentage toward the Heating Period. The flow value of three kind mixes have increased from the standard condition because the heating process causes the evaporation of the asphalt. The lowest flow level is 3,07 and the highest flow level is 3,50.

Figure 1(b) The stability value percentage toward the soaking period in STOA Condition From picture 2.

Figures 2



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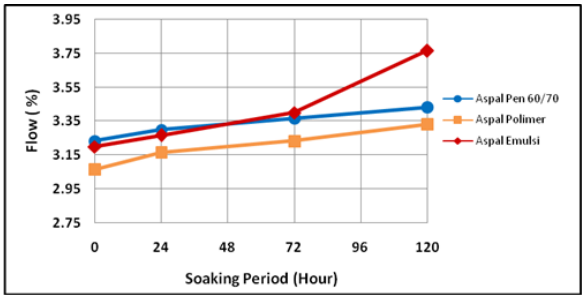

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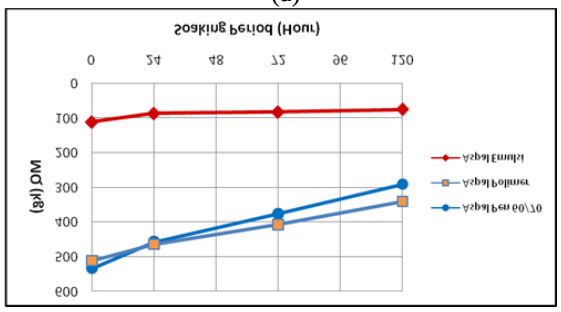

(c)

Figure 2(a) Stability Value Percentage toward Soaking Period in LTOA Condition.

Figure 2(b) Flow value toward the Soaking Period in LTOA condition.

Figure 2(c) MQ toward the Soaking Period in LTOA condition.

DISCUSSION

Heating or aging process in asphalt concrete mix causes the liquid part or asphalt part (maltenes) in asphalt concrete mix evaporates. In short period of heating, it causes the stability value of emulsion concrete asphalt increase, since there was an emulsion process, where water and liquid part of malteness evaporate. Therefore, maltenes will fulfill the space left by water pore and it makes its characteristic become more stable and sticky. From the previous research about water influence toward the durability of cold asphalt concrete mix, the evaporation in the heating process can increase the stability values.

The stability value of emulsion asphalt increases from 9% or 445kg into 486, whereas 60/70 pen bitumen mix decreases into 9% and polymer modified bitumen decreases into 7%. The stability value of emulsion asphalt concrete gets increasing stability value because of the heating process that causes the evaporation of the rest water in asphalt concrete mix. On the other hand, 60/70 pen bitumen concrete mix and polymer modification bitumen value decrease steadily because of the maltenes evaporation which result in weathering happens and asphalt concrete gets brittle [7)]. In long period heating, the stability value of three mixture declines sharply from the standard condition, emulsion asphalt concrete becoming 91%, 60/70 pen bitumen concrete and polymer modification bitumen concrete becoming 85% from the normal condition. The stability values of the three mixtures are still above the required standard, 800kg and 300kg for emulsion asphalt. Heating results in brittleness that caused the reduction of cohesion power in the asphalt concrete mix. Therefore, the road will soon get damage due to water reaction from the soaking. The three asphalt concrete mixtures have decreased their stability value in line with the soaking period [6)] . Short aging affect on the increasing of stability value in asphalt emulsion, which make the asphalt more resistant in the soaking condition. Polymer modified bitumen concrete and 60/70 pen pertamina have decreased its stability value due to the brittleness of short aging since both mixtures cannot stand of heating and its stability value decreases due to the soaking period [8)].

The flow value decreases in line with its stability value that causes MQ value in long aging soaking condition decrease. The solidity and flexibility of emulsion asphalt are more stable [4)]. The aging process influences the Marshall Quotient polymer modification asphalt and 60/70 pen pertamina bitumen. The three mixtures have increased their flow value. The rise of the flow value and the fall of stability value, affect the Marshall Quotient. It indicates that the solidity and flexibility of asphalt concrete mixture are better than asphalt polymer modification and 60/70 pen bitumen. The soaking period affects the reduction of stability value of long aging asphalt concrete mixture compared to normal soaking period with short heating. Marshall stability values in a long aging period of the three mixture experience a faster reduction on stability value. In 30 minutes soaking condition, the reduction stability value process of emulsion asphalt concrete decrease 9% to be 91%, polymer bitumen concrete mix and 60/70 pen bitumen concrete decrease 15% to be 85%, but all of the three kind mixes can still keep the stability above 80%.

The stability values get more reduction at 24 hours, 72 hours and 120 hours soaking period. At 24 hours until 120 hours soaking period, the stability value of polymer bitumen concrete declines sharply from 81% to 65%, emulsion asphalt concrete from 77% to 68%, and 60/70 pen pertamina bitumen concrete from 78 to 59% or from 1376kg to be 1032 kg. The influence of long heating process accelerate the weathering of asphalt concrete, so it will loss adhesion power which makes asphalt concrete will easily absorb water and the stability of asphalt concrete mix will get declining sharply. The flow value of asphalt concrete after getting long aging and soaking is higher than the flow value of asphalt concrete in standard condition. It is caused by the heating process that will be followed by aging. The process stability value reduction is also caused by the increasing of flow value in all kinds of pavement mixes.

CONCLUSION

The stability value of the three asphalt concrete mixture will decline due to the heating and soaking. The longer the heating process, the sooner it get water infiltration because of the soaking. Therefore, asphalt concrete will get reduction stability value due to weathering.

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