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Mixture Variation of Tack Coat on Shear Stress between Existing Fexible Pavement and Hot Roller Sheet Overlay

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Abstract

In order to enhance the drivers' comfort and the road performance, overlay (additional coating) was placed. Before overlay was placed, tack coat was considered essential to use to give adhesive power between the existing asphalt coating and the new asphalt coating or between the concrete road and the asphalt coating so that the strength can be achieved and the shear stress, due to load vehicle, is to be restrained. The research result was the viscosity of tack coat 15 pph which has high absorption for hot rolled sheet pavement. This indicates that the higher the number of tack coat viscosity, the lower the amount of tack coat to get through the asphalt layer. The shear stress on the variation of tack coat 30 pph and 50 pph has the higher value compare to the mixture of tack coat viscosity 15 pph. The highest number of tack coat 0.25 1/m2 was 6.002.5 kg/cm2 with tack coat viscosity of 30 pph. The three variations of tack coat have the shear stress maximum ranging from tack coat 0.25 1/m2 to 0.31 1/m2.

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Keywords: Hot rolled sheet overlay, tack coat, shear stress viscocity.

1. Introduction

Road as land infrastructure has a vital function in supporting any business or economic activities both in cities and villages. The relatively good condition of road would enable the people to attain the streamlined mobility in the establishment of economic and other social activities. However, the construction strength has gradually come to its dwindled productivity due to the increase of traffic load and the expiry of service. For that reason, overlay or the additional coating is regarded necessary to particularly increase the drivers' upon to give the bonding between the existing asphalt coating and the new asphalt coating or between the concrete road and the asphalt coating. This serves a purpose of forming a strong bonding which could restrain the shear stress of the vehicle load upon it.

This research aims to figure out the absorption quantity of tack coat, the variation of mixture composition and the extent value of tack coat absorption to find the distribution of tack coat emultion on each tack coat viscosity variation of hot roller sheet (HRS) overlay.

2. Literature Review

2.1 The type of overlay construction

One of the mixtures for overlay construction is thin layer of concrete asphalt (LATASTON) /HRS as the coating layer which consists of the mixture of gradated aggregate, filler and hard asphalt of rigid asphalt with certain proportion and compacted under hot condition of 2.5 cm 3 cm). Hot Rolled Sheet / LATASTON functions as the covering coat to avoid the water coming into the hard construction so that the construction strength can be maintained to some extent.

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2.2 Tack Coat

Tack coat is generally known as a thin layer which is spread between the existing asphalt surface and the new asphalt surface or composite hard surface. Tack Coat is the smelting of liquid asphalt which evaporates quickly upon the existing asphalt pavement (Afrilianto, 2007). Tack Coat is a thin layer of asphalt that provides adhesive strength at the same time provide strength between existing asphalt pavement layer and new pavement layer. Tack coat can be formed from rapid setting materials of asphalt emulsion with the water and solvent or cutback asphalt with volatile solvent. Magnitude of the dispersion measure tack coat depends on the condition of the surface of the existing road, ranging from 0.15 l/m2 – 0.35 l/m2.

2.3 Shear strength

In fact, tack coat should give the bonding capacity so that the existing pavement layer and the new pavement layer build the uniformly solid pavement layer. Shear strength is a bonding capacity on the pavement layer which provides strength against the effect of shear stress from the load vehicle on it (Afrilianto,2007). Fig. 1. shows the assumption of pavement model to work against the vehicle load

3. Research Methodology

3.1. Research Flowchart

The steps of laboratory testing are shown in Picture 2. The flowchart is such as follow:

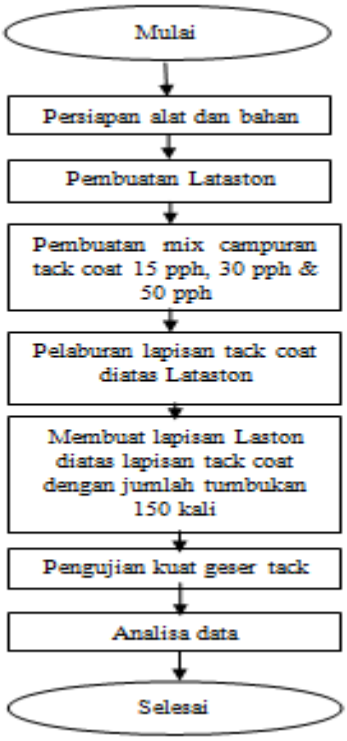

Fig. 2 The research flowchart

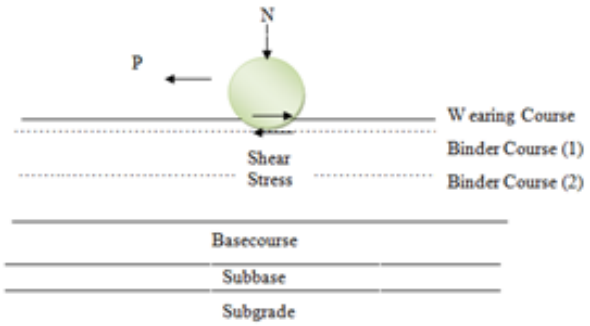

Fig. 1. Pavement model assumption

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3.2 The testing method of shear strength

The modified direct shear is used to test the shear strength of tack coat on the asphalt surface. Moreover, he Direct shear used is basically the same as the one used to get soil shear parameter even though the modification is applied to the holder of Proving ring and the holder of shear box which is based on the testing material of 4 inch with the height of + 7cm. Proving ring used is of 2000 pounds (907,18474 kg) and the direct shear is manually operated with the shear speed of +10 mm per minute.

4. The research result and discussion

4.1 The result of Viscocity analysis on the tack coat spread against the tack coat load on Hot Rolled Sheet.

The result of Viscocity analysis on the tack coat spread against tack coat load on Lataston is shown in Table 1 and picture 3.

Table 1. Viscocity analysis on the tack coat spread against tack coat load on Lataston.

Viscosity	Distribution of *Tack Coat*	
Variation	l/m^2	gram
15 pph	0.15	1.3
	0.25	2.2
	0.35	2.8
	0.45	3.6
	0.55	4.4
30 pph	0.15	1.2
	0.25	2.0
	0.35	2.7
	0.45	3.5
	0.55	4.3
50 pph	0.15	1.1
	0.25	1.9
	0.35	2.6
	0.45	3.4
	0.55	4.2

Source : Test result

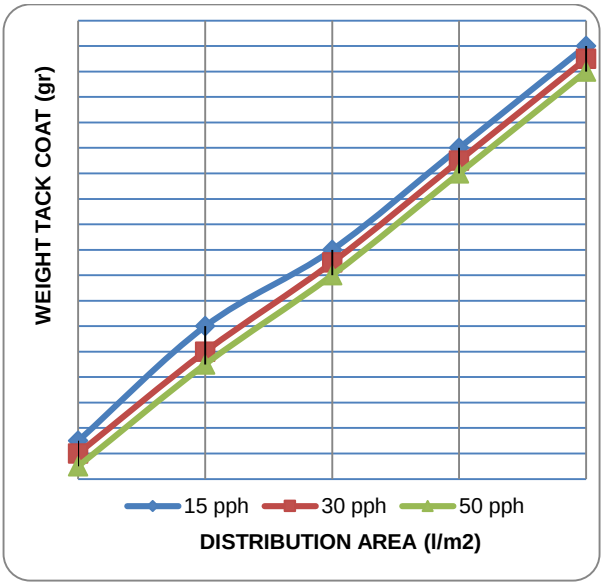

Fig. 3. Weight Tack Coat on the distribution area

Absorption value of tack coat on the hot rolled sheet surface for each distribution is 15 pph for its viscosity and followed by 30 pph and 50 ph respectively. This indicates that the higher the tack coat viscocity, the lesser the amount of tack coat to get through the asphalt pores. It was noted that the use of tack coat with low viscocity results in the high amount of tack coat to get through the asphalt pores.

4.2 The result of tack coat shear stress analysis to the Distribution area on the hot rolled sheet.

The test result reveals the shear stress numbers for each variation of tack coat on distribution area of tack coat plate as shown in table 2 and picture 4.

Table 2. The shear stress for kinds of variations of tack coat with distribution area on the flexible pavement.

Variation	Distribution area of *Tack Coat* l/m²	Shear Stress (Kg/cm2)
15 pph	0,15	4.082,46
	0,25	4.194,30
	0,35	3.485,93
	0,45	3.374,08
	0,55	3.299,52
30 pph	0,15	4.250,23
	0,25	6.002,51
	0,35	4.660,34
	0,45	3.896,04
	0,55	3.616,42
50 pph	0,15	4.343,43
	0,25	5.163,65
	0,35	5.070,45
	0,45	4.250,23
	0,55	3.877,40

Source : Test result

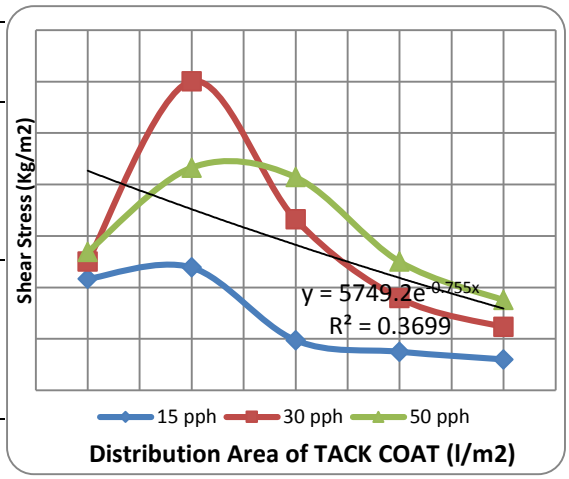

Fig. 3. Graphic of relationship,between shear force and distribution area measure of *Tack Coat* on flexible pavement

It can be identified that the variations of tack coat of 30 pph and 50 pph, there is a tendency among pph shear stress, and the amount of leverage measure tack coat forming an inverted parabola, and each has a top that is the value of the largest slide style as for the variation of the pph 15 has a slightly different pattern in which occurs the flatness on measure l/m2 – 0.35 0.55 l/m2 is small because the shear stress values are relatively similar. The shear stress which came up from each variation and distribution area measure of tack coat is as follow:

a) The variation of tack coat 15 pph with 0.151/m2 to 0.55 1/m2 came with with the shear stress of 4.082,46 kg/cm2; 4.194,30 kg/cm2; 3.485,93 kg/cm2; 3.374,08 kg/cm2 dan 3.299,52 kg/cm2. The highest shear stress was found on tack coat of 0.225 1/m2 with 4.200,00 kg/cm2.

b) The variation of tack coat 30 pph with 0.15 1/m2-0.55 0,55 l/m2 came with the shear stress of 4.250,2 kg/cm2; 6.002,5 kg/cm2 ; 4.660,3 kg/cm2 ; 3.896,0 kg/cm2 dan 3.616,4 kg/cm2 consecutively. The highest shear stress was found on the tack coat of 0,25 l/m2 with 6.002,5 kg/cm2.

c) The variation of *tack coat* 50 pph on 0,15 l/m2 – 0,55 l/m2 came with the shear stress of 4.343,4 kg/cm2; 5.163,7 kg/cm2 ; 5.070,4 kg/cm2 ; 4.250,2 kg/cm2 and 3.877,4 kg/cm2 consecutively. The highest shear stress was found on the *tack coat* of 0,3 l/m2 with 5.200,0 kg/cm2.

d) The maximum shear stress from the three variations of tack coat was derived from the variation of tack coat 30 pph on the tack coat of 0,25 l/m2 with 6.002,5 kg/cm2.

e) The variation of *tack coat* 50 pph came with a better shear stress than the variation of tack coat 15 pph and 30 pph, particularly on the tack coat of 0,15 l/m2 – 0,45 l/m2. The three variations of tack coat came with the maximum point ranging from tack coat of 0,25 l/m2 to 0,3 l/m2. It was revealed that the lower the number of tack coat viscocity was, the higher the number of the shear force was.

f) The three variations of tack coat came with the maximum shear stress ranging from the tack coat of 0.25 1/m2 to 0,3 l/m2. This was based on the variation of *tack coat* referred from

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"AASHTO M 20' which was 25 pph – 30 pph with the *tack coat* starting from 0,15 l/m2 – 0,35 l/m2 "According to the general specification of Public Work Department, Dirjen Bina Marga"

5. Conclusion

According to the research result and discussion, it can be concluded :

1. The mixture composition of tack coat viscosity 15 pph has high absorption load value for lataston pavement. This points out that the higher the number of tack viscosity, the lower the amount of tack coat to get through the asphalt pores.

2. For the hot rolled sheet pavement, the variation of *tack coat* 30 pph and 50 pph has shear stress higher than the emulsion of *tack coat* (viscositas) 15 pph. The highest shear stress is produced at the distribution measure of *tack coat* 0.25 l/m2 with 6002.5 kg/cm2 with *tack coat* viscosity of 30 pph.

3. All three emulsion variation of tack coat has maximum shear stress ranging between 0.25 l/m2 and 0.3 l/m2.

The researcher gives some advice which may be applied to carry out a further research:

1. The testing method of *tack coat* shear force with the modified *direct shear* can be utilized as one of the methods to measure the *tack coat* shear strength

2. Considering the huge effect of tack coat layer (mixture composition and besar sebaran takaran) on the road pavement, the road construction society is expected to it into account so that the quality road pavement is enhanced.

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