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Asphalt Mixing Performance Evaluation at Province Road Junction Sta 1+700 - 2+300

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Abstract: Asphalt mixture is a very important component that needs to be taken into account in flexible pavement construction to achieve the durability of a highway construction. In order to achieve the durability of road construction, it is necessary to control the quality of the mixture used to determine the quality of the mixture used in road construction. Evaluation of the mixture is carried out in the laboratory to check asphalt content, aggregate gradation and field density which must meet the required tolerances for the working mixture (JMF). Evaluation of the asphalt mixture can be done by the extraction method. The extraction method used in this study is the centrifugal extraction method. With this extraction method, the composition of a mixture can be known so that it can be compared with the mixture required in the Job Mix Formula (JMF). In conclusion, there is a decrease in the extracted asphalt content with the planned asphalt content, that is, with an average asphalt content value of extraction results of 6. 58% while the planned asphalt content value is 7.10% with the required tolerance of ±0.3%. In addition to the value of asphalt content, the field density also decreased from that which was planned in the work mix. It is known that the density value in the work mixture is 2,250 g/mm3 while the average field density value is 2,095g/mm3 so that the Job Standard Density (JSD) value is 93.108% and this value is below the tolerance limit. Then the aggregate gradation of the semi-gap HRS WC mixture at the Intersection section of the Lito province on average underwent a gradation change, namely a decrease in the percentage of passing on each sieve.

Keywords: performance evaluation, core drill test, centrifugal extraction

INTRODUCTION

Asphalt concrete is a type of pavement consisting of a homogeneous mixture of aggregate and asphalt, with or without additives (Silvia Sukirman, 2016). Asphalt concrete mixture has its own characteristics that must be possessed as a condition for achieving good mix quality, namely stability, durability or durability, flexibility or fatigue, fatigue resistance, surface roughness or shear resistance, water resistance and easy to implement. To get a mixture that meets the characteristics of the criteria, the right mix composition is needed starting from the asphalt, aggregate, and additional ingredients if needed.

The strength or durability of a pavement construction layer is largely determined by the ability to design a good aggregate composition. Understanding of mixing between aggregate and asphalt in the Asphalt Mixing Plant (AMP) and strong quality control in its implementation. The higher the consistency between design, implementation and quality control, the better the resulting pavement construction will be, but if the consistency of these three things is low, it will result in a weak road pavement construction layer which causes the road service life to not be achieved.

The service life of the road is greatly influenced by the initial quality of the hot asphalt mixture, traffic loads, heat/temperature, air and water. Therefore, besides being properly planned, the road must also be maintained properly so that it can serve the traffic load during the life of the plan.

METHODOLOGY

Field density check

Table 1. Terms of density

Required density % (JSD)	Number of test objects per test	Average minimum density (%JSD)	Minimum value per Single test (%JSD)
98	3-4 5 >6	98,1 98,3 98,5	95 94,9 94,8
97	3-4 5 >6	97,1 97,3 97,5	94 93,9 93,8

% JSD can be calculated using the following formula

% JSD = (Bj field)/(Bj lab) x 100% ……..…. (1)

Information:

Field Bj = obtained from the value of the specific gravity of the core test object (core results)

Bj Lab = required in JMF.

%JSD = (Job Standard Density) Density of the results of field compaction with a relative density percentage to the density of the work mixture (Job Standard Density) for each core test object.

Asphalt mixture extraction test

Extraction is a process of separating two or more mixtures of ingredients by adding a solvent that can dissolve one of the ingredients in a mixture (RSNI M-050 2004). In order to know and maintain the quality of a flexible pavement using asphalt binder, it is very important to carry out the extraction of asphalt mixtures. Extraction testing can be carried out with a socket or centrifugal extraction machine. According to SNI 03-6894-2002 the equations that can be used in the extraction of bitumen content using the Centrifuge method are:

K = (J)/D x 100% …….. (2)

K = Bitumen in Mix (%)

J = WT of Bitumen in Mix (gram)

D = WT before extraction (gram)

Aggregate gradation check

Sieve analysis or aggregate gradation serves to determine compliance with the provisions stipulated in ASTM C 33 specifications relating to the number of light particles in coarse aggregate and fine aggregate. What is meant by sieving analysis is determining the percentage by weight of aggregate grains that pass through a set of sieves and then the percentage figures are depicted in the form of a grain distribution chart (SNI 03-1968-1990).

Field Density Test Results (Density)

The field density for all types of compacted asphalt mixtures shall not be less than the provisions set out in table 1 above against the standard work density (Job Standard Density).

Field density calculation (Density) refers to SNI 03-6757-2002 with the following equation.

$$Gmb = \frac{Bk}{SSD-} \quad \text{……} \quad (3)$$

Table 2. Recapitulation of the mixed field density test results of HRS WC

No	Sample Point	Dry Weight (gram)	Weight in water (gram)	Surface Dry Weight (gram)	Field Density	Specification	Information
1	1+700	1973	1082	2016	93.89	97%	Fulfil
2	1+800	1292	713	1340	91.58		Does not meet
3	1+900	1153	631	1193	91.18		Does not meet
4	2+000	1199	657	1238	91.72		Does not meet
5	2+100	990	553	1025	93.22		Does not meet
6	2+200	2358	1298	2389	96.06		Fulfil
7	2+300	1569	857	1598	94.11		Fulfil
Average					93.11		Does not meet

The table above shows that the density of the field at the Intersection of the Provincial Road - Lito (SJPL) is below the predetermined specifications. In the 2018 general specification it is required for an average field density value of 97.5% for the number of test objects > 6, while the results of laboratory testing obtained a Standard Job Density value of 93.11%, this value is below the set standard.

Asphalt Content Extraction Test Results

Inspection of bitumen content from core test specimens or test specimens after field compaction. The results of the HRS WC mixed asphalt content extraction test on the Province-Lito Road Intersection section can be seen in the following table:

Table 3. Recapitulation of bitumen content extracted

No Sample	Recapitulation of Asphalt Content Value (%)
1+700	7.04
1+800	6.97
1+900	6.88
2+000	6.98
2+100	5.48
2+200	7.09
2+300	5.68
Average	6.59

From the laboratory test results, it was found that the average asphalt content value on the Lito Province-Road Intersection was smaller than the asphalt content value specified in the Job Mix Formula, it was known that the asphalt content required in the Job Mix Formula (JMF) was the average asphalt in the field is 6.59%, this amount does not meet the Job Mix Formula (JMF) and is below the tolerance limit set in the 2018 general specifications, namely ±0.3% against JMF.

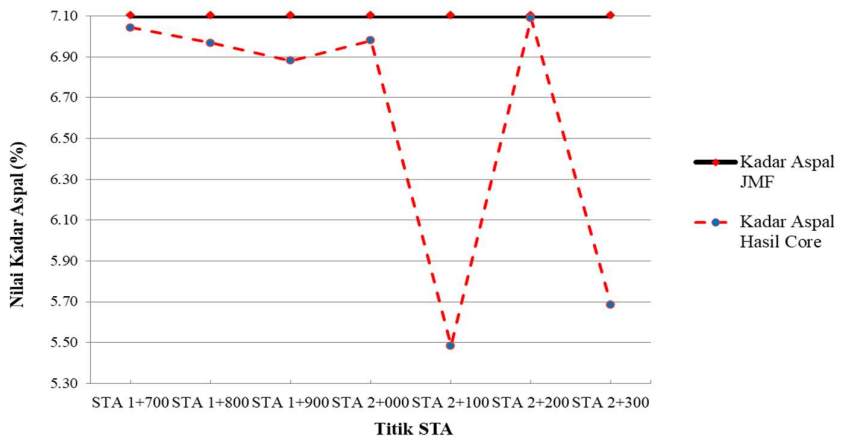

Figure 1. graph of extracted bitumen content, (Source: research results)

In the graph of asphalt content above, it can be seen that the decrease in asphalt content that occurred at the Simpang Jalan Province-Lito section. The difference in asphalt content that is too large at STA 2+100 and STA 2+300 is caused by the loss of a large amount of aggregate material due to damage to grain release and peeling of the asphalt film at STA 2+100 and STA 2+300.

Aggregate Gradation Test Results

After examining the asphalt content in the pavement samples taken at the Simpang Jalan Province - Lito (SJPL) section, then an examination of the aggregate was carried out, namely testing the aggregate gradation. The results of the HRS WC asphalt mixture gradation test at the Province-Lito Road Intersection section can be seen in the table below.

Table 4. Recapitulation of aggregate gradation tests

No	Sieve Number	Filter Aperture	Sample number % Pass the Sieve							Average	JMF
			1	2	3	4	5	6	7		
1	3/4	19.0	97.4	100	100	100	100	100	100	100	99.6
2	1/2	12.5	84.9	84.4	90.8	90.4	88.9	91.8	88.8	91.46	88.6
3	3/8	9.5	76.9	72.5	83.8	82.4	80.9	85.6	82.6	70.35	80.7
4	8	2.4	42.4	41.7	50.0	43.4	48.8	48.1	47.5	50.37	46.0
5	30	0.6	20.4	24.0	26.1	18.8	23.6	23.2	23.0	31.02	22.7
6	50	0.3	14.6	8.9	19.1	14.7	15.9	19.1	17.0	21.07	15.6
7	200	0.075	9.1	6.4	12.0	10.6	8.1	15.0	11.0	6.24	10.3

Table 4 above shows the recapitulation of the results of the aggregate gradation test from 7 samples of core specimens taken at the Provincial Road Intersection - Lito. Changes in the gradation of field aggregates with JMF can also be seen in graph 2. The results of the gradation test from the average gradation of core samples or core drill results from 7 samples can be seen in Figure 2 as follows.

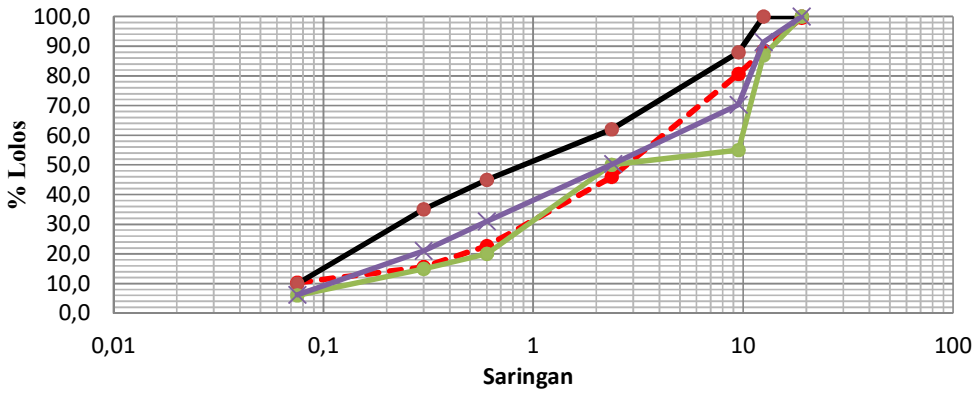

Figure 2. Ascorbic acid gradation test results, (Source: research results)

The average gradation graph shows that there is a reduction in the percentage of aggregate that passes the No. sieve. 50, no. 30 and No. 8 which was caused by damage to the release of granules that occurred at the Lito Province Road Intersection. The large amount of aggregate that passes the No.200 sieve will affect the binding strength of the asphalt and the interlocking properties of the materials. If there is material in the aggregate mixture that passes sieve No. 200 which is quite a lot, it also indicates that the material or aggregate used in the flexible pavement construction at the Lito Province Road Intersection (SJPL) has a low level of cleanliness considering that one of the requirements for the aggregate used is that it must be clean.

CONCLUSION

1. From the results of field observations, it was found that there were damage types of surface defects such as peeling of asphalt films, holes, cracks, and grain release that occurred at STA 1+700, STA 1+800, STA 1+900, STA 2+000, STA 2+100, STA 2+200 and STA 2+300. The types of asphalt film peeling damage, grain release and pitting are caused by poor mix quality, and inadequate field compaction.
2. From the tests that have been carried out in the laboratory at the Lito province Intersection, it was found that the asphalt mixture for the Lito Province Road Intersection has decreased density, where the density required in the JMF is 2.250 g/cm3 while the average field density obtained from laboratory tests is 2.095 g/cm3 so that the percentage of Working Standard Density is 93.11% below the required standard. In addition to density at the Lito Province road junction, asphalt content also decreased and changes in aggregate gradation, this can be seen from the results of extraction tests carried out in the Laboratory by obtaining an average field asphalt content value of 6.59% < JMF (7.10 %) so that the asphalt mixture on the Simpang Jalan Province-Lito section does not meet the specifications required in the JMF.

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