Evaluation of Sand Sheet Asphalt Mixture Pavement Performance on National Roads on Ambon Island

[1]Hamkah, [2]Rohana, [3]Aisyah

[1] Associate Professor, Department of Civil Engineering, Politeknik Negeri Ambon, Indonesia
[2] Lecturer, Department of Architecture, Muhammadiyah University of Makassar, Indonesia
[3] Student of The Department of Civil and Environmental, Institut Pertanian Bogor, Indonesia

Abstract: J. Syaranamual Street and Laksdya Leo Wattimena Street in Ambon are both part of Maluku Province's 81 national roads. To maintain road stability, the Indonesian government, through the Maluku BPJN, has improved the condition of two national roads by using sand sheet pavement. The evaluation of the performance of class B sand sheet pavements for the 2020 fiscal year is intended to evaluate and consider the use of similar pavements in the Maluku Province area for the following fiscal year. The evaluation's goal is to report on: 1) the use of asphalt mixture to meet sand sheet specifications, 2) the use of asphalt mixture to meet sand sheet specifications, and 3) the use of asphalt mixture to meet sand sheet specifications. 2) Asphalt mixture production method based on mixing equipment provisions, type of transport vehicle, spreading and compacting equipment; 3). The quality of sand sheet pavement is determined by the mixture's properties, thickness tolerances, minimum density, and quality control methods. The evaluation method is based on the performance of raw materials, processed materials, finished materials, equipment, and labor compared to the technical procurement requirements, namely the General Specifications of Highways 2018. The evaluation results show that all work provisions met the specifications and the Indonesian National Standard (SNI). Several factors must be considered, including increasing the number of core drill samples in thickness and density testing. It is suggested that the optimum asphalt content be reviewed and a new unit price for class B sand sheet work that has been adjusted to the minimum asphalt content be determined. The Indonesian government will use the results of this evaluation to plan future road projects.

Keywords: **Sand sheet, national roads, ambon island**

I. INTRODUCTION

A sand sheet, also known as a thin layer of sand asphalt, is a type of road pavement surface covering composed of fine aggregate or sand, or a mixture of both, mixed, spread, and compacted in hot conditions at a specific temperature [1], [2]. The sand sheet, abbreviated as SS, is classified into Class A and Class B [3].

This type of surface covering is effectively used for the design of low-traffic roads (<500,000 ESA), such as the general daily traffic level on the national road on Ambon Island [4], including J. Syaranamual road (link number 00411 K) and Leo Wattimena road (link number 003) in Ambon City. Eighty-one national roads spread across Maluku Province [5], only the two national roads mentioned above are programmed to use class B sand sheet pavement as a surface layer to maintain the stability of the national road in 2020 [4], [6].

The sand sheet construction program carried out until October 2020 has completed a 250-meters one-way (± 7.0 meters) road from the planned 6,500 meters. The problem is whether selecting the type of sand sheet pavement procurement for roads in Maluku Province can be carried out under the 2018 Bina Marga specifications [7], [8]. he performance report on the results of the sand sheet work procurement in 2020 is intended as data/information for evaluation and consideration of the use of similar construction works on national roads in Maluku Province for the fiscal year 2021 and after that. Research objectives: a) Evaluation of the type of asphalt and aggregate used as a mixture of asphalt to meet the requirements of material specifications; b) Evaluation of the mix production method based on the provisions of asphalt mixing installation equipment, type of vehicle, laying, and compaction equipment; c). Evaluation of sand sheet implementation quality based on marshal properties of asphalt mixture and quality control methods. The findings of this evaluation will be beneficial to stakeholders in the future, particularly in effectively and efficiently planning road works based on Indonesian national standards.

II. METHODS

Sampling and Test

Experimental data were obtained through testing carried out at the laboratory. The sample and preparation method consisted of a) asphalt mixture, which is taken over the spreader just after being poured by the transporter; b) core drill specimens on the two national roads were obtained by drilling, solid thickness measurements were carried out in the field shortly after the core drill sample was obtained; c) *Bricket* for mixed Marshall properties test, and d) bitumen mixture extraction for combined aggregate grading test. The four tests above were conducted at the Maluku BPJN Laboratory in Ambon. Secondary data is obtained from the DMF test result report, which the Provider previously submitted to obtain data on the use of the type of material and the composition of the mixture. Mixed production methods, transportation, and compaction are carried out by direct observation at implementation at the research site.

Research Sites

The study locations were carried out respectively: The J. Syaranamual Street (link number 00411 K) precisely starting from the Leimena Statue in Poka Village ending in Hunuth Village (Durian Patah) along 2,500 meters, and the Laksdya Leo Wattimena

Street (link number 003), precisely starting from Waiheru Village and ending in Negeri Lama Village along 4,000 meters in Ambon City [4], [5].

The asphalt mixing plant (AMP) is adjacent to the stone and sand quarry on the Wai Sikula River, Laha-Ambon. Location of sand sheet work, installation of mixing equipment (AMP), Stone Crusher, Quarry Stone, and Sand can be described in Figure 1.

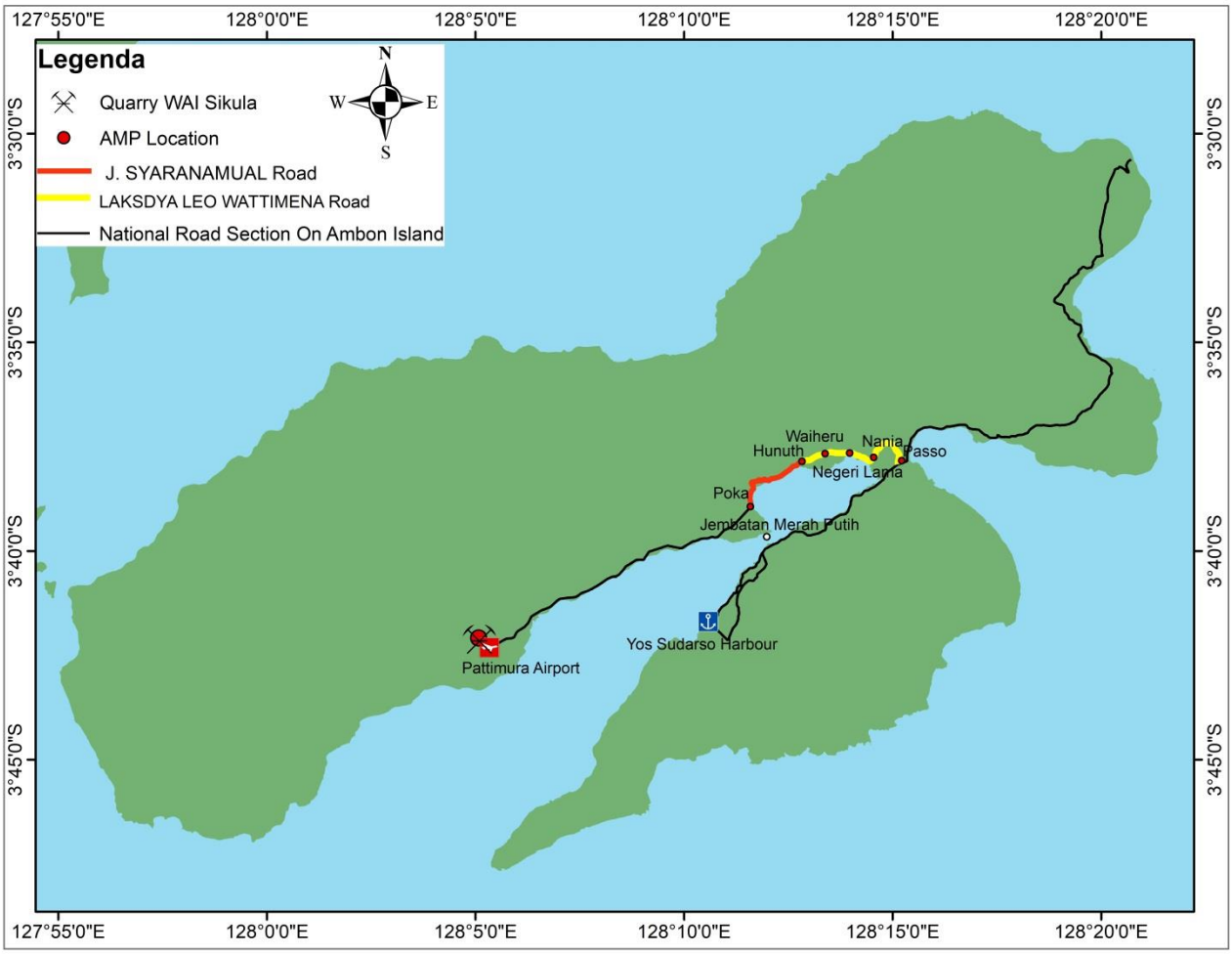

Figure 1 Location of AMP, Stone Crusher, Quarry, and Sand Sheet Work

Preventive Handling Location

The national road sections, which are planned to be overlaid with the SS-B type of pavement, are 2 of the 81 national roads in the Maluku Province, located on Ambon Island. The width of the road consists of a pavement element of 7.0 meters plus a shoulder element of at least 2 x 1.5 meters. The existing two road elements from the AC-WC pavement layer are in moderate condition. Although the pavement condition in some locations is stable, it has experienced cracks and peeling in some parts. Such existing conditions are at risk of decreasing pavement performance if left untreated/lately handled and will cause an increase in costs for the routine road maintenance program in the following year [9]. The dimensions and conditions of the existing pavement for two national roads are described below.

J. Syaranamual Street

The 3660 meters long road starts from the Leimena Statue T-junction to the north towards the Durian Patah T-junction across the hills in the villages of Poka and Hunuth. Most of the J. Syaranamual pavement surface conditions appear to have decreased in quality in the form of cracks and holes, as shown in Figure 2. BPJN Maluku programmed prevention efforts in 2020 with 2,500 meters of class B sand sheet to anticipate a decrease in the stability of the existing road from the condition. moderate to the slightly damaged condition [9].

Figure 2 Condition of Cracks and Holes on J. Syaranamual Street

Laksdya Leo Wattimena Street

The road is 5780 meters long, starting from the Durian Patah fork in Ambon, heading east to the Passo fork, crossing several relatively flat areas, namely Waiheru, Nania, and Negeri Lama villages. The condition has decreased to moderate along the road, starting from Waiheru Village to Negeri Lama Village, due to the number of pavements experiencing cracks, as shown in Figure 3. The rest of the road conditions for Laksdya Leo Wattimena started from Negeri Lama Village along the way to the T-junction of the Maluku Police School in Passo Village, which is still in steady condition [9].

Figure 3 Condition of Cracks on Laksdya Leo Wattimena Street

BPJN Maluku has programmed preventive handling in 2020 of 4,000 meters SS-B type of work to anticipate a decrease in the stability of the existing road from a moderate condition to a lightly damaged condition.

Evaluation Method

Performance evaluation is carried out on sand sheet work carried out by Provider PT. Kuda Laut Jaya (Contract Number: 02/Preserv-P.Amb.PT.KLJ/IV/2020, April 6, 2020) on two national roads in Ambon City with sampling and data collection methods adjusted to the time of execution of the work and limitations testing time.

Performance Evaluation

SS-B performance evaluation is carried out on the requirements: Raw materials, processed materials, finished materials, equipment, and labor [10] according to the fulfillment of SS-B specifications consisting of: a. Asphalt, crushed stone size 5-10, sand and stone ash against the requirements as raw materials; b. Production of asphalt mixture processed by the asphalt mixing installation (AMP) at the minimum temperature, measured above the conveyance before leaving the AMP location to the overlay location, and the temperature of the asphalt mixture before being poured into the Asphalt Finisher; c. Aggregate gradation of SS-B composite produced by asphalt mixing plant; d. The use of equipment consists of mixer, transport, spreader, and compactor; e. Compliance with equipment operators and workers at the location of laying the asphalt mixture.

Sampling

Samples of processed materials in the asphalt mixture are taken sufficiently at the asphalt mixing installation or behind the

Asphalt Finisher tool just before being spread for combined gradation testing. Samples of finished material in core drilling are taken at least 24 hours after final compaction. Pick up locations on two national roads. The Supervision Consultant determines the location at each cross-section of ± 100 meters. The provider takes samples of raw materials taken/delivered when submitting a Job Mix Design (JMD) to the Laboratory of BPJN XVI Ambon based on a letter from the Director of *PT. Kuda Laut Jaya* Number: 02/Preserv-P.Amb. PT.KLJ/IV/2020, April 6, 2020. The equipment evaluated consisted of: an asphalt mixer installation for the temperature tolerance of the asphalt mixture, a conveyer for the potential for decreasing the temperature of the asphalt mixture, and a spreader for the minimum layer thickness, and a compactor for the minimum density tolerance. The competence of the workforce includes the operators who operate each piece of equipment to the laying workers, observed directly in the field for the fulfillment of K3L equipment (Health, work safety, and environment) and the work results of the tools.

Data Collection

Primary data include Mixed gradation obtained through sieve analysis, Marshall properties (SNI 06-2489-1991), thickness, and density of SS-B samples prepared by core drill method. Secondary data include Raw material properties and Marshall properties of the mixture based on the design mix formula (DMF), both based on the report on the material testing results and the design mix formula from the Ambon BPJN XVI Laboratory.

III. DATA AND ANALYSIS

Construction Work Contract Data

The package of Ambon Island Road Preservation fiscal 2020 consists of 4 scopes of preservation work: Routine, road maintenance, Road reconstruction or rehabilitation preservation, Bridge Routine Maintenance, and Bridge Preservation [5]. The class B sand sheet work based on the contract attachment (Bill of Quantity) of the above package amounting to 1,465.22 tons is intended for the scope of road reconstruction/rehabilitation preservation work or Division 4 Preventive Works, contracted for the procurement of construction work with the contract data as presented in Table 1.

Table 1 Contract Data

Contract	Condition
Number	HK0203-Bb16/498674.1.1/01
Value (IDR)	10,021,536,000
Date	March 13, 2020
Duration	233 calendar days
Service Provider	PT. Kuda Laut Jaya

Materials and Equipment

The raw materials that have been prepared (stockpile) are mixed in the Asphalt Mixing Plant with the proportions of each aggregate fraction according to the job mix formula. The composition of the mixture in the percentage ratio of the weight of the four types of materials each consists of: 24.73% crushed stone 5/10, 11.91% river sand, 54.96% crusher dust, and 8.40% asphalt cement [11] as described in Table 2. Description of the three types of aggregates obtained from the Wai Sikula river in Laha Village, Ambon Island, the type of asphalt brand Pertamina penetration grade 60/70.

Table 2 The Composition of Class B Sandsheet Materials

Material Type	% Heavy	Description
Crushed Stone 5/10	24,73	Wai Sikula, Laha-Ambon
River Sand	11,91	Wai Sikula, Laha-Ambon
Crusher Dust	54,96	Wai Sikula, Laha-Ambon
Asphalt Cement	8,40	Pertamina, Grade 60/70

The hot-bin and asphalt boiler temperatures are maintained so that the hot asphalt mixture that comes out of the AMP is still in the whole range of 145^{o} – 165^{o}C as required by specification [9]. Hot asphalt mixture is not allowed to leave the AMP location to the overlay location if the asphalt mixture temperature results show less than 145^{o}C or exceed 165^{o}C. The test results for the mixture temperature above the Dump Truck, as shown in Figure 4, have met the required temperature of 160^{o}C.

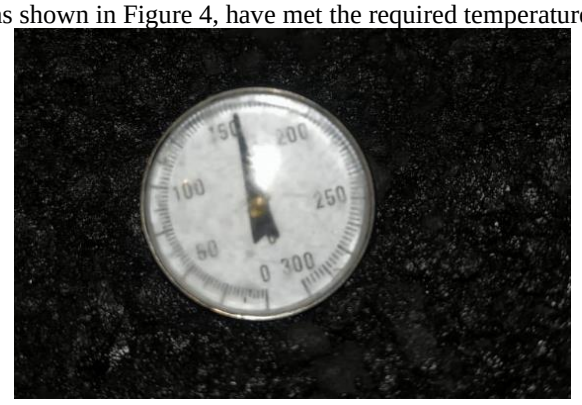

Figure 4 Measurement of Asphalt Mixture Temperature Above Dump Truck

The asphalt mixing installation (AMP) and the aggregate stockpile are in one location in Laha Village, Ambon City, batch type as shown in Figure 5. Even though the location of the AMP is ± 10 km from the overlay location, the transportation method uses a Dump Truck with a tarpaulin-covered tub, so the temperature of the mixture is asphalt can be maintained above 145^{0} C until the

viscosity range of the asphalt mixture above the Asphalt Finisher is still feasible to be spread.

Figure 5 Asphalt Mixing Plant (AMP) in Laha Village-Ambon

A fleet of 5 Dump Trucks is prepared to transport asphalt mixture to the location of national roads, sufficient to maintain the continuity of AMP production. The transport fleet is equipped with a metal body that is tight, clean, and flat, effectively preventing the asphalt mixture from sticking to the body during transportation. Self-engine mechanical spreading equipment (Asphalt Finisher) can spread and form asphalt mixtures according to the required thickness, grade line, and cross-section. The transport fleet (Dump Truck) and the spreader (Asphalt Finisher) are shown in Figure 6.

Figure 6 Dump Truck and Asphalt Finisher

The method of spreading half the road (± 3.5 meters) is carried out to avoid long traffic jams. The laying method uses an Asphalt Finisher assisted by labor for manual fireplaces, as shown in Figure 7.

Figure 7 Method of Overlaying 1/2 of The Road

Figure 7 shows that the workers lying behind the Asphalt Finisher have not used the correct personal protective equipment (PPE) or occupational health/safety equipment, so it is hazardous to the safety of workers. Similarly, Figure 8 shows a compactor operator operating a Pneumatic Tire Roller and a Tandem Roller, both of which do not use personal protective equipment (PPE) when

operating the equipment. The Tandem Roller's initial compaction is carried out at the asphalt mixture temperature > 125oC, followed by intermediate compaction using the Pneumatic Tire Roller still at the asphalt mixture temperature > 100oC. Final compaction was not carried out because the result of intermediate compaction was visually quite neat without leaving streaks.

Figure 7 Pneumatic Tire Roller and Tandem Roller

Mixture Properties of Sand Sheet Class B

The BPJN XVI Ambon laboratory recommends four types of materials consisting of Pertamina Asphalt (Grade 60/70), Crushed stone 5/10, sand, and crusher Dust (quarry Wai Sikula) in Laha Village-Ambon for a mixture of Class B Sand Sheet (SS-B). The recommendation [8] is based on the mixed design formulation (DMF). The properties of a mixture of Class B sand sheets using the above materials based on the results of the Marshall test (SNI 06-2489-1991) are described in Table 3.

For the fulfillment of the properties of the sand sheet mixture [9], consisting of Marshall Stability, VMA (Void in the mix of aggregate), VFB (Void filled with bitumen), VIM (Void in the mixture), and Melting as required [12], [13], then the value of 8.4% is the optimum bitumen content. Marshall test based on the report of DMF results is still filled with asphalt content of 8.0% to d. 9.0%. The density test results (Laboratory density) at the optimum asphalt content obtained a value of 2.108 *gr/cc*. This value is then used to determine the value of field density.

Table 3 Properties of Sand Sheet Class B (SS-B)

Marshall Test	Unit	SS-B	Specification
Opt. Bit. Content	*%*	8,4	-
Marshall Stability	*kg*	230	200 Minimum
VMA	*%*	26,4	20 Minimum
VFB	*%*	82	75 Minimum
VIM	*%*	4,9	3 - 6
Flow	*mm*	2,45	2 - 3
Density (Lab.)	*gr/cc*	2,108	-

Aggregate Gradation

The gradation of 3 types of aggregate according to sieve size each is described in Table 4. The gradation of sand sheet class B (SS-B) combined aggregate based on the combined gradation plan according to the design mixed formula (DMF) [8] is described in Table 5.

Table 4 Gradation by Type of Aggregate

Sieve Size		Crushed stone 5-10	Sand	Crusher Dust
Inch	*mm*			
3/8	9,52	100	100	100
#8	2,36	50,52	87,03	86,33
#200	0,075	1,90	12,32	15,32

Table 5 Combined Grading According to DMF

Crushed stone 5-10	Sand	Crusher Dust	Combined passed (%)	General Specification 2018
27 %	***13 %***	***60 %***	***100 %***	
27,0	13,0	60,0	100	100
13,64	11,31	51,80	76,75	75 – 100
0,51	1,60	9,19	11,13	8 - 18

Sand sheet mixture gradation (SS-B) as a result of implementation on two national roads in Ambon Island was carried out on samples of asphalt mixture produced by AMP in Laha, which were taken on a Dump Truck for two tests at the Maluku BPJN

Laboratory. The combined aggregate gradation test results and evaluation of compliance with specifications are described in Table 6.

The percentages that passed the #8 and #200 sieves showed an average value of 76.25 % and 12.37 %, respectively. Filter # 8 is in the grading envelope as required [11] 75 – 100%, and filter # 200, whose value is also still in the grading envelope of 8 – 18%. These results indicate that the mixed gradation is categorized as fulfilling the required Sandsheet Class B (SS-B) gradations requirements. The gradation of such a mixture has the potential to cause the asphalt mixture to have the potential to obtain the required thickness of the sand sheet of 1.5 *cm* (minimum) and the asphalt mixture to have the potential for optimum asphalt content according to the design [14], [15].

Marshall Properties of Mix

Marshall testing was carried out on the asphalt mixture produced by AMP on November 19, 2020, to obtain the Marshall properties of the asphalt mixture as required by Table 1. A sufficient sample of the asphalt mixture was taken behind the Asphalt Finisher when laying on the J. Syaranamual street section to make several brackets samples at the BPJN Laboratory Maluku. Four samples pounded with 75 collisions each were weighed (dry, in water, SSD). Tests for flow/melting, and Marshall stability (SNI 06-2489-1991), on two samples of brackets each, were distinguished for immersion in Water-bath (60oC) for 30 minutes and 24 hours. Marshall properties test data and the analysis results are shown in Table 7.

Table 6 Sand Sheet class B Combined Aggregate Gradation

Sieve Size		**Retain on each sieve (*gram*)**	**Cumulative Retaining (*gram*)**	**Percentage Cumulative**		**Cum..Passing (to meet Spec. 2018)**
mm	*Inch*			Retained	Passing	
		1	*2*	*3=2/2tot*	*4 = 100-3*	
2,36	# 8	133,4	133,4	28,44	71,56	
		125,3	125,3	26,74	73,26	
				Average	72,41	75 - 100
0,075	# 200	276,9	410,3	87,48	12,52	
		270,0	395,3	84,36	15,64	
				Average	14,08	8 - 18
	Pan	192,1	469,0	100		
		198,6	468,6	100		

Table 6 shows the stability value of 267.5 kg after 30 minutes of soaked, which has exceeded the minimum stability requirement (200 kg) as in Table 1. Thus the stability of the remaining Marshall of 95.0 % after being soaked for 24 hours has also exceeded the minimum requirement (90%). The melting value (flow) of 2.38 mm from the sand sheet mixture has also met the minimum requirement of 2.0 mm and the maximum requirement of 3.0 mm. Thus, the Marshall properties of the sand sheet Class B mixture (SS-B), which are spread representing two national roads on Ambon Island, have met the required asphalt mixture properties.

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Table 7 Marshall Properties of Class B Sandsheet Mix

No.	**Dry weight (*gram*)**	**in Water (*gram*)**	**in *SSD* (*gram*)**	**Volume (*cc*)**	**Density (*gr/cc*)**	**Flow (*mm*)**	**Stability (*kg*)**
	1	*2*	*3*	*4 = 3 -2*	*5 = 1/4*	*6*	*7*
A	Soaked in 30 minute						
1	1.187,1	580,9	1.200,0	619,1	1,917	1,80	275,0
2	1.185,6	580,8	1.199,0	618,2	1,918	2,95	260,0
					Average A	2,38	267,5
B	Soaked in 24 hour (Durability)						
3	1.193,2	567,4	1.219,6	652,2	1,830	2,85	253,0
4	1.190,1	570,5	1.217,6	647,1	1,839	2,80	255,0
					Average B	2,83	254,0
			Marshall Stability Remaining = B/Ax100(%)				95,0

Table 6 shows the stability value of 267.5 *kg* after 30 minutes of soaked, which has exceeded the minimum stability requirement (200 *kg*) as in Table 1. Thus the stability of the remaining Marshall of 95.0 % after being soaked for 24 hours has also exceeded the minimum requirement (90%). The melting value (flow) of 2.38 *mm* from the sand sheet mixture has also met the minimum requirement of 2.0 *mm* and the maximum requirement of 3.0 *mm*. Thus, the Marshall properties of the sand sheet Class B mixture (SS-B), which are spread representing two national roads on Ambon Island, have met the required asphalt mixture properties.

Sand Sheet Thickness and Density

The nominal thickness of the sand sheet (SS-B), which was spread/compacted on November 10, 2020, was measured based on samples taken at random at a distance between cross-sections of ±100 meters. Sampling (core drill) on November 13, 2020, represents the Laksdya Leo Wattimena Street section (Link no. 003) in 4 cross-sections, each at sta. 1+900 (L), 2+300 (L), 2+500 (L) and 2+600 (L) as shown in Figure 9. Taking core drill representing J. Syaranamual Street (Link no. 00411 K), taken at three cross-sections each in sta. 3+320 (R), 3+415 (R), and 3+515 (R). The sampling method with core drilling in the field is witnessed/agreed upon by the Provider, Supervisor, and Supervising Consultant. The thickness measurement of 7 samples was carried out at the core drilling location of each core drill sample 4 times using a caliper.

Figure 9 Core drill Sta. 1+900 (R) Laksdya Leo Wattimena Street

The weight test (grams) under conditions: dry, saturated surface dry (SSD), and weight in water were measured once each carried out at the Maluku BPJN Laboratory to determine the density of sand sheets class B previously soaked in 25^{o}C water for 24 hours.

Figure 10. Sample of Sand Sheet By Core Drill

The thickness measurement and weighing of the core drill samples are described in Table 8. The average thickness and density of the sand sheet (SS-B) are based on the data in Table 8. It can be calculated using the method in Table 8. Samples submitted by the provider to the Maluku BPJN Laboratory based on the results of core drills at three cross-sectional locations on the J. Syaranamual Street section and four cross-sectional locations on the L. Leo Wattimena Street section, after being measured and analyzed, the average thickness is 29.6 *mm*.

The minimum thickness of 7 measured samples is 24.0 *mm* on the Sta. 1+900 L for the Laksdya Leo Wattimena Street; this thickness is still more significant than the minimum thickness value for Sand sheet Class B (1.5 *cm*) [3]. The average thickness is 29.6 *mm*, more significant than the design thickness of 15.0 *mm*. The minimum thickness of the seven samples measured was 24.0 *mm* at the Sta. 1+900 Left side for the Laksdya Leo Wattimena Street, this thickness is still more significant than the minimum thickness value for Sand sheet Class B [11]. The average thickness of 29.6 *mm* is also more significant than the design thickness of 15.0 *mm*, and this result shows that the laying method using the Asphalt Finisher has met the thickness dimensions because it has reached the minimum requirements for the thickness of the sand sheet, which is 15.0 *mm*.

Table 8 Results of Core Drill Thickness and Weight Measurement

No.	Station (*R/L*)	Thickness (*mm*)	Dry Weight (*gram*)	In Water (*gram*)	In SSD (*gram*)
A.	J. Syaranamual Street	-	-	-	-
1.a	3+320 (R)	28,0	385,9	202,9	392,1
b		27,5			
c		27,0			
d		27,0			
2.a	3+415 (R)	28,0	371,9	189,8	376,5
b		28,0			
c		28,0			
d		27,5			
3.a	3+515 (R)	30,0	413,9	210,9	419,6
b		30,0			
c		30,0			
d		30,0			
B.	L. Leo Wattimena Street	-	-	-	-
1.a	1+900 (L)	25,0	349,1	188,9	354,8
b		25,0			
c		24,0			
d		25,0			
2.a	2+300 (L)	27,0	377,3	193,7	382,7
b		28,0			
c		27,0			
d		28,0			
3.a	2+500 (L)	34,0	473,8	237,7	476,3
b		34,5			
c		34,0			
d		34,0			
4.a	2+600 (L)	35,0	474,6	241,6	480,6
b		35,5			
c		35,5			
d		35,5			

Sand sheet Class B work spread using Asphalt Finisher, based on seven core drill samples representing two national roads on the island of Ambon, thus has fulfilled the thickness requirements. The field density, according to the results of the analysis in Table 9, is calculated as 95.5%; this result shows that the compaction method in the field using the Tandem Roller and Pneumatic Tire Roller is adequate because it has reached the sand sheet density requirement, which is 95% minimum.

Table 9 Analysis of the Average Thickness and Density of Sand sheet

No.	Location (Sta.) R/L	Average Thickness (*mm*)	Dry weight (*gram*)	Weight in water (*gram*)	Weight in SSD (*gram*)	Volume (*cm3/cc*)	Weight in volume (*gr/cc*)	Laboratory Density (gr/cc)	Relative Density (%)
1	*2*	*3*	*4*	*5*	*6*	*7 = 6 -5*	*8 = 4/7*	*9*	*10 = 8/9 x 100*
A	J. Syaranamual Street								
1	3+320 R	27,4	385,9	202,9	392,1	189,2	2,040	2,108	96,8
2	3+415 R	27,9	371,9	189,8	376,5	186,7	1,992	2,108	94,5
3	3+515 R	30,0	413,9	210,9	419,6	208,7	1,983	2,108	94,1
B	Laksdya Leo Wattimena Street								
1	1+900 L	24,8	349,1	188,9	354,8	165,9	2,104	2,108	99,8
2	2+300 L	27,5	377,3	193,7	382,7	189,0	1,996	2,108	94,7
3	2+500 L	34,1	473,8	237,7	476,3	238,6	1,986	2,108	94,2
4	2+600 L	35,4	474,6	241,6	480,6	239,0	1,986	2,108	94,2
		29,6				Average	2,012		95,5

Based on the thickness dimensions and minimal density, the sand sheet class B (SS-B) on the island of Ambon has been carried out using the mixed spreading method and compaction method according to the thickness and density requirements. The final results of the Class B sand sheet work that have been declared to meet the minimum thickness and density requirements on the national road section on the island of Ambon can be shown in Figure 11.

Figure 11. Final Results of Class B Sandsheet Work

IV. CONCLUSIONS

a. The type of asphalt material (Pertamina, Penetration 60/70), and the aggregate type of Crushed Stone 5-10, Sand, and Crusher Dust from the Wai Sikula quarry in Laha Village in Ambon, meet the requirements for material specifications to be used as a class B sand sheet mixture (SS-B).
b. The asphalt mixture production method using an asphalt mixing plant (AMP) batch type meets the requirements for asphalt mixture production equipment based on the results of measuring the temperature of the asphalt mixture and the Dump Truck transport vehicle based on the results of the combined gradation test from the sample extraction test results.
c. The use of an Asphalt Finisher and a Tandem Roller with a Pneumatic Tire Roller have complied with the 2018 General Specifications as spreading and compacting equipment, respectively, for class B sand sheet pavement.
d. The quality of the implementation of class B sand sheet work on two national roads in Ambon Island has met the quality requirements of the work based on the marshal properties of the asphalt mixture, work quality control methods, thickness dimensions, and minimal density.
e. The class B (SS-B) sand sheet work can be recommended for the improvement of other national road conditions in the Maluku Province region for the 2021 fiscal year and after.

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