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COMPARATIVE ANALYSIS OF THE USE OF BUTON ROCK ASPHALT (BRA B 5/20) IN BANGKA BELITUNG ISLAND WITH GENERAL SPECIFICATIONS 2018 REV.02 (CASE STUDY: ROAD AND BRIDGE PRESERVATION)

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Abstract— **The condition of the National road performance index of Bangka Belitung Province in 2020 decreased to 97.35% (584.49 km) and unstable conditions to 2.65% (15.9 km in the damaged category). One way to improve the stability of national roads is by preserving roads and bridges, namely Road Rehabilitation. In the road and bridge preservation work, a mixture of hot asphalt and asbuton was used, namely Asphalt Concrete-Wearing Course (AC-WC) with Buton rock asphalt, the type of buton asphalt used in this study is Asphalt pen. 60-70 with Buton Rock Asphalt (BRA B 5/20). This study aimed to determine the comparative analysis of the use of Buton Rock Asphalt (BRA B 5/20) in Bangka Island with General Specifications 2018 Rev.02 (Case Study: Road and Bridge Preservation). This research used literature study method. The result showed the application of the use of Buton Rock Asphalt (BRA B 5/20) in the case study of the road and bridge preservation package following the general specifications of 2018 rev 02. Based on the analysis results from the Marchall test of the JMF (Job Mix Formula) asphalt mixture AC-WC Asbuton, the graphic results showed that 4 (four) points following the General Specifications 2018 Rev.02, namely the average value of marshal stability obtained by 1,252 Kg has met the requirements namely 800 Kg; the average value of the cavity filled with asphalt (%) was 72.55% and has met the requirements, namely at least 65%; the average value of the cavity in the Aggregate (VMA) (%) was 15.61%, has met the requirements, namely at least 15.00%; and the value of the remaining Marshall Stability (%), after immersion for 24 hours, 60 oC obtained 90.16% was following table 6.3.3.1c) Requirements for the properties of mixtures Laston (AC) General Specifications 2018 Rev.02.**

Keywords— **Road and Bridge Preservation; Buton Rock Asphalt (BRA B 5/20); Asphalt Pen 60-70; Asphalt Concrete-Wearing Course (AC-WC) with Buton Rock Asphalt; general specifications 2018 rev 02.**

I. INTRODUCTION

The length of the national road in Bangka Belitung Province is 600.40 Km, which is divided into 2, consisting of 440.96 Km on Bangka Island and 159.53 Km on Belitung Island with a total of 40 road segments. In Semester 2 of 2019, the condition of road performance index in Bangka Belitung Province was 99.68% and not stable at 0.32% (1.9 km was included in the damaged category). The condition of national road performance index in 2020 decreased to 97.35% (584.49 km) and unstable conditions to 2.65% (15.9 km in damaged category).

One way to improve the stability of national roads is by preserving roads and bridges. Road and bridge preservation are road handling activities, in the form of prevention, maintenance, and repairs needed to maintain road conditions so that they continue to function optimally and specified plan life can be achieved. The type of road and bridge preservation that is handled is road rehabilitation, which is an activity to prevent extensive damage and any damage that was not taken into account in the design, which results in a stability decrease condition in certain parts/places of a road segment with mild damage conditions. The stability can be returned to a steady state according to the plan.

Flexible Pavement is a pavement system where the construction consists of several layers (Sukirman, S, 1999). In General Specifications 2018 Rev.02 Asphalt Concrete (AC) consists of three types of mixtures, namely Asphalt Concrete-Wearing Course (AC-WC), Asphalt Concrete Binder Course (AC-BC), and Asphalt Concrete Base (AC-Base) and sizes

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maximum aggregate of each mixture is 19 mm, 25.4 mm, 37.5 mm.

In the road and bridge preservation work, a mixture of hot asphalt and asphalt is used, namely Asphalt Concrete-Wearing Course (AC-WC) with buton rock asphalt. Asbuton is natural asphalt of Buton stone that consists of hydrogen and carbon elements, originating from the Buton Island, Southeast Sulawesi. Buton asphalt can be found in two mining locations, namely in Kkabungka and Llawele. Buton asphalt has the largest deficit in the world with an estimated natural asphalt reserve (tons) of 300 million tons. The need for the use of asphalt to meet the needs of road infrastructure development in various parts of Indonesia reaches around 1.2 million tons. However, only 50% of asphalt can be fulfilled and the rest still rely on imported

The current construction of road and bridge infrastructure can utilize local materials, both materials located near the job site and potential local natural resources. Besides being the first step towards an independent nation through self-sufficiency in construction materials, increasing state income, and increasing local people's income. One of the potential natural resources is buton asphalt (asbuton), which founded since 1920.

The positive impacts of using asbuton for the state and local area in Buton Island, include:

1. Reducing the import of oil asphalt so as to save the country's foreign exchange
2. Increase Regional Original Income of Buton Regency
3. Open new job opportunities, especially on the island of Buton
4. Can be used as an additive to improve the quality of domestic asphalt products
5. The softening point is higher than oil asphalt and stability resistance

Asbuton which is quite high makes it resistant to heat and does not melt easily, so it can increase the durability of road infrastructure in Indonesia.

The process of making Asbuton Kabungka begins with extracting raw materials from the Kabungka mine, then the asphalt is processed and granulated to produce granules that pass the existing quality tests. There are several types of asbuton on the market, namely a buton rock asphalt (BRA B 5/20), buton rock asphalt (BRA B 5/30), pre-mixed asbuton, high bitumen content asbuton, pure asbuton, and CPHMA. Asbuton modified asphalt consists of pre-mixed asphalt; Asphalt pen 60-70 with asbuton item b 5/20 and asphalt pen 60-70 with asphalt asbuton item b 50/30 (penetration class 50 with 30% bitumen content class).

In the construction sector, buton rock asphalt (BRA B 5/20) usually functions as an additive component to improve the quality of mixed asphalt. If this asphalt is mixed with 60/70 pen asphalt in the Asphalt Mixing Plant, the function is the same as modified asphalt.

The results of the asphalt mixture added with Asbuton produce a good quality asphalt mixture with the following tendencies:

a. High asphalt mix Marshall stability
b. High dynamic stability of asphalt mix
c. Increase construction life from fatigue test results
d. More resistant to temperature changes
e. Increased modulus value

Asbuton used in this study is an Asphalt pen. 60-70 with buton rock asphalt (BRA B 5/20), which is natural asphalt with a penetration power of 5% and a bituminous mineral concentration of 20%, and the rest is the percentage of other minerals. The percentage of use of buton rock asphalt (BRA B 5/20) is limited to 2-3% in hot asphalt mixtures (General Specifications 2018 Rev.02).

Stability is the ability of the pavement layer to accept traffic loads without any deformation (deformation) such as waves, grooves, or bleeding. High stability can be obtained by seeking: the gradation of an aggregate made dense (dense graded), coarse aggregate surface, cube-shaped aggregate, low penetration asphalt (hard), and asphalt with a sufficient amount of bonding between grains (Sukirman, 2003).

Flexibility is the ability of the pavement material to be able to follow (adjust) deformations that occur due to repeated traffic loads without cracking and volume changes. High flexibility properties can be obtained by means of the use of aggregates with gradation gaps to obtain a large VMA, using soft asphalt (high penetration), and the use of quite a lot of asphalt to obtain a small VIM. (Sukirman, 2003).

The problems in this research are as follows:

1. Knowing the Marshal Stability of the asphalt mixture AC-WC Asbuton;
2. Knowing the voids in Aggregate (VMA) % of the asphalt mixture AC-WC Asbuton;
3. Knowing the asphalt-filled cavity (%) of the asphalt mixture AC-WC Asbuton

Based on this background, the writer conducted research which was published in a journal entitled: "Analysis of Application of buton rock asphalt (BRA B 5/20) in Bangka Island (Case Study: Road and Bridge Preservation)"

II. RESEARCH METHODS

This study used the literature study method, namely collecting data from regulations, Circulars of the Directorate General of Bina Marga, General Specifications 2018 Revision 02, and from the internet in the form of news and articles that can support this journal.

III. EXPERIMENT AND RESULT

The results of the study will be described first in the descriptive form to describe the purchase of asbuton to testing asbuton in the laboratory, as follows:

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1. The work started with ordering Asbuton from Trenggalek, East Java, namely through PT. Y;
2. Taking into account the arrival time of Asbuton materials to the job site, because the delivery range takes a long time due to using a ship;
3. Check abuton rock asphalt (BRA B 5/20);

Fig. 1 Asbuton

Table-1 Provisions for buton rock asphalt Type BRA B 5/20 and Type BRA B 50/30

No	Asbuton Grain Characteristics	Testing Method	Type B 5/20	Type B 50/30
1	Original Form Characteristics			
	- Asbuton grain size			
	• Passed sieve no 3/8'' (9.5 mm) % • Passed sieve no 8 (2.36 mm) %	SNI 03-4142-1996 SNI 03-4142-1996	- 100	100 -
	- Asbuton Bitumen content (%)	SNI 03-3640-1994	Min 18	Min 20
	- Water content (%)	SNI 2490:2008	Max 4	Max 4
2	Characteristics of Extracted Bitumen (SNI 8279;2016) and Recovery (SNI 4749:2015)			
	- Solubility in TCE (%) Weight	SNI 2438:2015	Min 99	Min 99
	- Asbuton asphalt penetration at 25^{o}C, 100 g, 5 seconds, 0.1 mm	SNI 2456:2011	2-10	40-70
	- Softening Point; ^{o}C	SNI 2456:2011	-	Min 48
	- Ductility at 25^{o}C; cm	SNI 2456:2011	-	≥ 100
	- Berat jenis	SNI 2456:2011	-	Min 1.0
	- Weight loss (with TFOF); LoH (Loss of Heating, %)		-	≤ 2
	- Asbuton asphalt penetration after LoH at 25^{o}C, 100 g, 5 seconds; (% of initial penetration)		-	≥ 54

(General Specifications 2018 Rev.02)

1. After the buton rock asphalt (BRA B 5/20) has met the requirements in the table above, then the asphalt pen 60-70 was mixed, as follows:

a. The mixing process of buton rock asphalt (BRA B 5/20) was conducted by heating the aggregate in the dryer and weighed according to their respective proportions, then put into the pugmill. The aggregate was mixed for 10 seconds then asphalt was added and mixed for 20 seconds. (General Specifications 2018 Rev.02). buton rock asphalt (BRA B 5/20) is one of the local materials that makes Indonesia proud.

Mixture conditions must meet the tolerances of the composition of the mixture as shown in the table below:

Table-2 Tolerance of Mixed Composition

Combined Aggregate	**Mixed Composition Tolerance**
Equal to or greater than 2.36 mm	±6% total weight of aggregate
Passed 2.36 mm sieve to No. 50	± 4% total weight of aggregate
Passed sieve No. 100 and hold No. 200	± 3% total weight of aggregate
Passed sieve No. 200	± 3% total weight of aggregate

Asphalt Level	**Tolerance**
Total asphalt level in the mixture	± 0.5% total weight of aggregate
Asbuton water level	± 0.1% weight of asbuton grains

Mixed Temperature	**Tolerance**
Materials leave the AMP and sent to the overlay	-10^{o}C from the temperature of the asphalt mixture in the truck as it exits the AMP

(General Specifications 2018 Rev.02)

2. The results of the asphalt mixture AC-WC buton rock asphalt (BRA B 5/20) can be seen in the results of the JMF (Job Mix Formula), as follows:

SUMMARY JOB MIX FORMULA

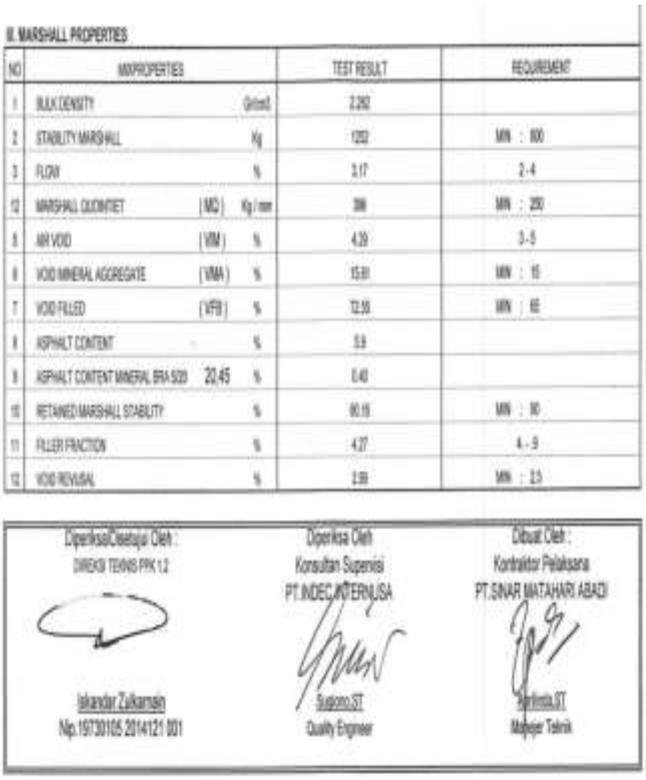
AC WC Asb

I. COMPOSITION OF MIX

NO	COLD BIN / DMF			HOT BIN					
1	SPLITE	: 12	%	HOT BIN I	: 36	%	HOT BIN I	: 33.8	%
2	SCREEN	: 36	%	HOT BIN II	: 25	%	HOT BIN II	: 23.5	%
3	ABU BATU	: 41	%	HOT BIN III	: 26	%	HOT BIN III	: 24.5	%
4	PASIR	: 15	%	HOT BIN IV	: 11	%	HOT BIN IV	: 10.4	%
5	MINERAL Asb	: 2	%	MINERAL Asb	: 2	%	MINERAL Asb	: 1.9	%
	% TOTAL MATERIAL	: 100	%	% TOTAL MATERIAL	: 100	%	ASPALT CONTENT	: 5.9	%
	ASPALT CONTENT	: 6.2	%	ASPALT CONTENT	: 5.8	%	STRIPING AGENT	: 0.18	%
	STRIPING AGENT	: 0.25	%	STRIPING AGENT	: 0.25	%	% TOTAL CAMPURAN	: 100.10	%

II. GRADATION OF MIX

NO	SIEVE SIZE	1"	3/4"	1/2"	3/8"	No.4	No.8	No.16	No.30	No.50	No.100	No.200
1	COLD BIN/DMF	100	100	94.18	86.72	60.30	48.74	35.80	25.42	15.03	9.30	5.80
2	HOT BIN	100	100	90.78	80.78	56.55	41.02	32.01	24.55	18.90	8.49	4.27
3	SPESIFICATION	100	100-100	90-100	77-90	53-69	33-53	21-40	14-30	9-22	6-15	4-10



II. MARSHALL PROPERTIES

NO	MIXPROPERTIES			TEST RESULT	REQUIREMENT
1	BULK DENSITY		Gr/cm3	2.282	
2	STABILITY MARSHALL		Kg	1282	MIN : 800
3	FLOW		%	3.17	2-4
12	MARSHALL QUOTIENT	(MQ)	Kg / mm	398	MIN : 250
5	AIR VOID	(VIM)	%	4.29	3-5
6	VOID MINERAL AGGREGATE	(VMA)	%	15.81	MIN : 15
7	VOID FILLED	(VFB)	%	72.58	MIN : 65
8	ASPHALT CONTENT		%	5.9	
9	ASPHALT CONTENT MINERAL BRA 500	20.45	%	0.40	
10	RETAINED MARSHALL STABILITY		%	90.15	MIN : 90
11	FILLER FRACTION		%	4.27	4 - 9
12	VOID REVISAL		%	2.99	MIN : 2.5

Diperiksa/Disetujui Oleh :	Diperiksa Oleh	Dibuat Oleh :
DIREKSI TEKNIS PPK 1.2	Konsultan Supervisi	Kontraktor Pelaksana
	PT.INDEC,INTERNUSA	PT.SINAR MATAHARI ABADI
Iskandar Zulkarnain	Sugiono,ST	Sarfinda,ST
Nip.19730105 2014121 001	Quality Engineer	Manajer Teknik

Fig. 2 The results of the JMF (Job Mix Formula)

Table-3 Provisions for the Properties of the Laston Mixture (AC)

Mixture Characteristic		Laston		
		Wearing Course	Bearing Course	Base
Number of collisions per field		75		112 (3)
Ratio of particles passing 0.075mm sieve with effective asphalt content	Min	0.6		
	Max	1.6		
Voids in the mix (%) (4)	Min	3.0		
	Max	5.0		
Voids in the mineral agregat (VMA) (%)	Min	15	14	13
Voids Filled Asphalt (%)	Min	65	65	65
Marshall stability (kg)	Min	800		1800 (3)
Melting(mm)	Min	2		
	Max	4		
Residual Marshall stability (%),	Min	90		

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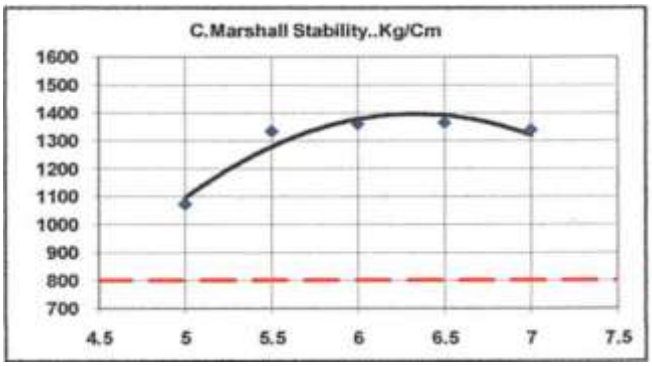
after immersion for 24 hours, 60 ^{o}C		

(General Specifications 2018 Rev.02)

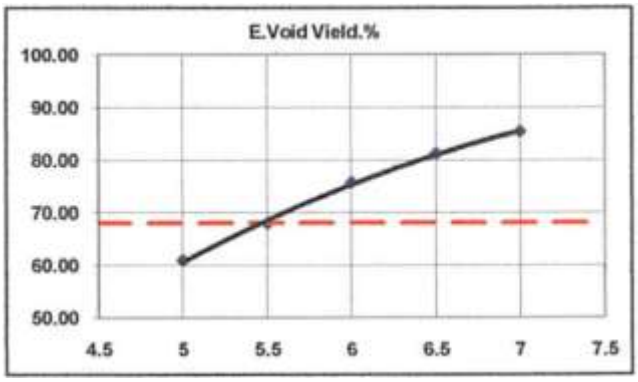
3. Analyzed the comparison of the use of Buton Rock Asphalt (BRA B 5/20) in Bangka Island with General Specifications 2018 Rev.02.

In the AC-WC marshal test, the AC-WC Asbuton asphalt mixture can be obtained as follows:



Graph 1**.** Marshall Stability

From the graph can be obtained the average value of the Marshall Stability was 1,252 Kg and has met the requirements, 800 Kg.



Graph 2. Voids Filled Asphalt (%)

From the graph can be obtained the average value of the voids filled asphalt (%) was 72.55% and has met the requirements, at least 65%.

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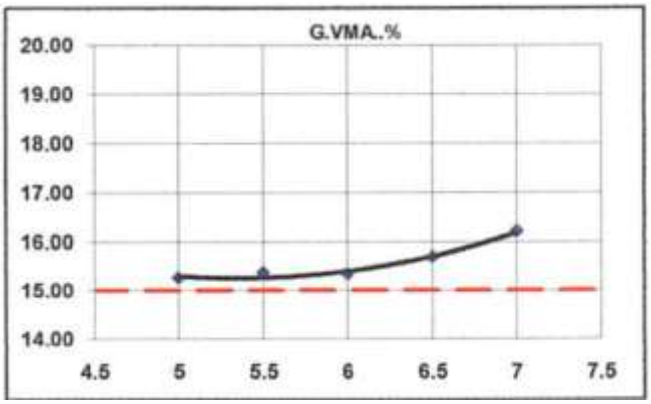

Graph 3. Voids in the Mineral Aggregate (VMA) (%)

From the graph can be obtained the average value of the Voids in the Mineral Aggregate (VMA) (%) was 15.61% and has met the requirements, at least 15.00%.

From this analysis, the following results were obtained:

Table-3 The results of analysis

	General Spec 2018 Rev 02	**JMF PT "X"**	**Appropriate/Not Appropriate**
Voids in the Mineral Aggregate (VMA) %	Min. 15	15,61	Appropriate
Voids Filled Asphalt (%)	Min. 65	72,55	Appropriate
Marshall Stability (Kg)	Min. 800	1.252,00	Appropriate
Residual Marshall stability (%), after immersion for 24 hours, 60 ^{o}C	Min. 90	90,16	Appropriate

From the discussion, it was obtained 4 (four) points, namely Cavity in Aggregate (VMA), Cavity filled with asphalt, Marshall Stability, and Marshall Stability remaining after immersion for 24 hours, 60 oC in accordance with General Specifications 2018 Rev.02.

IV.CONCLUSION

Based on the results of the analysis of the use of asbuton item B 5/20 on the road and bridge preservation package which aims to compare it with the general specifications of the 2018 Bina Marga revision 02. From the results of the analysis, it can be concluded that:

1. Marshall stability is in accordance with the General Specifications 2018 Rev.02 was 1,252 Kg from a minimum of 800 Kg;
2. Voids in the Mineral Aggregate (VMA) % complies with General Specifications 2018 Rev.02 was 15.61% from a minimum of 15%;
3. Voids Filled Asphalt (%) complies with the General Specifications 2018 Rev.02 was 72.55% of a minimum of 65%;
4. Residual Marshall stability (%), after immersion for 24 hours, 60 ^{o}C complies with General Specifications 2018 Rev.02, which was 90.16% from a minimum of 90%.

V. REFERENCE

[1] Eva Wahyu Indriyati. (2017). Kajian Perbandingan Penggunaan Aspal Modifikasi Asbuton Dan Asphalt Rubber (Ar) Untuk Infrastruktur Jalan. Jurnal Teknik Sipil Vol. 14 No.2 (pg 94-100).

[2] Furqon Affandi. (2008). Karakteristik Bitumen Asbuton Butir Untuk Campuran Beraspal Panas. Pusat Litbang Jalan dan Jembatan, (pg 1-6).

[3] Ir. Soehartono. (2010). Teknologi Aspal dan Penggunaannya dalam Konstruksi Perkerasan Jalan.

[4] Kementerian Pekerjaan Umum. (2013). Surat Edaran Menteri PU No. 10/SE/M/2013 tentang Pedoman Spesifikasi Teknis Campuran Beraspal dengan Asbuton. Badan Penelitian dan Pengembangan Kementerian Pekerjaan Umum, (pg 6-9).

[5] Kementerian Pekerjaan Umum dan Perumahan Rakyat. (2018). Spesifikasi Umum 2018 Revisi 02 untuk pekerjaan jalan dan jembatan. Direktorat Jenderal Bina Marga, (pg 6-79 - 6-89).

[6] Kementerian Pekerjaan Umum. dan Perumahan Rakyat. (2018). Peraturan Menteri PUPR No. 18/PRT/M/2018 tentang Penggunaan Aspal Buton untuk Pembangunan dan Preservasi Jalan.

[7] Kurniadji. (2005). Aplikasi Pemanfaatan Asbuton untuk Pemeliharaan Jalan. Badan Penelitian dan Pengembangan, Puslitbang Jalan dan Jembatan Balitbang Departemen Pekerjaan Umum (pg 4-9).

[8] M. Toni Saifuddin, Syahrul, Ari S.. (2016). Optimasi penggunaan aspal penetrasi 60/70 pada campuran asphalt concrete base (ac – base). Universitas 17 Agustus 1945, (pg 1-6).

[9] S. Sukirman. (1999). Perkerasaan Jalan Raya. Nova, (pg 9-27)

[10] S. Sukirman. (2003). Beton Aspal Campuran Panas. Granit, (pg 1-6).

[11] Sri Yeni Mulyani, STP. (2012). Kajian Lingkungan Pemanfaatan Asbuton. Badan Penelitian dan Pengembangan Puslitbang Jalan dan Jembatan, (pg 12-16).

[12] Valdo Y. Pinangkaan, Tampanatu P. F. Sompie, Sudarno . (2022) . Analisis Perbandingan Karakteristik antara AC-WC Asbuton dengan Cold Paving Hot Mix Asbuton (CPHMA).Semesta Teknika Vol. 25 No 1, (pg 60-70).

[13] Willy Pravianto. (2013). Kumpulan Teknologi Asbuton (Asbuton for all people). Badan Penelitian dan Pengembangan Pusat Litbang jalan dan jembatan, (pg 12-26).