Differences in The Spreading Temperature Between the Grained Buton Bitumen with the Penetration Asphalt 60/70

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Abstract. The need for asphalt in Indonesia is so high that every year it has to import asphalt oil around 600,000 tons. The amount of imported oil asphalt can certainly be reduced by the optimum utilization of asbutons. This research study was to determine the influence of temperature differences at the time of the finisher Asphalt Concrete mix asphalt - Binder Course (AC-BC) field with the use of grained Buton Asphalt and bitumen 60/70 penetration, using local aggregate in asphalt mixtures Asphalt Concrete - Binder Course (AC -BC). The method used is a survey of direct sampling to the field. Temperature measurement data is taken on asphalt mixture in asphalt finisher before compacted. Temperature data collection is done for Asphalt Buton Grain type 5/20 and asphalt penetration 60/70 then calculated decrease happened and long time required asphalt carrier vehicle from asphalt mixing plane to the location of an overlay. So we get the difference of temperature decrease. The result showed that the temperature decrease on the asphalt of grain buton was increased, compared to the asphalt mixture using liquid asphalt with approximate time ± 5 hour trip from asphalt mixing plane to location. So it needs special handling in the field implementation to cope with rapid temperature decline.

Keywords: Asphalt Buton; Penetration Asphalt 60/70; Temperature

1. Introduction
National consumption in Indonesia is so high that every year it has to import asphalt oil about 600,000 tons. The amount of imported asphalt oil can certainly be reduced by the optimum utilization of asbuton. In this study will use asphalt granular buton as a substitute material in asphalt mixture to reduce the use of oil asphalt. BGA is an asbuton item have been processed fabricated and ready-made with quality maintained [1].

The asbuton deposit is estimated at 677 million tons equivalent to 170 million tons of oil asphalt, with 10-50% bitumen content with penetration value 3-212 dmm. Asbuton is found in the bay location of Sampolawa to Lawale bay along 75 km with a width of 27 km and coupled with Enreko region. The resilient modulus will increase with the addition of grain asbuton into the asphalt mixture (Kurniadji, Nono, 2006). Pure asbutons have good properties, in terms of physical testing such as penetration, softening point, solubility, ductility, weight loss with thin film oven test and high penetration index value (+0.144) compared with conventional oil asphalt about -1.127 so very suitable for heavy traffic and areas with high temperatures like Indonesia.

The stiffness determination of the marshall mechanical property and the tensile strength test indirectly indicate that the mixture with polypropylene fibre modification is resistant to the pavement deformation force and groove,therefore the mixture may be used on busy intersections or truck stops and parking lots where standing load causes time to extend deformation [2]. This study deals with the use of Buton Asphalt grained and bulk asphalt, and to know the aggregate usage of local use on asphalt Asphalt Concrete-Binder Course (AC-BC), to determine the differences in the effect of temperature at the time of the finisher asphalt Asphalt Concrete-Binder Course (AC -BC) before compaction in the field.
2. Literature Review

Generally flexible pavement layers in Indonesia, using Asphalt Concrete (Asphalt Concrete). Concrete asphalt is a mixture for flexible pavement consisting of coarse aggregate, fine aggregate, filler and asphalt with specified proportions, and essentially this flexible pavement construction comprises several layers placed on the ground. The layers serve as traffic load receptors and then spread it to the underlying layer [8].

Aggregates are a combination of crushed stone, gravel and sand or any combination of other materials that can be used in asphalt concrete mixtures. The proportions of coarse aggregates, fine aggregates and fillers are based on predetermined specifications and gradations. The amount of aggregate in the asphalt mixture is typically 90 to 95 per cent by weight or 75 to 85 per cent of the volume. Aggregates can be obtained naturally or artificially. The aggregate pore content affects the extraction level of asphalt, the higher the aggregate pore level, the less the extracted bitumen content (Putri, 2015).

Asphalt or bitumen is a brownish-black material that has visco-elastic properties so it can soften and melt when it gets warmed up and vice versa. It is this viscoelastic property that can make the asphalt envelop and bind the aggregate to stay in place during the production process and the service life. Generally, the asphalt produced is derived from the distillation of petroleum called hard asphalt. asphalt with special properties obtained based on the degree of control performed at the stage of the distillation process (Soehardi, 2017).

In Asbuton Utilization Guidelines (Bina Marga 2006), Asbuton grains to be used should be packaged in bags or other containers that are waterproof and resistant to ultraviolet rays and are easy to handle when mixed in the mixing chamber (pugmill) with packing size 40 kg. The asbuton of the grain should be placed in a dry, roofed place so that the asbuton is protected from direct sunlight. High asbuton accumulation should not exceed 2 meters for grain asbuton grain Type 15/25, 2.5 meters for grain asbuton Type 15/20, and 3 meters for 5/20 grain type asbuton.

Asphalt is a thermoplastic material, meaning it will become harder or thicker if the temperature is reduced and will be soft or more liquid if the temperature increases. This property is called sensitivity to temperature changes. The sensitivity to the temperature of each type of asphalt varies, which is influenced by the chemical composition of the bitumen, although it may have the same penetration or viscosity value at some temperature. Examination The nature of asphalt sensitivity to temperature change needs to be done so that obtained information of good temperature range for the implementation of work.

According to Sukirman (2003), the temperature of asphalt concrete mixing is between 1400°C up to 1600°C. According to Bina Marga (1989), upon exit from the mixing plant, the concrete asphalt mixture should have a temperature of 1400°C up to 1700°C. If the asphalt content in the mixture is too high or the air cavity is too small, the aggregate consolidation occurring in the asphalt mixture due to the traffic load will cause the asphalt rise to the surface of the asphalt pavement mixture. These symptoms mostly occur at high temperatures, so limiting the softening point of the asphalt at a temperature of 1500°C is expected to anticipate this problem.

According to Bina Marga (1989), the temperature of compaction ranges from 900°C to 1100°C. The mixing temperature is at a viscosity temperature of 170 ± 20 cSt, while the compacting temperature at the velocity temperature is 280 ± 30cst (Sukirman, 2008). At low temperatures, cracks are the type of damage that usually occurs. these symptoms are directly related to the modulus of asphalt stiffness and paved asphalt. During the winter the pavement will contract, but because the pavement structure is usually restricted or blocked to contract, its relative length cannot change. So that temperature (temperature) is very influential or important in paved mixing.
The Hot Asphalt Mixed Asphalt Mixture has different mixing and compaction temperatures depending on the type of asphalt to be used. To determine the mixing and compaction temperatures of each type of binder it shall be tested in the laboratory pursuant to ASTM E 102-93. Based on the results of testing in the laboratory-type binder will be obtained the relationship between viscosity with temperature or can use Table 1.

**Table 1. Conditions of Asphalt Viscosity for mixing and compacting**

| No  | Implementation Procedures         | Asphalt Viscosity | Mixed Temperature with the binder |
|-----|-----------------------------------|-------------------|-----------------------------------|
|     |                                   | Asphalt Pen 60    | Asbuton Modification or Pure Asbuton Bitumen |
| 1   | Mixing Marshall Test Materials    | 0.2               | 155±1                             | 160±1                          |
| 2   | Compaction of Marshall test objects | 0.4             | 145±1                             | 150±1                          |
| 3   | Max Mixing Temperature in AMP     | Depending on the Type of Asphalt Used | 165 | 170 |
| 4   | Mixing, Target Temperature Range  | 0.2-0.5           | 145-155                           | 150-160                        |
| 5   | Pours a Powdered Mixture from the mixing tool | ± 0.5           | 135-150                           | 140-135                        |
| 6   | Supply to the Pamper Tool         | 0.5-1.0           | 130-150                           | 135-155                        |
| 7   | Initial Compaction (Steel Wheels) | 1-2               | 125-145                           | 130-150                        |
| 8   | Main Compaction (Rubber Wheel)    | 2-20              | 90-125                            | 95-130                         |
| 9   | Final Compaction (Steel Wheels)   | < 20              | 70-90                             | 70-95                          |

Note: Aggregate Temperature When Mixing Can not Be More Than 180 °C

3. Research Methods

This research uses Asphalt Buton Grain 5/20 type and penetration asphalt 60/70, the material used is aggregate that derived local Quarry from Muara Takus village with the value of Abrasion is equal to 33.7%, Breaking Grain 100 / 98.82, Value of CBR is 62.28%, the value of $\gamma_d$ max is 2.187 gr / cm³ and Wopt is 5.37% (Soehardi, 2018), which is used on Asphalt Concrete-Binder Course (AC-BC) asphalt mixture. The method used is a survey of direct sampling to the field. Temperature measurement data is taken on asphalt mixture in asphalt finisher before compacted. Temperature data collection is done for Asphalt Buton Grain type 5/20 and asphalt penetration 60/70 then calculated decrease happened and long time required asphalt carrier vehicle from asphalt mixing plane to the location of an overlay. So we get the difference of temperature decrease. Results Research data collected and arranged in the form of tables and curves for easy analysis based on theories and research results that have been done before, based on these results are drawn conclusions.
4. Result and discussion

This research intends to know the difference of temperature effect between Asphalt mixture using Asphalt Buton Grain 5/20 type and Asphalt Concrete-Binder Course (AC-BC) using Local Quarry asphalt Concrete-Binder Course (AC-BC) using Asphalt Concrete-Binder Course (AC-BC) with Muara Takus check the temperature of the field at the time of the spread before it is compacted. Temperature measurements are carried out on asphalt Concrete-Binder Course (AC-BC) asphalt concrete mixer transport vehicles having the same size and transport capacity of 700cm x 240 cm x 210 cm and using the same type of cloth cover that is in the morning to night day with the same mileage. so the data obtained about the temperature difference between asphalt mixture using Asphalt Buton Grain and Asphalt mixture using Asphalt liquid as in table 2 as follows:

| No | Travel Time (Hours) | Asphalt Mixture Temperature Using Asphalt Liquid 60/70 (ºC) | Asphalt Mixed Temperature Using Asphalt Buton Grain Type 5/20 (ºC) | Difference in Temperature Decrease (ºC) | Air Temperature (ºC) |
|----|---------------------|------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------|----------------------|
| 1  | 5.25                | 139.00                                                     | 118.15                                                        | 20.85                                  | 30                   |
| 2  | 5.20                | 139.20                                                     | 118.50                                                        | 20.70                                  | 30                   |
| 3  | 5.15                | 139.35                                                     | 118.75                                                        | 20.60                                  | 25                   |
| 4  | 5.1                 | 139.45                                                     | 119.00                                                        | 20.45                                  | 30                   |
| 5  | 5.05                | 139.60                                                     | 119.25                                                        | 20.35                                  | 25                   |
| 6  | 5                   | 139.85                                                     | 119.65                                                        | 20.20                                  | 30                   |
| 7  | 4.95                | 140.00                                                     | 120.00                                                        | 20.00                                  | 30                   |
| 8  | 4.85                | 140.10                                                     | 120.25                                                        | 19.85                                  | 30                   |
| 9  | 4.74                | 140.25                                                     | 120.60                                                        | 19.65                                  | 25                   |
| 10 | 4.66                | 140.45                                                     | 120.90                                                        | 19.55                                  | 30                   |
| 11 | 4.60                | 140.50                                                     | 121.20                                                        | 19.30                                  | 30                   |
| 12 | 4.53                | 140.55                                                     | 121.30                                                        | 19.25                                  | 30                   |
| 13 | 4.5                 | 140.60                                                     | 121.50                                                        | 19.10                                  | 25                   |
| 14 | 4.45                | 140.75                                                     | 121.70                                                        | 19.05                                  | 30                   |
| 15 | 4.35                | 140.85                                                     | 121.90                                                        | 18.95                                  | 30                   |

Average Temperature Decrease: 16.55

Source: Soehardi et al. (2018)

From Figure 12 it can be seen that the temperature decrease in the grain of buton grains has increased, when compared with the asphalt mixture using liquid asphalt. This can be caused by the asphalt mixture has decreased significantly due to the influence of the temperature of the air in the location and the process of overlaying. However, it should take into account the minimum temperature of mixture of asphalt mixture that can be layed out is 1300C (technical specification Bina Marga 2010 rev 2). The average temperature of the asphalt mixture at the time of production is 1600C, then the maximum duration of travel is approximately 5 hours.
Dari Gambar 12 dapat dilihat bahwa penurunan suhu pada aspal buton berbutir mengalami peningkatan, jika dibandingkan dengan campuran aspal menggunakan aspal cair. Hal ini dapat disebabkan campuran aspal mengalami penurunan yang cukup signifikan akibat pengaruh suhu dari udara dilokasi dan proses penghamparan. Namun harus memperhitungkan suhu minimal campuran campuran aspal yang bisa dihampar yaitu 130°C (spesifikasi teknis Bina Marga 2010 rev 2). Suhu rata–rata campuran aspal saat produksi adalah 160°C, maka lama perjalanan maksimum adalah lebih kurang 5 Jam.

5. Conclusion
Penurunan suhu pada aspal buton berbutir mengalami peningkatan, jika dibandingkan dengan campuran aspal menggunakan aspal cair. Selisih penurunan suhu rata–rata campuran aspal yang telah dihampar sebelum dipadatkan adalah 16,55 °C /Jam dengan suhu udara 25°C – 30°C. Sehingga perlu penanganan khusus dalam pelaksanaan dilapangan untuk mengatasi penurunan suhu yang cepat.

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