The Composition Aggregate Uses: A Grain of Buton Asphalt

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Abstract. The most widely used pavement structures in Indonesia are flexible pavements consisting of coarse aggregate compositions, fine aggregates, asphalt and filler materials. The type of pavement used is densely graded pavement (asphalt concrete). The ability of the mixture of asphalt concrete in holding the vehicle load (traffic) is strongly influenced by the quality of the asphalt concrete mix. This study aims to find out the composition of Muara Takus quarry aggregate usage of Asphalt Concrete-Binder Course (AC-BC) asphalt mixture with the use of Asphalt Buton Grain type 5/20 and penetration asphalt 60/70. The method used is a survey of direct sampling to the field and testing laboratory. Sampling of aggregate data is done in the field and then sieve analysis using the standard in accordance with SNI 1968: 2008 and aggregate composition. The results of the screening analysis of both AC-BC asphalt mixtures using Asphalt Liquid Pen 60/70 and Asphalt Buton Grain Type 5/20 there is a very significant difference to the use of aggregate on Asphalt Buton Grain alone into the Asphalt AC-BC mixture and not using a filler.

Keywords: asphalt buton; penetration asphalt 60/70; aggregate composition

1. Introduction

In line with the rapidly growing volume of traffic can have an impact on the demand for construction of pavement structures and the use of materials used. Especially for conditions in Indonesia where the burden of excessive traffic (overloading) often occur so it is necessary to take into account special consideration in the planning of the asphalt mixture including the composition of the mixture of fine aggregate (fine aggregate) and coarse aggregate (coarse aggregate) and filler thus the performance of pavement a good path is needed (Rizal, et al 2014). Pavement structures on soft soils also need special attention, because soft soils have a weak bearing capacity (Srihandayani, 2018).

The most widely used pavement structures in Indonesia are flexible pavements consisting of coarse aggregate compositions, fine aggregates, asphalt and filler materials. The type of pavement used is densely graded pavement (asphalt concrete). The ability of the mixture of asphalt concrete in
withstand vehicle load (traffic) is very influenced by the quality /quality of asphalt concrete mixture. One of the most potent ingredients of asphalt concrete in producing good quality mixtures is coarse aggregate. The crude aggregate requirement to produce a concrete pavement with high structural value is having a wear rate of ≤ 40% to be used as a plywood on Asphalt Concrete pavement - Bearing Course (AC-BC) (Suherry, et al, 2014).

The Ministry of Public Works and People's Housing (PUPR) estimates the national oil asphalt requirement in 2016 of 1.5 million tons. In this case, PT Pertamina is only able to produce national oil asphalt of 650,000 tons or 43 "and to meet the shortage will be imported asphalt oil. Based on data from the Directorate General of Highways, the actual utilization of Asbuton Directorate General of Highways (2007-2015) only reached 294,408 tons or 64.5% of the planned target of 456,333 tons. Meanwhile, the 2016 plan of 105,847 tons for 943.74 km road length has only been realized by approximately 40%. Thus, the government continues to encourage the use of Buton asphalt as an alternative to oil asphalt. In this case, Asphalt Development Association Buton (ASPABI) has declared its readiness with a production capacity of 396,000 tons per year for Granular type, 140,000 tons per year of Semi extraction type, and 148,000 tons CPHMA type (Tribun, 2015).

This study aims to find out the composition of the village Barelang quarry aggregate to the asphalt mix Asphalt Concrete - Binder Course (AC-BC) with the use of Asphalt Buton Grain type 5/20 and asphalt penetration 60/70.

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 act as traffic load receptors and then spread it to the underlying layer (Sukirman, 2008).

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.

Graduation is an aggregate grain arrangement according to its size, aggregate size can be obtained through screening analysis. A set of filters generally comprises a sieve of 3/4 " , 1/2 " , 3/8 " , No.4, No.8, No.16, No.30, No.50, No.100, No .200. The aggregate gradation is expressed as a percentage of passes or percentages retained calculated on the basis of aggregate weight. Aggregate gradation determines the magnitude of the cavity or pore that may occur in mixed aggregates, a good aggregate mixture is an aggregate composed of large to small aggregates evenly because the cavities formed by large aggregates will be filled by smaller aggregates.

The aggregate grading is determined by the filter analysis, where the aggregate sample must pass through a set of filters. The size of the screen states the size of the wire network aperture and the filter number represents the number of wire network openings per square inch of the filter. The aggregate grading is expressed as a percentage by weight of each sample passing on a particular filter. This percentage is determined by weighing aggregates that pass or hold on each filter.
A well-graded aggregate is an aggregate whose grain size is evenly distributed over a range of grain sizes. A well-graded aggregate is also called a densely aggregated aggregate. The mixture of fine aggregate has the little pore, is easily compacted and has high stability. In choosing mixed aggregate gradations, except for Latasir and Lataston gradations, the Laston type mix needs to take into account the Fuller Curves, Control Points and Restricted Gradient Zones. In the General Specification of Bina Marga Year 2010 revision 3, hot mixed asphalt concrete sets gradation with 2 (two) special specifications i.e. gradation targets are at the control point and avoids the prohibition area. As shown in Table 1.

### Table 1. Combined Aggregate Grading Envelope For Asphalt Mixture

| The size of the sieve (mm) | % of weight that passes to the total aggregate in the mixture |
|----------------------------|-------------------------------------------------------------|
|                            | Latasir (SS)       | Lataston (HRS)    | Laston (AC)        |
|                            | Class A | WC | Base | WC | Base | WC | BC | Base |
| 37,5                       | 100     |    |      |    |      |    |    |      |
| 25                         | 100     | 90-100 |
| 19                         | 100     | 100 | 100 | 100 | 100 | 100 | 90-100 | 76-90 |
| 12.5                       | 90-100  | 90-100 | 87-100 | 90-100 | 90-100 | 75-50 | 60-78 |
| 9.5                        | 90-100  | 75-85 | 65-90 | 55-88 | 55-70 | 77-90 | 66-82 | 52-71 |
| 4,75                       | 53-69   | 46-64 | 35-54 |
| 2.36                       | 75-100  | 50-72 | 35-55 | 50-62 | 32-44 | 35-53 | 30-49 | 23-41 |
| 1,18                       | 21-40   | 18-38 | 13-30 |
| 0,600                      | 35-60   | 15-35 | 20-45 | 15-35 | 14-30 | 12-28 | 10-22 |
| 0,300                      | 15-35   | 5-35  | 9-22  | 7-20  | 6-15  |
| 0,150                      | 6-15    | 5-13  | 4-10  |
| 0,075                      | 10-15   | 8-13  | 6-10  | 2-9   | 6-10  | 4-8  | 4-9  | 4-8  | 3-7  |

Source: General specification of Bina Marga 2010 revision 3

### 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 2.187gr / 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 and testing laboratory. Sampling of aggregate data is done in the field then sieve sieve analysis using standard in accordance with SNI 1968: 2008 and aggregate composition using aggregate from quarry of village of estuary estuary, 5/20 grain bitumen buton and 60/70 penetration asphalt on Asphalt Concrete- Binder Course (AC-BC). The results of research data collected and arranged in the form of tables and curves for easy analysis based on theories and research results tedlah done before, based on these results drawn conclusions.
4. Result and discussion

Research To find out the difference of aggregate use composition between Asphalt mixture using Asphalt Buton Grain 5/20 and Asphalt Concrete-Binder Course (AC-BC) using the local Quarry asphalt Concrete-Binder Course (AC-BC) using Muara Takus aggregate. The result of the sieve analysis test obtained by Grade Aggregate Combined AC-BC mixture using Penetration Aspect 60/70 which can be seen in table 2.

| Table 2. Aggregate Gradation Combined AC-BC mixture using Asphalt Liquid Pen 60/70 |
|---------------------------------------------------------------|
| **No.** | **Filler** | **Aggregate** | **Mixed Aggregate Grades** | **Sample** | **Selection** | **Min** | **Max** |
| # mm | Agg Coarse Medium Fine Filler | | |
| 1 | 25,4 | 100,00 | 100,00 | 100,00 | 100 | 100,00 | 100,00 | 100 | 100,00 | 100,00 | 100 | 100 |
| 3/4 | 19 | 98,77 | 100,00 | 100,00 | 100 | 99,67 | 99,62 | 99,58 | 99,58 | 90 | 100 |
| 1/2 | 12,5 | 93,24 | 100,00 | 100,00 | 100 | 90,26 | 88,79 | 87,32 | 87,32 | 75 | 90 |
| 3/8 | 9,5 | 35,82 | 87,55 | 100,00 | 100 | 78,76 | 76,19 | 73,62 | 73,62 | 66 | 82 |
| # 4 | 4,75 | 4,98 | 41,19 | 99,50 | 100 | 54,63 | 50,85 | 47,07 | 47,07 | 46 | 64 |
| # 8 | 2,36 | 1,20 | 24,61 | 72,25 | 100 | 37,64 | 34,80 | 31,96 | 31,96 | 30 | 49 |
| # 16 | 1,18 | 0,90 | 11,14 | 55,77 | 100 | 26,72 | 24,52 | 22,33 | 22,33 | 18 | 38 |
| # 30 | 0,6 | 0,80 | 1,95 | 42,70 | 100 | 18,34 | 16,69 | 15,04 | 15,04 | 12 | 28 |
| # 50 | 0,3 | 0,60 | 0,87 | 34,00 | 100 | 14,87 | 13,54 | 12,20 | 12,20 | 7 | 20 |
| # 100 | 0,15 | 0,50 | 0,72 | 23,55 | 100 | 10,83 | 9,90 | 8,98 | 8,98 | 5 | 13 |
| # 200 | 0,075 | 0,30 | 0,62 | 11,02 | 100 | 5,98 | 5,55 | 5,12 | 5,12 | 4 | 8 |

Source: Soehardi et al. (2018)

If illustrated with graph gradation Aggregate Gradation Combined AC-BC mixture using Asphalt Liquid Pen 60/70 can be seen in Figure 1.

![Figure 1](image_url)
Based on the picture shows that the test results of the sieve analysis on the three samples obtained gradation Aggregate Gradation Combined AC-BC mixture using Asphalt Liquid Pen 60/70 which is the lowest value and still falls within the upper and lower limits of the specified Binamarga 2010 revision 3.

The result of the sieve analysis test obtained by Grade Aggregate Combined AC-BC mixture using Asphalt Buton Grain Type 5/20 which can be seen in table 3

Table 3. Aggregate Gradation Combined Mixture AC-BC using Asphalt Buton Grain Type 5/20

| No. Filter | Aggregate Grades | Mixed Aggregate Grades |
|------------|------------------|------------------------|
|            | Coarse Agg 100.00 | Medium Agg 100.00 | Fine Agg 100.00 | Sand 100.00 | Asbuton 100.00 | Trial I 100.00 | Trial II 100.00 | Trial III 100.00 | Selection acbc 100.00 | Spck Min 100 | Spck Mak 100 |
| # 1 " 25,4 | 100.00 100.00 100.00 100.00                                    |
| 3/4 " 19 93,15 100.00 100.00 100.00 100.00 98,56 98,36 98,15 98,15 90 100 |
| 1/2 " 12,5 11,51 100.00 100.00 100.00 100.00 81,42 78,76 76,11 76,11 75 90 |
| 3/8 " 9,5 8,15 74,10 100.00 100.00 100.00 72,42 69,67 66,91 66,91 66 82 |
| # 4 4,75 1,84 20,94 98,45 98,41 100.00 53,40 50,50 47,60 47,60 46 64 |
| # 8 2,36 1,09 12,20 74,59 69,57 100.00 39,35 37,15 34,94 34,94 30 49 |
| # 16 1,18 1,03 10,23 56,10 48,72 95,80 30,16 28,51 26,86 26,86 18 38 |
| # 30 0,6 0,97 9,31 42,02 33,30 94,90 23,47 22,24 21,01 21,01 12 28 |
| # 50 0,3 0,89 8,12 30,46 18,17 76,70 17,01 16,13 15,24 15,24 7 20 |
| # 100 0,15 0,69 4,60 22,68 5,82 48,50 11,03 10,37 9,71 9,71 5 13 |
| # 200 0,075 0,48 2,15 14,85 3,02 20,30 6,51 6,08 5,65 5,65 4 8 |

gradation graph Combined Aggregate Gradation The AC-BC mixture using Asphalt Buton Grain Type 5/20 can be seen in Figure 2.
Based on the picture shows that the test results of the sieve analysis on the three samples obtained gradation Aggregate Gradation Combined Mixture AC-BC using Asphalt Buton Grain Type 5/20 which is the lowest value and still falls within the upper and lower limits of the specified Binamarga 2010 revision 3.

The results of the screening analysis of both AC-BC asphalt mixtures using Asphalt Liquid Pen 60/70 and Asphalt Buton Grain Type 5/20 there is a very significant difference to the use of aggregate on Asphalt Buton Grain Type 5/20 is the direct addition of Asphalt Buton Grain alone into the Asphalt AC-BC mixture and not using a filler. Because the buton bitumen itself contains a lot of filler.

5. Conclusion
The results of the screening analysis of both AC-BC asphalt mixtures using Asphalt Liquid Pen 60/70 and Asphalt Buton Grain Type 5/20 there is a very significant difference to the use of aggregate on Asphalt Buton Grain Type 5/20 is the direct addition of Asphalt Buton Grain alone into the Asphalt AC-BC mixture and not using a filler.

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