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Effects Of Mixed Asphals With Feldspar Filler Modification On Oil Asphals

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Abstract- Each composite material in a pavement mixture gives different variations of characteristics and performance, therefore it is still necessary to test the variations of the material to find the suitability of the use, so that by testing it can contribute information about the use of materials that can be used as an alternative in reference to choosing a replacement material This study aims to determine the characteristics of marshall using asphalt binder modified polymer AC 50/70 by using the material of feldspar stone ash, in terms of Marshall stability, flow VF, VIM (Void in Mix), VIM (Void in Bix) VMA (Void in Mineral Aggregate), MQ (Marshall Quotient), and. Density, This research uses hot mixed asphalt test (Hot Mix) with Marshall method. The asphalt content used was 4%, 4.5%, 5%; 5.5%; 6%; 6.5%; and 7% with each variant made 5 specimen. Implementation of the research was conducted at Civil Engineering Laboratory Faculty of Engineering, Islamic University of Sultan Agung Semarang. Implementation stages include aggregate examination (fine aggregate and coarse aggregate), filler examination, manufacture of asphalt concrete mix test and test using Marshall method.

Keywords*: Asphalt mixture, feldspar, filler, Asphalt oil*

1. Introduction

Indonesia is a country with abundant natural resources. Natural resources such as rocks, sand and volcanic ash have many that can be utilized by the community. However, we need to know that there are rock materials that are underutilized by society, such as feldspar stone.

Feldspar stone is the name of the people who are located in the vicinity of Jepara belonging to andhesit rocks. While andhesit rocks are a group of igneous rocks. Frozen rocks are rocks formed from the lava that comes out of the bowels of the earth then frozen on the surface of the earth. (Al - Mujjabuda'wat, 2011).

Along with the development of research on road pavement, the use of materials modifications that are sourced from natural or artificial materials into one of the forms of business undertaken. Finding material formulations in addressing the improvement of nature to load and natural conditions into a demand that must be done. With consideration of feldspar aggregate function that its use is still minimal in the field of highway construction, so in this study asphalt polymer modification and feldspar stone aggregate can be used as an alternative to highway construction material

Some asphalt material formulations have been developed, but still need to be tested. Each composite material in a pavement mixture gives different variations of

characteristics and performance, therefore it is still necessary to test the variations of the material to find the suitability of the use, so that by testing it can contribute information about the use of materials that can be used as an alternative in reference to choosing a replacement material .

Based on some description of the background above, then the formulation of this research problem is as follows:

1. What is the value of asphalt characteristics of filler modification at AC 50/70 PT. Pertamina with feldspar stone aggregates in terms of Marshall testing using optimum bitumen content?
2. What is the value of the filler bitumen content on the optimum 50/70 AC used as the aggregate binder?

2. Literature Review

Asphalt is made from crude oil and generally derives from the remnants of marine organisms and the remnants of past seas deposited by rock shards. After millions of millions of years of organism material and sludge accumulate in layers of hundreds of meters, the load from the top load pushes the lower layer to sedimentary rock. The sediments are long - turned into or processed into crude oil which becomes the basic compound of hydrocarbons. Asphalt usually comes from the distillation of crude oil, but the asphalt is also found as a natural material (eg, asbuton), which is often called mineral (Shell Bitumen, 1990).

Asphalt is an elaborate colloidal system of hydrocarbon material made from Asphaltenes, resins and oils. Asphalt materials are dark brown to black and are inherent, solid or semi-solid form derived from nature by oil refining (Kreb, RD & Walker, RD., 1978). Asphalt can also be interpreted as a binder on an asphalt mixture formed from complex compounds such as Asphaltenes, resins and oils. Asphlatenes of the formation material of asphalt and resin affect the properties of adhesion and ductility, oils have an effect on viscosity and flow (Hunter RN, 1994)

Anang Priambodo (2003) defines asphalt is also a material that is visco-elastic and has diverse characteristics ranging from highly attached to elastic. Among other asphalt properties are:

1) Asphalt has the properties of Thrixotropy, ie left without experiencing tension - the asphalt voltage will become hard in accordance with the course of time.
2) Asphalt has Rheologic properties, namely the relationship between stress (stress) and strain (strain) that is influenced by time. When subjected to a very fast loading period, the asphalt will be elastic, but the loading that takes a long time of the nature of the asphalt becomes plastic (viscous).
3) Asphalt is a Thermoplastic material, ie its consistency or viscosity will change according to the temperature changes that occur. The higher the temperature the lower the viscosity or the asphalt will be more dilute, and vice versa.

Aggregate is a collection of cracked stone, gravel, sand or other mineral in the form of natural or artificial products (Department of Public Works Directorate General of Highways, 1998). Whereas in general aggregate is defined as a hard and solid hard earth formation (Silvia Sukirman, 2003). According to Wignall, (2003) all paved pavement layers are composed of aggregates, obtained from crushed stone, slags or gravel with sand or soft grain. Aggregates have an important function in influencing the behavior of pavement. In general, aggregates have mechanical strength for the construction of roads, as well as on the surface layer (topmost) which will directly withstand the traffic load, but this section becomes worn out due to high traffic load, causing the surface to become slippery and unsuitable or Feasible again for the vehicle to

pass. Aggregates are a major component of a pavement layer containing 90-95% aggregate based on percentage weight and 70-85% aggregate based on volume percentage. So that the carrying capacity, durability and quality of pavement are determined also from aggregate properties and from mixed results with other materials (Purba, 2006).

The nature and quality of the aggregate determine its ability to carry the traffic load because it is required for a surface layer that directly bears the load on it and passes it to the layer below it. The quality of an aggregate is strongly influenced by the properties it contains. Among the properties that exist are strength or strength, durability or durability, adhesiveness or adhesiveness to asphalt and workability or ease of implementation. The properties of strength and durability are influenced by gradation, mud content, hardness and shape grain. Gradation is the outer measure of the aggregate and is divided into coarse, fine aggregate and filler aggregates. Good, uniform, and balanced gradations increase the strength and durability of the cavities formed by the filler so that the density increases as no empty space is available (Krebs, et al, 1971).

The asphalt attachment to the aggregate is affected by the aggregate nature of water. Granite and aggregates containing silica are hydrophilic aggregates, water-impregnable aggregates, which result in the aggregate not easily attached to asphalt, asphalt bonds with aggregate easily removed. In contrast aggregates such as diorite, andesit, are hydrophobic aggregates, aggregates that are not easily tied to water, but are easily bonded to asphalt.

Aggregate density is the ratio between the weight of the aggregate volume and the volume of water. Aggregates of small density have large volume or light density.

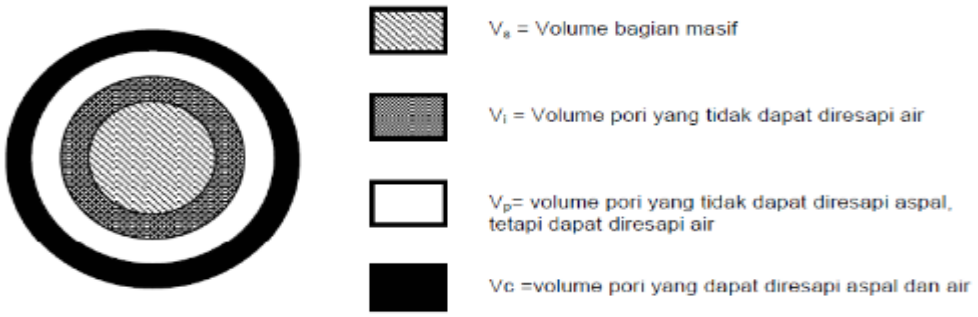

Figure 1. Aggregate Point Volume Scheme
(Source: Sukirman, 2003)

Figure 1 above shows an aggregate grain volume scheme, which consists of mass aggregate volumes (Vs), non-impregnated pore volume (V), water impregnated pore volume (Vp + Vc), and impregnated pore volume Asphalt (Vc).

Vs+Vp+Vi+Vc = Total aggregate grain volume

Vp+Vi+Vc = Aggregate pore volume

Effect of effective weights =

$$\frac{Bk}{Bj-Ba} \quad \text{.....(1)}$$

Keterangan:
Bk = Weight of oven dry test object, in grams
Bj = Weight of dry surface test object saturated, in grams
Ba = Weight of dry surface test object saturated in water, in grams
The specific gravity of fine aggregate shall be determined by use SNI 03- 1969-1990; SK SNI M-09-1989-F atau AASHTO T84-88.

Fillers may consist of limestone dust, dolomite dust, Portland cement, fly ash, high cement blast furnaces or other non-plastic mineral materials. This micro aggregate filler material must pass the no. 200 (0.075 mm). Of the many types of fillers, lime is widely used in Portland cement. Portland cement is easy to obtain and has excellent grain grading but the price is very expensive.

The function of this filler (filler) is

1) As a cavity between the coarser particles, the air cavity becomes smaller and produces friction resistance and high granular locking, by increasing the stability of the mixture.
2) When added to the asphalt, the filler becomes a suspension, thereby forming the mastics together with the asphalt binding of the aggregate particles. With the addition of filler material, the asphalt becomes more viscous and the aggregate capability becomes strengthened.

Aggregate gradation is an aggregate grain arrangement according to its size, aggregate grain size can be obtained through screening analysis. A set of filters generally consists of 4 inches, 3 ½ inch, 3 inch, 2 ½ inch, 2 inch, 1 ½ inch, 1 inch, ¾ inch, ½ inch, 3/8 inch, No.4, 8 , No.16, No.30, No.50, No.100, and No.200. The size of the filter in length indicates the size of the opening, while the filter number indicates the number of openings in 1 inch length (Sukirman, 2003).

Asphalt used as pavement material functions as:

1) Binder, provides a strong bond between asphalt and aggregate and fellow asphalt.
2) Filler material, filling the cavity between the aggregate grains and the pores present in the aggregate itself.

The main function of asphalt for both types of pavement forming process is the process of mixing prahampar, and pascahampar is different. In the asphalt pretampar process mixed with the aggregate will wrap or enyelimuti aggregate grains, fill the pores between the grains, and seep into the pores of each grain

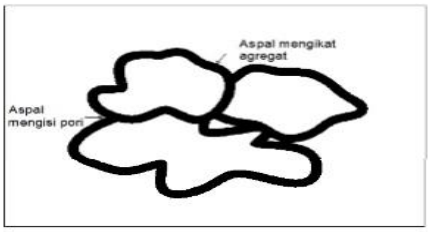

Figure 2. Asphalt function on each aggregate item
(Source: Sukirman, 2003)

The illustration of the asphalt for each aggregate item is illustrated in Figure 2.

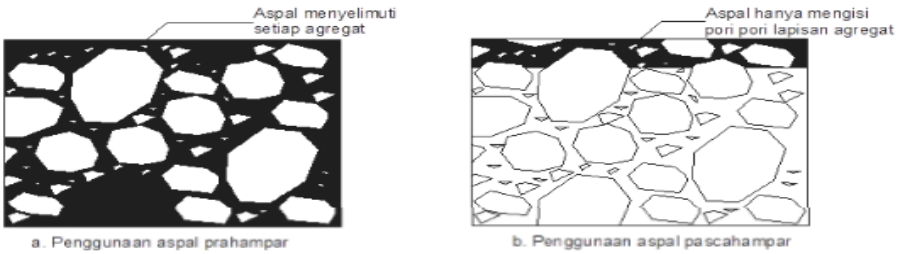

Figure 3. Differences in asphalt function on the road layer
(Source: Sukirman, 2003)

Volumetric Properties Of Asphalt Concrete Mixes

Bit concrete is formed from aggregates, asphalt, and or without additives, which are mixed evenly or homogeneously at the mixing plant at a certain temperature. The mixture is then spread and compacted, resulting in solid asphalt concrete. Analytically, we can determine the volumetric properties of solid asphalt concrete, either compacted in the laboratory, or in the field. Commonly used parameters are:

1. V_{mb} = Bulk volume of solid concrete
2. V_{sb} = Aggregate volume, is the bulk volume of the aggregate (the massive pore volume + pores present within each aggregate item)
3. Vse = Aggregate volume, is the effective volume of aggregates (massive volume of pores + unloaded pores within each aggregate item)
4. VMA = The pore volume between the mixed aggregate grains, in solid asphalt concrete, includes those filled with asphalt, (*void in the mineral aggregate*).
   V_{mm} = Volume without pores of solid asphalt concrete
5. VIM = Asphalt pore volume of solid asphalt (*void in mix*).
6. VFA = *volume of voids filled with asphalt*
7. V_{ab} = The volume of asphalt is absorbed into the aggregate of solid asphalt concrete
8. Asphalt film thickness = Asphalt film thickness or asphalt blanket is often used also to determine the characteristics of asphalt concrete

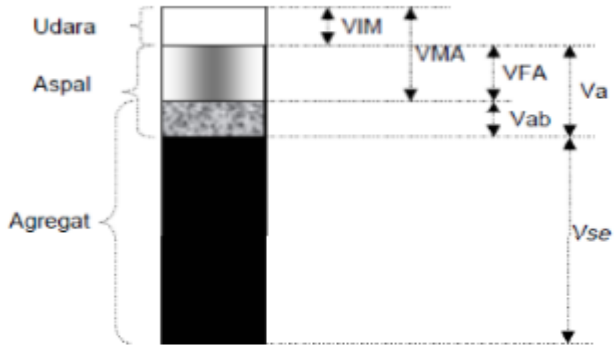

Figure 4. Schematic of various types of asphalt concrete volume
(Sukirman, 2003)

3. Methods

In this study, the test is carried out in stages, consisting of aggregate testing (coarse, fine and filler), asphalt and test to mixture (Marshall test). Tests on aggregates are tested for specific gravity checks, abrasion testing with a Los Angeles engine, attachment and water absorption.

For asphalt testing modification polymer modification 50/70 was carried out combustion testing, penetration testing, point-burning point test, soft point testing, specific gravity. While the method used as mixed testers is Marshall method, where from Marshall test results obtained in the form of Marshall components, namely stability, flow, void in total mix (VIM), void filled with asphalt and then can be calculated Marshall Quotient -his. The research variables are divided into 3 namely:

1) Free Variable
   The independent variable that influences the dependent variable. The independent variables in this research are 5% asphalt content, 5.5% asphalt content, 6% asphalt content, 6.5% asphalt content and 7% asphalt content.
2) Dependent Variables
   The dependent variable is the variable that is affected or the result, because of the independent variables. The dependent variables in this research are weight value of asphalt concrete mix, stability value, flow value, VFB value, VIM value, VMA value, marshall quotaen value (MQ), and Density value.

To clarify the relationship between variables can be seen in the flowchart picture relationship between variables contained below:

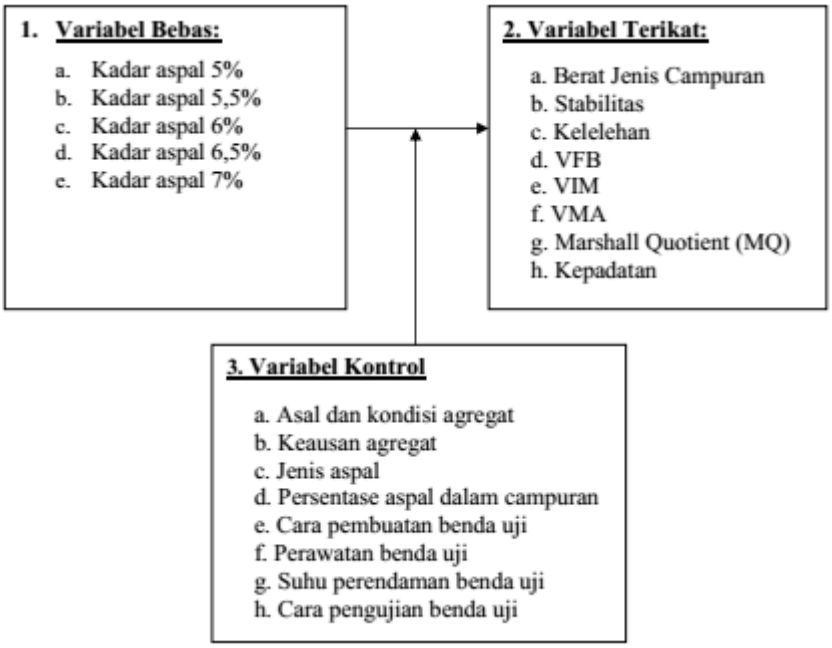

Figure 5. Flow chart

Rough Aggregate Testing

The crude aggregate for this plan is an aggregate that passes the 3/4 " filter and is suspended above a 2.36 mm filter or strainer no.8. Crude aggregates for testing purposes shall consist of crushed or broken pebbles and shall be provided in nominal sizes. According to Sukirman, (2003) the provisions can be seen in Table 1.

Table 1.
Rough aggregate conditions

No.	Karakteristik	Metode Pengujian
1	Specific gravity and water absorption agregat kasar	SNI 03-1969-1990
2	Abration with Los Angles machines	SNI 03-2417-1991
3	Aggregate water content	SNI 03-1971-1990
4	Analysis of fine and fine aggregate filters Coarse aggregat	SNI 03-1968-1990

The fine aggregates of each source shall consist of natural sand or crushed rock passes no. 8 and and stuck on the filter no. 200. Smooth aggregates of cracking and natural sand should be stockpiled in separate reserves from the above crude aggregates and protected against rain and water effects. The material shall be a clean, hard material free of clay or other undesirable material. According to Sukirman 2003 the provisions on fine aggregates are listed in Table 2.

Table 2.
Fine aggregate terms

No.	Karakteristik	Metode Pengujian
1.	Specific gravity and fine aggregate water absorption	SNI 03-1970-1990
2.	Aggregate water content	SNI 03-1971-1990
3.	Analysis of fine and aggregate aggregate filters	SNI 03-1968-1990

Filler

Filler must pass filter no. 200. The filler should also be free of any undesirable material. The added filler should be dry and free of clots. The fillers tested in this study are stone ash which has the same provisions as in Table 3 (Sukirman, 2003)..

Tabel 3.
Filler terms

No.	Karakteristik	Metode Pengujian
1.	Specific gravity	AASHTO T-85 - 81
2.	Material pass filter no.200	SK SNI M-02-1994-03

The Marshall testing step for asphalt 50/70 modification is as follows:

1) Weighing the aggregate according to the percentage of the desired gradation target for each specimen by weight of the mixture of about 1200 grams so as to produce a test specimen height of approximately 63.5 mm □ 1.27 mm. The drying of the aggregate mixture is then carried out until the weight remains until the temperature (150 ± 5) ºC.
2) In this study there were 15 specimens and every 3 specimens were given asphalt content varying from 5%; 5.5%; 6%; 6.5%; 7%.
3) The aggregate is heated in a mixing pan at a temperature of ± 28 ° C above the mixing temperature for solid asphalt. Asphalt that has reached the level of consistency is poured into the aggregate and stirred evenly.
4) After the compaction temperature has been reached, the mixture is introduced into the preheated mold at a temperature of 100 ° C to 170 ° C and smeared oil first, and

the bottom of the mold is given a piece of filter paper which has been cut in accordance with the diameter of the mold while being stabbed with the spatula as much as 15 times at the edge and 10 times in the middle.

5) Performed alternating compaction by pounding the specimen with the number of collisions as much as 75 times as adjusted to the type of planned traffic that is heavy traffic.
6) After the compaction process is finished the silenced test object to the temperature down, after the cold test object issued with ejector and coded.
7) The test specimen is cleaned from the impurities attached and measured the height of the specimen with a precision of 0.1 mm and weighed the weight of the dry specimen (Bk).
8) The specimens are fed into water at 25 ° C for 3 to 5 minutes and then weighed to obtain the Weight of Test Items in Water (Ba).
9) The test piece is removed from the tub and dried with a cloth on the surface to allow the saturated surface dry (SSD) condition to be weighed (Bj)
10) The test piece is immersed in a soaking bath at 60 ± 1ºC for 30 to 40 minutes. For immersion test get residual stability at 60 ± 1ºC for 24 hours.
11) The inside of the surface of the suppressor head is cleaned and lubricated so that the test piece is easily removed after the test.
12) The test piece is removed from the submersible bath, then placed directly in the center at the bottom of the suppressor head and then the top of the head is placed by inserting through the guide rod. After the installation is complete then placed right in the middle of the loading tool. Then a flow meter is mounted on the stand above one of the guide rods. While the sleeve sheath is firmly held against the upper segment of the suppressor head.
13) Head suppressor raised to touch the top of the ring testers, then set the position of the needle watches and watches kelelehan suppressor to zero.
14) The loading is given to the specimen at a fixed speed of about 50 mm per minute until maximum loading is reached, or loading 46 decreased as indicated by the needle of the press watch and recorded the maximum loading.
15) Value melting (flow) indicated by the gauge needles melting watches is recorded at the time of the maximum loading is reached.

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