



## The Study On Utilization Waste Tire Seeds As Amixture Of Ac-Wc Asphalt On Road Pavement

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### ABSTRACT

Aus-Layered Asphalt Concrete (AC-WC) is the topmost layer of the pavement structure that is directly related to the vehicle wheels. WC) in this study selected tire ore waste as an added material to the job mix. In this study, the variation of the mixture added with tire ore starting from 0%, 3%, 6% and 8% addition of tire ore waste for the highest variation value is 3%, stability value is 494.99 kg, *Voids Filled With Asphalt's* value is 68,40%, value of *Voids in Mix* is 3.65%, flow value is 3,21 %, value of *Marshall Quotient* is 154,61 kg/mm, Density's value is 2,29 gr/cc. Finally, it was concluded that the addition of waste tire ore is not in accordance with SNI 06-2489-1991 because the higher percentage value in the mixture will decrease the value of Marshall Stability.



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## 1. Introduction

Roads are the most dominant transportation infrastructure used, judging from the high intensity of road users[1][2], the maintenance and construction of roads must also have good quality and there must be innovation updates from time to time on the infrastructure of road construction[2][3].

Aus Layer Asphalt Concrete (AC-WC) is the topmost layer of the pavement structure that is directly related to the vehicle wheels[4][5], has a smoother texture than Intermediate Asphalt Concrete (AC-BC), in this study tire ore was chosen as an added material. Asphalt Lapis Aus (AC-WC) due to the lack of utilization of tire ore and the nature of the ore itself is elastic which is suitable to be mixed with Asphalt Lapis Aus (AC-WC)[5][6].

## 2. Literature Review

in previous research that has been carried out with the title “The Effect of Adding Waste Tire Powder as a Substitute for Fine Aggregate on the Stability of the AC-WC Layer. -WC)” containing granules/waste of tire powder and comparing with asphalt mixture without waste of tire powder[7].

The mixing method used in this study is the middle limit of the AC-WC mixture gradation in the requirements of Highways. 30 has an optimum asphalt content of 5.75% and a mixture with 100% waste tire powder as a substitute for aggregate in fraction No. 30 has an optimum asphalt content of 6.05%. The results of the Marshall Immersion test show the residual strength index of the AC-WC mixture with 50% waste tire powder as a partial substitute for aggregate in the No. fraction. 30, has the largest value of 95.49%. The optimum mixture was obtained in a mixture containing waste tire powder as a substitute for fraction No. 30 as much as 56% by 95.645%

## 3. Research method

In this research will do some stages in general. Starting with the preparation stage, the data collection stage, materials and equipment to be used such as waste tire ore, coarse aggregate, fine aggregate, asphalt, as well as test objects, then proceed to the data analysis stage and the last stage is drawing conclusions[8][9][10].

### 3.1 Description and Technical

#### 1. Data Collection Techniques

In compiling this report, the researcher carried out several methods of collecting data, which included primary and secondary data collection at the time of the research[10].

## 2. Primary Data Collection

Is the data obtained from the results of experiments / experiments in the laboratory. In this case, it includes data on aggregate inspection, asphalt inspection and inspection of test objects (briquettes)[11].

## 3. Interview

Interviews are data collection techniques that are carried out face-to-face and direct questions and answers to informants[12]. Like when before making a job mix formula. The researcher also asked directly to people who understood the process of making asphalt mixtures, especially to laboratory lecturers, and the head of the laboratory[13].

## 4. Documentation

During the implementation of the research, starting from taking water hyacinth in the river to alleviating test objects (briquettes) the research always documents it, with the aim that from the documentation that researchers can take, hopefully later it can be useful in preparing reports[13].

## 5. Observation

Observation is data collection where researchers go directly to the Lamongan Islamic University laboratory to conduct direct research on the utilization of used tire ore waste on the AC-WC asphalt mixture[14][15]. From this, it is hoped that researchers will be able to find out how the effect of adding waste tire ore to the asphalt mixture and so that researchers can find out various kinds of work process situations (conditions) in the laboratory[16][8].

## 6. Secondary Data Collection

Secondary data is data obtained indirectly, for example from previous research references and references from literature books[17]. In this case the researcher collects data by visiting the library, study center, archive center, journal or reading many books related to his research[18][19].

## 7. Data Analysis

After doing research on the addition of a mixture of waste tire ore to the hot asphalt mixture, researchers can compare the results of the Marshall Properties test using 4 types of test objects in which 4 test objects are given before being added and after being given additional waste tire ore[20][21]. After testing and research, the results will be obtained, which is then carried out by making mathematical modeling with the help of MS Excel 2013 software to determine the relationship between the additional levels of waste tire ore, (i) asphalt quality; and, (ii) values of marshall properties[22]. The final result is a mathematical model of the relationship between the addition of waste tire ore: (i) asphalt

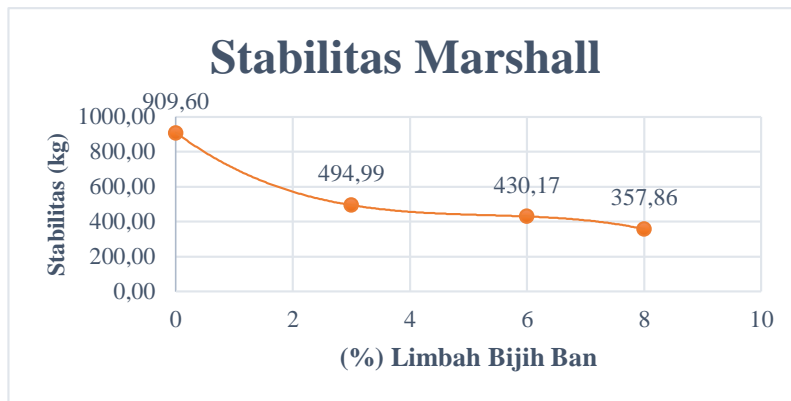
quality (penetration; softening point; flash point and burning point of asphalt); and, (ii) the values of the marshall properties. The results of data analysis are used as the basis for drawing a final conclusion[19].

#### 4. Results and Discussion

##### 4.1 Marshall Test Test Process

Marshall test refers to SNI 06-2489-1991, with the final test results to determine the value of marshall stability, flow, marshall quotient, voids filled with bitumen, voids in mineral aggregates and voids in mineral aggregates[23]. air voids (voids in mix) where the hot asphalt mixture is added with waste tire ore [24].

##### 4.1.1 Relationship of Waste Tire Variation with Marshall Stability

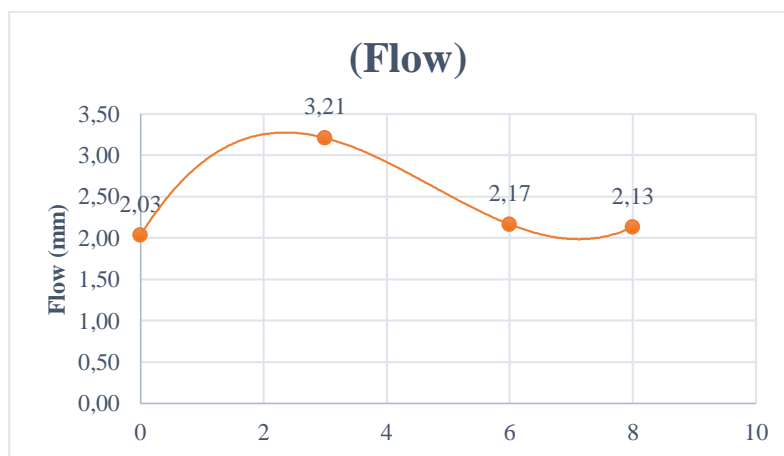


**Figure 1.** Graph of Relationship % Waste Tires with Marshall Stability

Source: Integrated Laboratory Research, 2021

Stability is the ability of the pavement to accept a load until yielding occurs. From the marshall stability graph, the highest value is obtained with a value of 909.60 kg.

##### 4.1.2 Relationship of Tire Ore Waste Variation with Plastic Melt (FLOW)



**Figure 2.** Graph of Relationship between Flow Model and Tire Ore Waste

Source: Integrated Laboratory Research, 2021

Yield (flow) is a vertical deformation that occurs from the beginning of loading until the stability condition decreases, which indicates the amount of deformation that occurs in the pavement layer due to resisting the load it receives. The amount of flow value is expressed in mm or 0.01". The flow value is influenced by asphalt content, asphalt viscosity, aggregate gradation, compaction amount and temperature. From the flow chart above, the highest asphalt flow value is 3.21 mm.

**4.1.3 Relationship of waste tire ore with VMA**

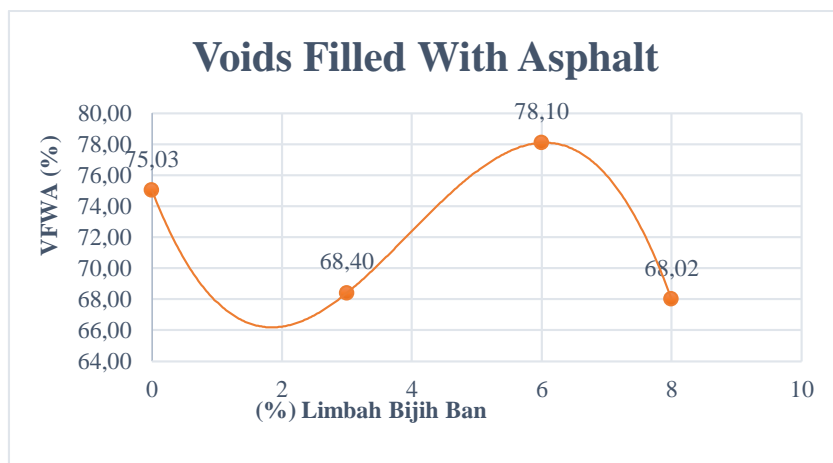


**Figure 3.** Graph of VMA Relationship Model with Tire ore Waste

Source: Integrated Laboratory Research, 2021

VMA is the intergranular space occupied by asphalt and air in the compacted asphalt mixture. In the component diagram, it is the sum of the air volume and the effective asphalt volume. From the VMA chart above, the highest VMA value is 15.67%.

**4.1.3 Relationship between Tire Ore and VFVA**



**Figure 4.** Graph of VFVA Relationship Model with Tire Ore Waste

Source: Integrated Laboratory Research, 2021

VFWA is the percent of voids between aggregate particles (VMA) filled with asphalt, excluding asphalt absorbed by aggregate. From the graph above, the highest value is 78.10%.

#### 4.1.3 Relationship of Tire Ore Waste and Density

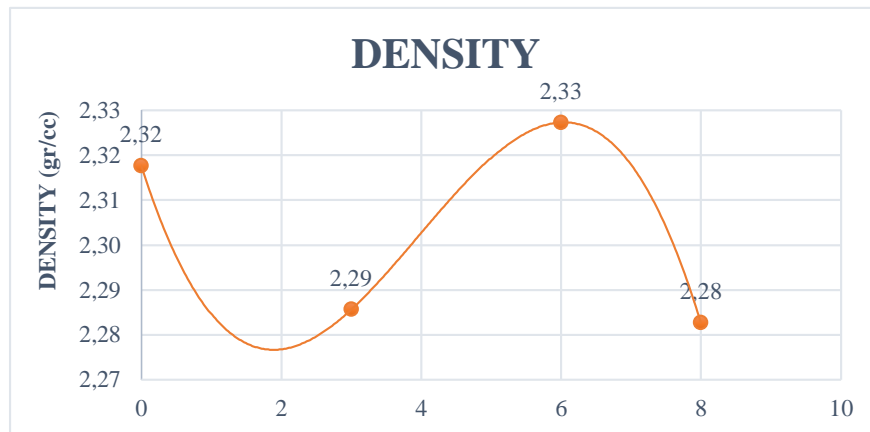


Figure 5 Graph of Density Relationship Model with Tire Ore Waste

Source: Integrated Laboratory Research, 2021

The density value is the volume weight value to show the density of the asphalt concrete mixture. From the density graph, the highest density is 2.33 gr/cc.

#### 4.1.3 Relationship between Tire Ore Waste and VIM

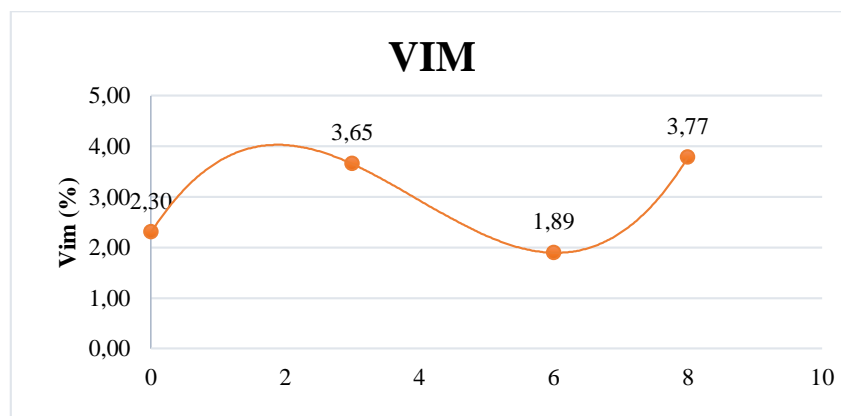


Figure 6 Graph of VIM Relationship Model with Tire Ore Waste

Source: Integrated Laboratory Research, 2021

Void in the Mix (VIM). VIM shows the percentage of voids in the mixture. The VIM value affects the durability of the asphalt aggregate mixture, the higher the VIM value indicates the larger the voids in the mixture so that the mixture is porous. From the VIM chart above, the highest score is 3.77%.

#### 4.1.3 Relationship of Tire Ore Waste Variation with Marshall Quotient

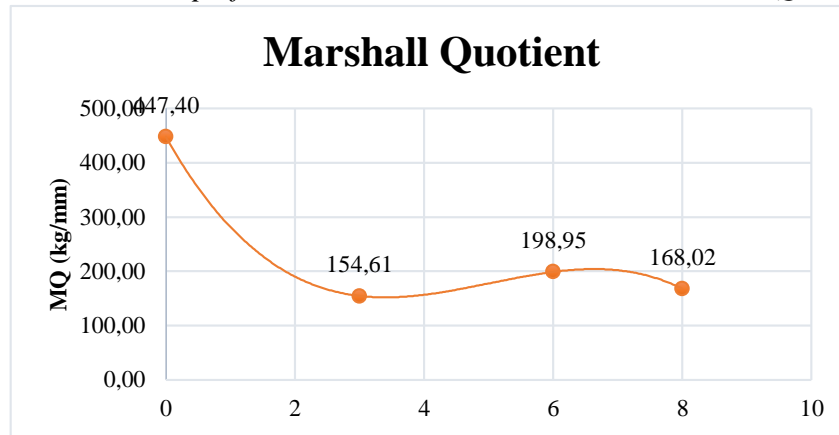


Figure 7 Graph of MQ Relationship Model with Tin Waste

Source: Integrated Laboratory Research, 2021

Marshall Quotient (MQ). The MQ value expresses the stiffness properties of a mixture. If the MQ value is too high, the mixture will tend to be too stiff and easy to crack. Conversely, if the MQ value is too low, the pavement becomes too flexible and tends to be less stable. From the MQ graph above, the highest value is 447.40 kg/mm.

## 5. Conclusions and Suggestions

### 5.1 Conclusion

From the results of tests conducted regarding the effect of mixing tire ore on hot asphalt, the following conclusions can be drawn:

1. The process of making AC-WC asphalt specimens with the addition of tire ore waste as an asphalt mixture includes; (1) Planning the work mix (Job Mix Formula), (2) The process of testing the stacked object, (3) The process of testing the asphalt, (4) The process of mixing the test object, (5) The process of printing the test object.
2. Of the 3 variations used, namely from the average value of variation 0%,3%,6% and 8% addition of waste tire ore for the highest variation value of 3%, with a stability value of 494.99 kg, VFWA with the value of 68.40%, VIM with a value of 3.65%, with a value of FLOW with a value of 3.21 mm, Marshall Quotient with a value of 154.61 kg/mm, VMA with a value of 15.56% and Density with a value of 2.29 gr/cc . Then it was concluded that the addition of used tire ore was not in accordance with the recommended standard because the higher the percentage value in the mixture, the lower the Marshall stability value.

**Suggestion**

1. It is hoped that it can be used as a reference for future research, so that there are no errors in conducting research.
2. So that future researchers will be more careful in conducting research, both during the calculation process, weighing, making test objects, and testing test objects.

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