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# Analysis of Road Maintenance Between Burda Fast and Hotmix: A Case Study in Road Section Bojonegoro (Pajeng) – Nganjuk (Guyangan)

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## Abstract

The East Java Provincial Government through the Public Works Department of Highways has a road improvement and maintenance work program to maintain road stability. However, in its implementation, it is often faced with less-than-ideal conditions, such as natural disasters, resulting in a reduced budget for the work program. Therefore, an alternative method for maintaining asphalt pavement is needed which has advantages in terms of cost efficiency, but does not reduce quality and also does not require a more complicated process compared to carrying out road maintenance work which was usually carried out in previous years, (by using Hotmix). In this research, fast burda was used as an alternative to Hotmix for asphalt road maintenance, namely making fast burda from 2 x 3 cm coarse aggregate, 1 x 2 cm aggregate, 1 x 1 cm aggregate, and 60/70 penetration asphalt. The method used in the research is to compare road maintenance work using fast burda and Hotmix. The analysis carried out in this research is a comparison of the duration of work time, service life and cost analysis between work using fast burda and using Hotmix. The results of this research show that the duration of work with a 1 m2 sample for asphalt road patching using hot mix is the same as road patching using fast burda. The service life of road patches using Hotmix is longer than road patching using fast burda, namely fast burda starts to experience damage in the 5th month, while Hotmix starts to experience damage in the 6th month. Meanwhile, in terms of costs, work using fast burda is cheaper compared to work using Hotmix, fast burda requires IDR303.355 per square meter, while Hotmix requires IDR318.84 per square meter. So the difference in implementation costs per square meter is IDR15.490. Burda can quickly be used as an alternative method for maintaining asphalt pavement when budget conditions are reduced due to national problems or natural disasters.

**Keywords**

Fast burda, hotmix, cost efficiency, job time efficiency, service life

## INTRODUCTION

Road infrastructure is one of the main public assets in transportation which is most often used by the public to support economic activities, education, business, work, etc. [1]. Therefore, roads are one of the main supporters of a country's socio-economic activities. This is emphasized in Road Law no. 38 of 2004 concerning roads which states that roads are transportation infrastructure that plays an important role in the economic, sociocultural, environmental, political defense and security sectors. Roads that have been completed and operated will experience a decline in condition according to the increasing age of the road so that at some point it can hamper community activities [2]. The road network in Indonesia mostly consists of regional roads which include provincial roads and district roads. Therefore, provincial and district roads are the main support for economic, social, and regional development activities that are planned within a certain age and require quite large funding [3].

The East Java Provincial Government through the Public Works Department of Highways has one mission, namely "Improving the condition of provincial road services in East Java". In this regard, the East Java Public Works Department of Highways must program road repairs and maintenance [4]. However, sometimes the government faces a budget crisis due to government problems or various natural disasters that require high handling costs. So the above results in budget cuts in various sectors, including road construction and maintenance budgets. Referring to [5] concerning Procedures for Road Maintenance and Supervision, road operators are required to prepare a road maintenance plan. Road maintenance includes routine maintenance, periodic maintenance and road rehabilitation including complementary buildings and road equipment. The general road maintenance plan

includes information systems, asset management systems, and road maintenance handling plans. Information systems include data collection, processing and maintenance activities to produce information and recommendations for handling road maintenance. This data includes road inventory data and road condition data [6].

This makes the East Java Province Public Works Department of Highways look for innovation to fulfill its mission. Damage conditions that in previous years were handled using Hotmix at high costs no longer apply [7]. The East Java Province Public Works Department of Highways must implement new road maintenance methods that have low costs and maximum results. Pavement service life cycle costs (discounted life cycle costs) Cost analysis to determine the choice and operation of pavement throughout the service life cycle at the most appropriate cost from several technically feasible alternatives. In addition to construction costs, road user costs are also taken into account [8]. Such as costs due to reduced road capacity at the location being handled, and road maintenance costs related to various activities such as maintenance and rehabilitation of road pavement during the service period [9].

Faced with these conditions, the East Java Province Public Works Department of Highways needs to look for innovations to continue to fulfill its mission and work programs optimally even with a limited budget. One of the dominant activities in routine maintenance work within the East Java Province Public Works Department of Highways is Reactive Routine Maintenance [10]. Handling road maintenance which is carried out reactively aims to repair any damage that has occurred to the road pavement beyond the ability of observation and to return it to a condition by the plan [11].

Under ideal budget conditions, road patchwork is generally carried out using Hotmix material, hot mix (Hotmix) is a mixture of aggregate and asphalt that is mixed hot in the AMP (Asphalt Mixing Plant) continuously up to the heating temperature limits. For asphalt, the temperature is between 140ºC and 160ºC, while the heating temperature for the aggregate must be between 135°C and 170°C [12]. And so far, road maintenance, surface patching and road reconstruction have always relied on the use of Hotmix [13]. Because it is assumed that Hotmix has advantages, namely better strength and service life and visually looks neater [14]. However, Hotmix also has disadvantages, including a more complex production process that requires high-temperature heating and must be carried out under the required hot temperature conditions, which makes it dependent on time and weather to maintain the required temperature. And based on observations from the work that has been carried out, road maintenance using Hotmix materials is expensive [13,15].

## RESEARCH SIGNIFICANCE

This research aims to find out the comparison of the duration of time for carrying out road maintenance work using Hotmix compared to Fast Burda, the comparison of the service life of the results of road maintenance work with an observation time of 10 months, the costs incurred for road maintenance. The benefit of this research can be to ensure road maintenance performance using Hotmix and using Fast Burda.

## METHODOLOGY

In the discussion of this research methodology, each step will be described in detail, it is hoped that this can be an innovation in the use of Fast Burda for maintenance purposes on roads in East Java Province. The explanation of the research method is as follows: literature study, survey, and research data collection which includes primary data and secondary data, determining the research location, preparing materials and tools, making test objects, laying out test objects, data analysis which includes evaluation of the duration of time, evaluation of the patching service period, evaluation of road maintenance costs, and concluding also suggestions.

### A. RESEARCH LOCATION

This research took place on the Bojonegoro (Pajeng) – Guyangan (Nganjuk) District Border Road (Link 172) Km. Bjn. 53+250 – 53+500. The work carried out using hot mix and fast burda was on the same road section as the adjacent research point so that both locations had road criteria, traffic conditions, land use, causes of damage, and the extent of damage that were close to the same.

The following figure is a map of the location of the road section for carrying out road patching work using Hotmix and fast burda.

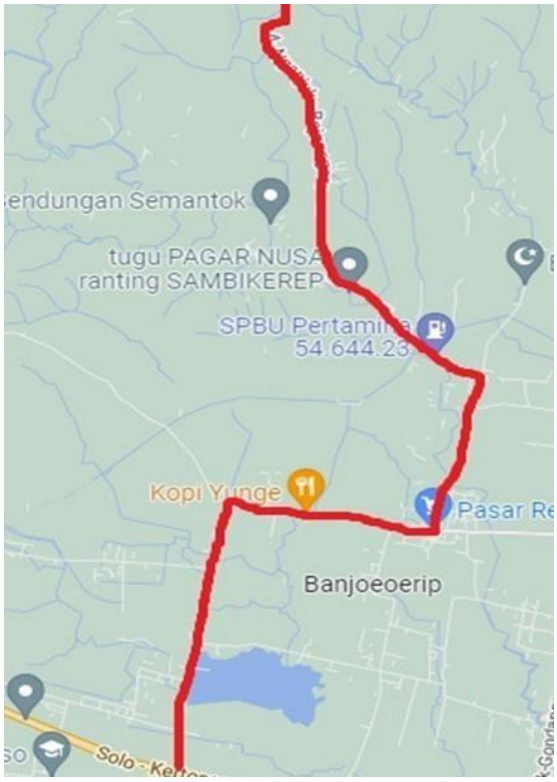


Figure 1 Bojonegoro (Pajeng) – Guyangan (Nganjuk) Regency Road Section (Link 172) the location of the road patching work
(Source: Google Maps, 2023)

B. RESEARCH PREPARATION

The preparation stage is the planning stage before carrying out research. The first preparation stage for this research is collecting materials for carrying out the research.

- ✓ Data Type
  a. Primary data

     Primary data is data obtained through direct field surveys. Primary data was obtained by conducting a field survey to determine the locations that would be used as research samples. Field surveys are carried out by determining the location of roads with damage and the same extent of damage according to road stability criteria.

     In a series of road management processes, in the first stage a road condition survey is carried out. The method used in surveying road conditions is the PKRMS (Provincial Road Management System) method. Road condition data describes the physical condition of the road related to damage conditions that can affect traffic comfort and safety. Road condition data is identified on road pavement elements. To fulfill the objectives of a road condition survey, the list of data that needs to be recorded during a road condition survey is as follows, namely: location of road segments, condition of road asphalt damage, and survey of road asphalt damage.
  b. Secondary Data
     Secondary data was obtained from the East Java Province Public Works Department of Highways, namely Basic Unit Prices and daily traffic. This data is needed for calculating costs and service periods for Burda fast and Hotmix.
- ✓ Determination of samples
  The determination of research location samples is based on road stability criteria regarding road conditions

C. RESEARCH SURVEY

Research surveys are obtained through direct field surveys at predetermined locations. The survey before the research consisted of existing road conditions that had not been treated with routine road maintenance either with Hotmix or fast Burda. The method used for the survey is by the Road Maintenance procedures of the Directorate General of Highways. These stages are as follows:

- ✓ Road management system survey
- ✓ Validation of survey data
- ✓ Determining treatment criteria
- ✓ Validation of treatment criteria data with existing conditions

D. DATA ANALYSIS

- ✓ Evaluate the Length of Implementation Time
  Data analysis is carried out by determining work locations based on damage conditions that are the same or close to them in several locations. Then calculate the area of work required for routine road maintenance. Next, road maintenance work was carried out using Hotmix and fast Burda, where the duration of each work was recorded.
- ✓ Evaluation of Road Maintenance Service Period
  The analysis was carried out by recording the condition of road patches which were carried out using hot mix and patches which used fast burda.

  Over a certain period, regular observations of the condition of the patch are carried out, namely the possibility of patch damage occurring. In this way, analysis data on the service life of road maintenance is obtained.
- ✓ Evaluation of Road Maintenance Costs
  After the work is carried out, data on the volume of fieldwork is obtained which is then processed with Basic Unit Prices (HSD) and analysis for Hotmix work, while for Fast Burda work, a composition error trial is carried out to determine the analysis. The needs analysis that has been obtained is processed with Basic Unit Prices to determine the amount of repair costs using Burda quickly.

E. OBJECTIVE ANALYSIS

This stage analyzes the differences in implementation between the use of Hotmix and Fast Burda, including the following:

a) Time Requirements
   How long does it take to spread Hotmix compared to Fast Burda spread.
b) Service period
   Evaluate the comparison of how long the service life is between maintenance work using Hotmix and Fast Burda.
c) Financing
   Comparing cost requirements for jobs using Hotmix and Burda is quick.

## RESULTS AND DISCUSSIONS

In this chapter, a description of the analysis stages carried out in the research will be explained. These stages are to complete the objectives to be achieved in the research, namely knowing the differences in the implementation of road maintenance work, service life, and differences in road maintenance costs using Hotmix compared to Burda Rapid.

A. IMPLEMENTATION ANALYSIS

In carrying out its duties, the Public Works Department of Highways refers to the work guidelines, namely the 2018 General Specification for Highways, revision 2. In this specification, it is stated that the asphalt material used for Burda must be of the Pen.60/70 hard asphalt type which meets the provisions of ASTM D946 /946M-15 or polymer-modified emulsion asphalt according to the provisions. Asphalt materials that have been heated at the spraying temperature for more than 10 hours at the spraying temperature or have been heated beyond 200°C. The materials used in this research were crushed stone measuring 2x3, 1x2, and 1x1 and asphalt penetration 60/70. The choice of material measuring 3 cm, which in the field is usually referred to as 2x3 crushed stone, was because there was a lot of damage in the form of holes in the road pavement in this section with a depth of around 5 cm. So the right material is material with a maximum grain size of

3 cm. Meanwhile, the 1x2 and 1x1 crushed stone functions as a filler for the space between the 2x3 crushed stone, as well as a lock or interlock. Taking different sizes of crushed stone material from Burda, this composition is called Fast Burda. Next, testing will be carried out on the material.

✓ Damaged Conditions of Asphalt Roads

The condition of road pavement damage is the main input data for road pavement components. In the PKRMS system, there are 10 (ten) main types of pavement damage on asphalt roads and shoulders, namely as follows:

a. Unevenness/Roughness or IRI (m/km)
b. Obesity/Bleeding (m2)
c. Loose aggregate/Ravelling (m2)
d. Disintegration/Disintegration (m2)
e. Crack with depression (m2)
f. Patches/Patching (m2)
g. Other cracks (m2)
h. Holes/Potholes (m2)
i. Groove/Rutting (m2)
j. Edge damage (m2)

The road damage above was observed visually except for the type of road damage code a, namely road unevenness known as the International Roughness Index (IRI). IRI is measured automatically using a Roughometer-supporting device. In PKRMS, IRI data is not required to be measured because the PKRMS system can still carry out data analysis with and without IRI data.

✓ Asphalt Road Damage Survey

From a survey of road conditions that had been carried out on the road sections that had been designated as research objects, it was concluded that the road damage was in the form of asphalt with holes, which started with crocodile cracks on the road pavement and continued to raveling which ultimately resulted in the road becoming potholes.

From this data, it was determined that the treatment was to patch the hole by patching the road hole first to form a square.

✓ Rapid Burda Aggregate Testing

Material testing will be compared with the 2018 Bina Marga specifications revision 2 because it is hoped that this research can be utilized by the Bina Marga Service which has authority over road maintenance and construction.

The rough material in this study was obtained from PT. Trijaya Adymix Mojokerto. Tests are carried out to determine the characteristics of the material used, and whether the material meets the requirements set out in the specifications or not. The test results will be compared with the 2018 Bina Marga specifications revision 2 so that they can be used to make fast burda test objects and continue with extraction testing. The results of testing the characteristics of the aggregate material can be seen in Table 1.

The coarse aggregate test results produced in Table 1 show that the coarse aggregate material has met the specified specification requirements so that the materials mentioned above can be used as materials for road pavement.

✓ Rapid Burda Asphalt Testing

Penetration burnt asphalt material 60/70 produced by PT. Pertamina was obtained from PT. Trijaya Adymix. The characteristics of 60/70 penetration burnt asphalt will be checked according to the general requirements of the 2018 Bina Marga Specifications revision 2.

Table 1 Fast Burda Characteristic Results

| Testing | Requirements | Results |
|---|---|---|
| Bulk Specific Gravity, gr/cm³ | - | 2,452 |
| Water Absorption, % | maks.3 | 1,137 |
| Abrasion with Los Angeles Machines, % | maks. 40 | 20,87 |
| Aggregate adhesiveness to bitumen, % | min. 95 | 97 |

The test results for the characteristics of 60/70 penetration burnt asphalt can be seen in Table 2.

Table 2 Test Results for Asphalt Penetration Characteristics 60/70

| Testing | Requirements | Results |
|---|---|---|
| Penetration at 25℃ (0.1mm) | -60-70 | 67 |
| Kinematic Viscosity 135℃ (cSt) | ≥ 300 | 354 |
| Softening Point (℃) | ≥ 48 | 52 |
| Ductility at 25℃ (cm) | ≥ 100 | 147 |
| Flash Point (℃) | ≥ 232 | 35 |
| Specific gravity | ≥ 1,0 | 1,043 |

Based on Table 2, it can be seen that the characteristic values of 60/70 penetrating asphalt refer to the 2018 General Bina Marga Specifications. From this table, it can be seen that the 60/70 penetrating asphalt used meets the requirements so that it can be used for road pavement work.

✓ Fast Burda Aggregate Proportion Planning

After preparing the materials and testing the materials to be used, the asphalt mixture is continued with optimization. In this research, the mixture was made in mixed gradations. In this study, mixture gradation was used which aims to determine the proportion of aggregate that will be used as an asphalt mixture. The aggregate proportion contains the content of several types of aggregate in 1 (one) sample of 1 m2.

Determination of aggregate proportions is done by blending. Blending is a trial and error effort by varying the percentage of aggregate to meet the specification gradation criteria [3].

In this trial and error effort, the aggregate proportions obtained are as follows in Table 3/

Table 3 Percentage Aggregate

| Ingredients | Proportion |
|---|---|
| Aggregate 2 x 3 | 50% |
| Aggregate 1 x 2 | 33% |
| Aggregate 1 x 1 | 17% |

Taking a proportion where 2x3 aggregate is the most dominant is expected to increase the carrying capacity of the road because the load received is dominated by trucks. Then from the proportion data above, calculate the volume of each ingredient contained in 1 m2 of fast Burda. The aggregate volume is in Table 4.

Table 4 Volume Aggregate

| Ingredients | Thick (cm) | Volume ($m^3$) |
|---|---|---|
| Aggregate 2 x 3 | 3 | 0,03 |
| Aggregate 1 x 2 | 2 | 0,02 |
| Aggregate 1 x 1 | 1 | 0,01 |

✓ Determination of Asphalt Composition of Fast Burda Mixtures

From the calculation results, an estimated ideal asphalt content value of 4.5% of the total aggregate weight was obtained. Furthermore, to find the optimum asphalt content, generally, the ideal asphalt content is made into test objects with 5 variations of asphalt content, each of which differs by 0.5%. By using the calculations above, you can get the estimated asphalt content and overall aggregate requirements.

✓ Equipment Used

The tools used in this research include equipment used for fast Burda-making activities and fast Burda-spreading activities. Equipment used includes:

a. Manual sprayer
b. Truck (shaft loader)
c. Pick Up
d. Compactor
e. Jackhammers
f. Asphalt cutter
g. Other tools

B. PRODUCTION AND DISTRIBUTION PROCESS OF BURDA FAST AND HOTMIX

✓ Fast Burda production stage

This fast burda is produced in two types of thickness, namely 6 cm and 3 cm. A thickness of 6 cm is used to fill holes in road pavement where the holes are approximately 6 cm deep. Meanwhile, 3 cm thick is used to fill holes in the pavement with a depth of approximately 3 cm.

Apart from the thickness type, fast burda is also produced in two types of variants. The first variant, fast burda production, has an area determined which is adjusted to the area of damage to the road pavement. This applies to handling road damage where the production and laying time does not exceed 3 days. Assuming that for 3 days there will be no additional damage to the existing road. The second variant, fast burda is produced with an unspecified area, which will later be cut according to road damage conditions. This is applied to treatments where the production and spreading time is more than 3 days. Because beyond that time, road damage is expected to become more extensive. The production stage is carried out in an open space equipped with a flat roof and floor made of rebated concrete. This floor functions as a work floor for research materials.

The following is the fast burda production process where the area of damage to the road pavement has not been determined so that it can be produced without area measuring standards.

1. First Stage

At this stage, the rebated concrete floor with a roof covering functions as the working floor, which is then sprinkled with 3 cm thick sand, functioning as a separator between the aggregate and the working floor to facilitate Fast Burda removal. Followed by spreading 2x3 aggregate on top of sand evenly on the surface and rubbing it with hot asphalt at a temperature of approximately 300 degrees Celsius.

2. Second Stage

Spread the 2x1 aggregate evenly over the 2x3 aggregate that has been smeared with hot asphalt.

3. Third Stage

On top of the 2x1 aggregate which has been spread evenly, it is rubbed flat with burnt asphalt at a temperature of approximately 300 degrees Celsius.

4. Fourth Stage

Spread the 1x1 aggregate evenly over the 2x1 aggregate that has been smeared with hot asphalt.

5. Fifth Stage

Cutting burda quickly is based on the area of damage to the road body using an asphalt cutter tool.

6. Sixth Stage

The next stage is the quick delivery of burda materials using a dump truck to the location of the road damage to be handled. The capacity for fast burda delivery using a dump truck is 55 square meters.

The second variation of fast burda is the production of fast burda with dimensions that have been determined or adjusted to the dimensions of the hole damage in the road pavement. The following are the production stages of fast burda with a thickness of 3 cm.

1. First Stage

The first step is to make formwork to adjust the dimensions to suit the damage to the road pavement. Next, 3 cm thick sand is spread inside the formwork above the work floor to separate the aggregate from the work floor.

2. Second Stage

In the second step, spread 1x2 aggregate on top of the sand until it is even. Then spread hot asphalt over the 1x2 aggregate until it is even.

3. Third Stage

In the third step, spread the 1x1 aggregate on top of the 1x2 aggregate which has been polished with hot asphalt. The production stage of fast burda 3 cm thick with dimensions that have been adjusted to the dimensions of damage to the road pavement has been completed.

The following are the production stages of fast burda with a thickness of 6 cm.

1. First Stage

Make formwork to adjust the dimensions according to the damage to the road pavement. Next, 3 cm thick sand is spread inside the formwork above the work floor to separate the aggregate from the work floor. Then spread 2x3 aggregate on top of the sand until it is even and rub it with hot asphalt until it is even.

2. Second Stage

Spread 2x1 aggregate on top of 2x3 aggregate that has been polished with hot asphalt.

3. Third Stage

Spread 1x1 aggregate on top of 2x1 aggregate that has been polished with hot asphalt. The production stage of fast burda 6 cm thick with dimensions that have been adjusted to the dimensions of damage to the road pavement has been completed.

✓ Hotmix production stage

Procurement of Hotmix materials is done by purchasing at the Asphalt Mixing Plant (AMP) and is paid for until it is delivered to the work location. The cost required for each tonnage is IDR 1,700,000 and when converted to square meters with a thickness of 5 cm it is IDR 206,531 per square meter.

The use of Hotmix in road maintenance work is obtained through the procurement or purchase of finished materials from the Asphalt Mixing Plant (AMP). Therefore, this research does not describe in detail the analysis of Hotmix production costs. Hotmix procurement costs include delivery costs to the work location.

## C. TIME DURATION ANALYSISOF FAST BURDA AND HOTMIX JOBS

Based on the evaluation results of the length of implementation time, the total duration of work implementation using fast burda and Hotmix is:

- ✓ Work using hot mix does not require any time at all at the production stage, because the material is produced in AMP. Meanwhile, for fast burda, the production stage takes 25 minutes for each m2.
- ✓ At the spreading stage, it can be seen that the work duration between hole-filling jobs using fast burda is the same as using hot mix for 20 minutes. The process of carrying out hole patching work during the overlay stage at several road maintenance points can run simultaneously for each work process. Daily capacity analysis for hole patching work using hot mix was obtained from the Maintenance Work Specifications of the East Java Province Public Works Department of Highways. Meanwhile, daily capacity analysis for hole-filling work using burda was quickly obtained from a trial and error process carried out in the field.

## D. PRODUCTION AND DISTRIBUTION PROCESS OF BURDA FAST AND HOTMIX

The analysis was carried out by recording the condition of road patches which were carried out using hot mix and patches which used fast burda. Over a certain period, regular observations of the condition of the patch are carried out, namely the possibility of patch damage occurring. In this way, analysis data on the service life of road maintenance is obtained.

Please note that road patching work is a maintenance activity, where road patching does not improve the condition of the road's stability. So that way, maintenance work does not have a service life. For this research, visual observations were carried out to compare the results of work using Hotmix and using burda modifications which were observed over a certain period as follows:

a. First Moon Observation

In the fast burda patches from the two research locations, the condition of the patches was still in good condition, namely there was no loose aggregate and the surface of the patches still looked flat.

In patches using hot mix, the condition of the patches is also in good condition, there is no loose aggregate and no deformation.

b. Second Moon Observation

On work using fast burda, the patch is still in good condition, there is no change in visual appearance and no loose aggregate.

Meanwhile, in work using hot mix, the patch condition is also in good condition, there is no loose aggregate.

c. Third Moon Observation

In fast burda fillings, the condition of the fillings is still in good condition, without cracks, deformation, or loose aggregate. Meanwhile, for patches using Hotmix, the condition of the patches still looks good without any changes to the patches.

d. Fourth Moon Observation

In the fast burda patch, the condition of the patch is still good, there is no loose aggregate, no cracks, and no deformation. Meanwhile, for patches using hot mix, the condition of the patches is still good, with no loose aggregates, cracks, or deformation.

e. Fifth Lunar Observation

In fast burda patches, it began to be found that a small portion of aggregate was released from the patch, namely 2% of the total area of the patch. Meanwhile, in patches using Hotmix, the condition of the patches is still in good condition, there is no loose aggregate.

f. Sixth Moon Observation

In the fast burda patch, the amount of aggregate released from the patch increased, namely 4% of the total area of the patch, but the patch was still in good condition, not experiencing deformation. Meanwhile, in patches using hot mix, the condition of the patch starts to have loose aggregate, which is 1.5% of the total area of the patch.

g. Seventh Moon Observations

In fast burda patches, the amount of aggregate released from the patches increases, namely 6% of the total patch area. Meanwhile, in patches using hot mix, the amount of aggregate released also increases, namely 3% of the total area of the patch.

h. Eighth Month Observations

In the fast burda patch, the amount of aggregate released from the patch increases and widens, namely 8% of the total area of the patch. Meanwhile, in patches using hot mix, the amount of aggregate released also increases and widens, namely 5% of the total area of the patch.

i. Ninth Moon Observation

In the fast burda patch, the amount of aggregate released from the patch increases and widens, namely 15% of the total area of the patch. Then in patches using hot mix, the amount of aggregate released also increases and widens, namely 10% of the total area of the patch.

j. Tenth Moon Observation

In the fast burda patch, the amount of aggregate released from the patch increases and widens, namely 20% of the total area of the patch. Then in patches using hot mix, the amount of aggregate released also increases and widens, namely 15% of the total area of the patch.

The following is a summary of the analysis of patch conditions over a period of 10 months using visual observations. Available in Table 5.

After a 10-month observation process to analyze the service life of patches using fast burda and using Hotmix, it can be concluded that the service life of patches using Hotmix is better than using fast burda. The difference in service life using fast burda and Hotmix is 1 month, namely at the 5th month the patch with fast burda starts to

experience raveling (some of the aggregates comes off from the patch) although in an insignificant amount, whereas, at the end of the 6th month, the patch using Hotmix starts experienced raveling (part of the aggregate separated from the patch). At the end of the 10th month of observation, 20% of the damage was found in the form of raveling on fast burda, while 15% of damage was found on hot mix.

Table 5 Summary of Patch Condition Observations

| The month | Fast Burda | Hotmix |
|---|---|---|
| 1 | Good condition | Good condition |
| 2 | Good condition | Good condition |
| 3 | Good condition | Good condition |
| 4 | Good condition | Good condition |
| 5 | Remove Aggregate 2% | Good condition |
| 6 | Remove Aggregate 4% | Remove Aggregate 1,5% |
| 7 | Remove Aggregate 6% | Remove Aggregate 3% |
| 8 | Remove Aggregate 8% | Remove Aggregate 5% |
| 9 | Remove Aggregate 15% | Remove Aggregate 10% |
| 10 | Remove Aggregate 20% | Remove Aggregate 20% |

E. EVALUATE ROAD MAINTENANCE COSTS

After the work is carried out, fieldwork volume data is obtained which is then processed with Basic Unit Prices and analysis for Hotmix work, while for Fast Burda work a composition error trial is carried out to determine the analysis. The needs analysis that has been obtained is processed with Basic Unit Prices to determine the amount of repair costs using Burda quickly.

✓ Fast Burda Budget Plan

Costs are calculated by referring to the need for materials, wages, and tools used in the field. In road maintenance work, namely, road patching using fast burda, costs are incurred per square meter. The total cost for materials and wages for fast burda production per square meter is IDR177.001 and the total cost of materials per cubic meter is IDR2.950.017, and the total cost for the fast burda overlay process per square meter is IDR126.354 and the total cost of the overlay process per cubic meter is IDR2.105.902.

✓ Hotmix Cost Budget Plan

Costs are calculated using the applicable analysis in the General Guidelines for Self-Managed Work of the East Java Public Works Department of Highways concerning the Provincial Basic Unit Prices. In road maintenance work, namely, road patching using hot mix, costs are incurred per square meter. The total cost for Hotmix materials per square meter is IDR206.531 and the total material cost per cubic meter is IDR4.130.622, and the total cost for the Hotmix overlay process per square meter is IDR122.314 and the total cost of the overlay process per cubic meter is IDR2.246.296.

In the analysis of the Budget Plan above, it can be compares between the costs of carrying out road patching work using fast burda and using hot mix per square meter Table 6 as follows:

Table 5 Summary of Patch Condition Observations

| Work implementation | Hotmix | Fast Burda | Difference |
|---|---|---|---|
| Materials + Production | IDR 206.531 | IDR 177.001 | IDR 29.530 |
| Degree wages | IDR 112.314 | IDR 126.354 | IDR 126.354 |
| Total | IDR 318.845 | IDR 303.355 | IDR 303.355 |

The budget plan for materials, wages and tools for patching work using a fast burda is IDR318.845 per square meter, while the budget plan for patching work using Hotmix is IDR303.355 per square meter. The results of the analysis above include an analysis of the duration of work implementation, an analysis of service life, and an analysis of the costs required for work using fast burda or using hot mix.

## CONCLUSIONS

This study aimed to assess the use of fast burda as an alternative to Hotmix for asphalt road maintenance in East Java, focusing on cost, work duration, and service life. Given budget constraints due to natural disasters, fast burda—composed of various-sized aggregates mixed with 60/70 penetration asphalt—was tested as a more cost-effective solution. The research compared road patching using fast burda and Hotmix on a section of the Bojonegoro (Pajeng) – Guyangan (Nganjuk) District Border Road. Data was collected through field surveys and secondary sources from the East Java Public Works Department. The study evaluated the time, durability, and costs associated with each method to determine the potential benefits of fast burda for road maintenance under constrained budgets.Based on research that has been carried out, Fast Burda can be used for road maintenance work to replace Hotmix in conditions where the road maintenance budget is not ideal.

The duration of laying for hole filling work using hot mix is faster when compared to using fast burda. From the recording results, it was concluded that Hotmix was 1 minute faster than fast burda in an area of 1 square meter. The service life of work patches using Hotmix is better when compared to fast burda. From the results of the observations, it was concluded that the fast burda work began to experience damage (raveling) in the 5th month at 2%, while the hot mix began to experience damage (raveling) in the 6th month at 1.5%. At the end of the observation, namely in the 10th month, it was found that the damage to the fast burda reached 20%, while in the Hotmix work the damage in the 10th month reached 15%. The costs required for patching work using the fast burda were more economical when compared with Hotmix, namely a difference of IDR50.378 per square meter.

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