ABSTRACT

ANALYSIS OF MARSHALL PARAMETERS OF WEARING COURSE PAVEMENT MIXTURE USING CRUMB RUBBER AS BINDER

By

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This study aims to analyze the effect of using crumb rubber as the primary binder combined with waste cooking oil on the Marshall characteristics of wearing course pavement mixtures, including stability, flow, Void in Mix (VIM), and Marshall Quotient (MQ).

The research methodology was conducted experimentally in the laboratory using binder content variations of 9%, 9,5%, 10%, 10,5%, and 11%. For each variation, three specimens were prepared, resulting in a total of 15 samples. The binder consisted of a combination of 2/3 crumb rubber and 1/3 waste cooking oil, and all specimens were tested using the Marshall method.

The test results show that the use of crumb rubber as a binder in wearing course pavement mixtures is able to increase stability, reaching 924 kg at 10% content. The flow value is within the ideal range of 3,5 mm at 10% content. The Marshall Quotient (MQ) reaches a maximum value of 267 kg/mm at 10%, indicating the most optimal balance between stability and flow. Meanwhile, the Void in Mix (VIM) values for all variations do not meet the required specifications, with the lowest value of 16,98% obtained at 10,5% content.

Based on these results, the use of crumb rubber combined with waste cooking oil affects the Marshall characteristics of wearing course pavement mixtures, including stability, flow, VIM, and MQ. The 10% content shows the most optimal condition, characterized by high stability and flow within the ideal range, reflecting a balance between strength and deformation. Therefore, the 10% content is determined as the optimum content in this study.

Keywords: crumb rubber, waste cooking oil, wearing course, Marshall parameters, optimum content.

ABSTRAK

ANALISIS PARAMETER *MARSHALL* CAMPURAN PERKERASAN JALAN TIPE *WEARING COURSE* DENGAN BAHAN PENGIKAT *CRUMB RUBBER*

Oleh

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Penelitian ini bertujuan untuk menganalisis pengaruh penggunaan *crumb rubber* sebagai bahan pengikat utama yang dikombinasikan dengan minyak jelantah terhadap karakteristik *Marshall* pada campuran perkerasan jalan tipe *wearing course*, yang meliputi stabilitas, *flow*, *Void in Mix* (VIM), dan *Marshall Quotient* (MQ).

Metodologi penelitian dilakukan secara eksperimental di laboratorium dengan variasi kadar 9%, 9,5%, 10%, 10,5%, dan 11%, Pada setiap variasi kadar dibuat tiga benda uji, sehingga total sampel yang digunakan dalam penelitian ini berjumlah 15. Bahan pengikat berupa kombinasi 2/3 *crumb rubber* dan 1/3 minyak jelantah, kemudian seluruh benda uji diuji menggunakan metode *Marshall*.

Hasil pengujian menunjukkan bahwa penggunaan *crumb rubber* sebagai bahan pengikat pada campuran perkerasan tipe *wearing course* mampu meningkatkan nilai stabilitas hingga mencapai 924 kg pada kadar 10%. Nilai *flow* berada pada rentang ideal sebesar 3,5 mm pada kadar 10%. Nilai *Marshall Quotient* (MQ) mencapai maksimum sebesar 267 kg/mm pada kadar 10%, yang menunjukkan keseimbangan paling optimal antara stabilitas dan *flow*. Sementara itu, nilai *Void in Mix* (VIM) pada seluruh variasi kadar tidak memenuhi spesifikasi, dengan nilai terendah sebesar 16,98% yang diperoleh pada kadar 10,5%.

Berdasarkan hasil tersebut, penggunaan *crumb rubber* yang dikombinasikan dengan minyak jelantah berpengaruh terhadap karakteristik *Marshall* pada campuran perkerasan tipe *wearing course*, meliputi stabilitas, *flow*, VIM, dan MQ. Kadar 10% menunjukkan kondisi paling optimal, ditandai oleh stabilitas tinggi dan *flow* dalam rentang ideal yang mencerminkan keseimbangan antara kekuatan dan deformasi. Oleh karena itu, kadar 10% ditetapkan sebagai kadar optimum dalam penelitian ini.

Kata kunci: *crumb rubber*, minyak jelantah, *wearing course*, parameter *Marshall*, kadar optimum.