

Tingginya insiden kecelakaan lalu lintas di Indonesia, yang secara signifikan diakibatkan oleh rendahnya nilai *skid resistance* permukaan jalan, khususnya pada kondisi suhu tinggi yang lazim di iklim tropis. Inovasi *nano crumb rubber* diharapkan dapat meningkatkan elastisitas, ketahanan terhadap deformasi, dan stabilitas termal aspal, sehingga mampu mempertahankan performa skid resistance pada suhu ekstrem. Tujuan penelitian ini menganalisis pengaruh bahan tambah *nano crumb rubber* (NCR) dalam campuran AC-WC terhadap nilai *skid resistance*, karakteristik Marshall.

Metode yang digunakan eksperimen laboratorium. Pada *skid resistance* digunakan alat *British Pendulum Tester* (BPT) dengan sampel sebanyak 196 benda uji yang digunakan dalam penentuan Kadar Aspal Optimum (KAO), Pengujian karakteristik Marshall dan *skid resistance*. Kadar *nano crumb rubber* yang digunakan 0,5%, 0,75% dan 1% dengan proses pencampuran kering dari total berat campuran dan metode basah dari total berat aspal. Suhu yang digunakan pada pengujian Skid Resistance yaitu 30°C, 40°C, dan 50°C.

Hasil pengujian stabilitas Marshall diperoleh nilai tertinggi benda uji kontrol, metode kering dan basah sebesar 1427 kg, 1440 kg, 1817 kg (0%, 0,5%, 1% nano crumb rubber), Hasil pengujian Skid Resistance, nilai BPN tertinggi pada suhu 30°C, pada benda uji kontrol (0% NCR), metode kering (1% NCR) dan metode basah (1% NCR) diperoleh berturut-turut sebesar 75,6; 90,2; dan 96,0. Nilai BPN tertinggi pada suhu 40°C, pada benda uji kontrol (0% NCR), metode kering (1% NCR) dan metode basah (1% NCR) diperoleh berturut-turut sebesar 71,8; 83,3; dan 94,7. Nilai BPN tertinggi pada suhu 50°C, pada benda uji kontrol (0% NCR), metode kering (1% NCR) dan metode basah (1% NCR) diperoleh berturut-turut sebesar 70,4; 81,6; dan 91,1. Nilai *skid resistance* mengalami peningkatan dengan penambahan NCR pada suhu 30°C, 40°C, dan 50°C masing-masing sebesar yaitu 20%, 16%, dan 17% pada metode kering dan 27%, 33%, dan 30% pada metode basah terhadap benda uji kontrol. Berdasarkan hasil pengujian *skid resistance* proses pencampuran metode basah memiliki nilai BPN lebih tinggi dibandingkan proses pencampuran metode kering.

Kata Kunci: *Nano Crumb Rubber*, Metode kering dan basah, *Skid Resistance*, Suhu Permukaan Perkerasan, AC-WC

ABSTRACT

The high incidence of traffic accidents in Indonesia is significantly caused by the low skid resistance of road surfaces, especially in high temperatures that are common in tropical climates. Nano crumb rubber innovation is expected to enhance the elasticity, resistance to deformation, and thermal stability of asphalt, thereby maintaining skid resistance performance under extreme temperatures. The objective of this study is to analyze the influence of nano crumb rubber (NCR) additives in AC-WC mixtures on skid resistance values and Marshall characteristics.

The method used was a laboratory experiment. For skid resistance testing, the British Pendulum Tester (BPT) was used with 196 test specimens employed in determining the Optimum Asphalt Content (OAC), Marshall characteristics testing, and skid resistance. The nano crumb rubber content used was 0.5%, 0.75%, and 1%, with dry mixing of the total mixture weight and wet mixing of the total asphalt weight. The temperatures used in the skid resistance testing were 30°C, 40°C, and 50°C.

The Marshall stability test results showed the highest values for the control test specimens, dry method, and wet method at 1427 kg, 1440 kg, and 1817 kg (0%, 0.5%, and 1% nano crumb rubber), respectively. The results of the Skid Resistance test showed the highest BPN values at 30°C for the control specimen (0% NCR), dry method (1% NCR), and wet method (1% NCR), respectively, at 75.6, 90.2, and 96.0. The highest BPN values at 40°C, on the control test specimen (0% NCR), dry method (1% NCR), and wet method (1% NCR) were obtained successively as 71.8; 83.3; and 94.7. The highest BPN values at 50°C for the control sample (0% NCR), dry method (1% NCR), and wet method (1% NCR) were obtained successively as 70.4; 81.6; and 91.1. Skid resistance values increased with the addition of NCR at temperatures of 30°C, 40°C, and 50°C, respectively, by 20%, 16%, and 17% in the dry method and 27%, 33%, and 30% in the wet method compared to the control test specimen. Based on the skid resistance test results, the wet mixing process has a higher BPN value compared to the dry mixing process.

Keywords: Nano Crumb Rubber, Dry and wet methods, Skid Resistance, Pavement Surface Temperature, AC-WC