INTISARI

Marka jalan berperan penting bagi keselamatan dan keteraturan lalu lintas. Pada rehabilitasi *overlay* HMA dengan cat marka *water-based*, residu marka lama sering tersisa sebagai lapisan *non-bitumen* pada antarmuka. Residu ini menurunkan *Interlayer Shear Strength* (ISS) dan berpotensi memicu slippage, shoving, serta delaminasi. Tantangan meningkat pada suhu tinggi dan beban berat. Stabilitas antarlapisan terhadap gaya geser ditinjau melalui *Stress to Shear Ratio* (SSR), yaitu perbandingan tegangan geser aktual dengan kuat geser antarmuka.

Interface menghubungkan AC-WC eksisting dengan AC-WC *overlay* menggunakan aspal PG 60/70 berkadar optimum 5,28% serta agregat andesit sesuai spesifikasi AC-WC. Variabel penelitian meliputi ketebalan residu 0, 1, 2, dan 3 mm; suhu 25, 40, dan 60 °C; serta beban normal 1, 2, dan 3 kN. Pengujian mencakup geser langsung (*Leutner*) dan geser dengan beban normal memakai alat pegas. Prosedur meliputi pembuatan HMA bawah, pengaplikasian cat marka dan *tack coat*, pembuatan *overlay*, serta pengujian geser. Nilai kuat geser digunakan dalam analisis SSR untuk menilai keamanan antarmuka pada beban lalu lintas model MST 8 Ton, 10 Ton, dan Truk 1.2H.

Pada suhu 25 °C, kuat geser tertinggi terjadi pada residu 0 mm (1,098 MPa dengan *displacement* 1,780 mm), turun pada 1–3 mm (0,780–0,594 MPa) dengan *displacement* hingga 3,407 mm. Kenaikan suhu menurunkan kuat geser di semua ketebalan (0 mm: 1,098 menjadi 0,614 hingga 0,168 MPa). Penambahan beban normal meningkatkan kuat geser, namun memperbesar *displacement* (0 mm; 25 °C: 1,098 menjadi 1,345 MPa; 1,780 menjadi 4,550 mm). *Failure envelope* residu 3 mm selalu di bawah 0 mm. Analisis BISAR menunjukkan skenario *full slip* lebih kritis dibanding *full bonding*. SSR pada 60 °C mencapai ≥ 1 sehingga overlay gagal, sedangkan MST 8 Ton aman (SSR < 1). Residu marka, suhu tinggi, dan beban normal bersama meningkatkan risiko *slippage failure*.

Kata kunci: BISAR 3.0, cat marka *water-based*, *interlayer shear strength*, *overlay*, *stress-to-strength ratio*

ABSTRACT

Road markings play an important role in ensuring traffic safety and order. During HMA overlay rehabilitation using water-based paint, residual markings often remain as non-bituminous layers at the interface. These residues reduce the Interlayer Shear Strength (ISS) and may trigger slippage, shoving, and delamination. Challenges become more significant at higher temperatures and under heavy loads. The interlayer stability against shear stress is evaluated through the Stress to Shear Ratio (SSR), defined as the ratio between actual shear stress and interlayer shear strength.

The interface connects the existing AC-WC with the AC-WC overlay using PG 60/70 asphalt with an optimum binder content of 5.28% and andesite aggregate mix in accordance with AC-WC specifications. The research variables include residue thicknesses of 0, 1, 2, and 3 mm; temperatures of 25, 40, and 60 °C; and normal loads of 1, 2, and 3 kN. The tests consist of direct shear (Leutner) and shear under normal load using a spring-based device. The procedure includes preparing the lower HMA layer, applying paint marking and tack coat, constructing the overlay, and performing shear tests. The obtained shear strength values are used in SSR analysis to evaluate interface safety under traffic load models of Maximum Axle Load (MST) 8 Ton, 10 Ton, and Truck 1.2H.

At 25 °C, the highest shear strength occurred at 0 mm residue (1.098 MPa with 1.780 mm displacement), decreasing at 1–3 mm (0.780–0.594 MPa) with displacement up to 3.407 mm. Increasing temperature reduced shear strength across all thicknesses (0 mm: 1.098 to 0.614 to 0.168 MPa). Increasing normal load raised shear strength but also increased displacement (0 mm; 25 °C: 1.098 to 1.345 MPa; 1.780 to 4.550 mm). The failure envelope of 3 mm residue consistently lay below that of 0 mm. BISAR analysis showed that full slip scenarios were more critical than full bonding. SSR at 60 °C reached ≥ 1, indicating overlay failure, while MST 8 Ton remained safe (SSR < 1). Marking residue, high temperature, and normal load collectively increase the risk of slippage failure.

Keywords: *BISAR 3.0, water-based traffic paint, interlayer shear strength, overlay, stress-to-strength ratio*