

Peningkatan suhu di perkotaan akibat *Urban Heat Island* (UHI) menjadi masalah serius yang disebabkan oleh karakteristik permukaan perkotaan yang menyerap dan menahan panas. Untuk mengatasi hal ini, penelitian ini bertujuan menganalisis kinerja pendinginan, daya tahan, dan ketahanan gelincir (*skid resistance*) berbagai jenis pelapis reflektif panas (*heat-reflective coatings/HRC*) pada permukaan aspal *Hot Mix Asphalt* (HMA) dengan tiga tipe gradasi agregat yang berbeda: padat (*asphalt concrete-wearing course*), terbuka (*porous asphalt-20*), dan celah (*Stone matrix asphalt-halus*).

Penelitian ini menggunakan tiga variasi agregat HMA (*asphalt concrete-wearing course*, *porous asphalt-20*, dan *Stone matrix asphalt-halus*) yang dilapisi dengan empat jenis HRC: resin epoksi putih, resin epoksi hijau, emulsi akrilik hijau, dan cat BeCool. Data dikompilasi melalui pengujian langsung pada sampel HMA yang telah dilapisi. Kinerja pendinginan dianalisis dengan mengukur perubahan suhu permukaan, ketahanan gelincir diukur menggunakan *British Pendulum Test*, dan daya tahan terhadap abrasi diuji dengan *Dry Track Abrasion* menggunakan alat *Wet Track Abrasion Test*.

Hasil penelitian menunjukkan bahwa semua jenis HRC efektif dalam menurunkan suhu permukaan Resin Epoksi Hijau pada HMA *asphalt concrete-wearing course* menunjukkan kinerja pendinginan terbaik, menurunkan suhu puncak hingga 35,1°C dan mencapai suhu akhir terendah (27,5°C). Resin Epoksi Putih pada *asphalt concrete-wearing course* juga mencatat suhu puncak terendah di antara HRC lainnya. Untuk ketahanan gelincir, Emulsi Akrilik Hijau (EAH) justru meningkatkan atau mempertahankan nilai *British Pendulum Number* (BPN) dibandingkan HMA hitam, dengan nilai BPN untuk *Asphalt concrete-wearing course* EAH 67,2, *Porous asphalt-20* EAH 70,6, dan *Stone matrix asphalt-halus* EAH 68,5. Sebaliknya, HRC berbasis resin epoksi dan BeCool cenderung menurunkan nilai BPN. Dalam hal daya tahan (abrasi kering), HRC berbasis Resin Epoksi (Putih dan Hijau) menunjukkan kinerja paling unggul dan konsisten. Resin Epoksi Putih pada *asphalt concrete-wearing course* memiliki kehilangan massa terendah (1,630%). Sebaliknya, BeCool pada *Stone matrix asphalt-halus* menunjukkan kehilangan massa tertinggi (12,519%). Terdapat korelasi positif sedang (Spearman's Rho=0,462) antara kehilangan massa akibat abrasi dan peningkatan  $\Delta T$  (kinerja pendinginan yang buruk).

**Kata kunci :** Pelapis reflektif panas, *Urban heat island*, Kinerja pendinginan aspal, Ketahanan gelincir, Daya tahan abrasi

The increase in urban temperatures due to the Urban Heat Island (UHI) effect is a serious problem caused by the characteristics of urban surfaces that absorb and retain heat. To address this issue, this study aims to analyze the cooling performance, durability, and skid resistance of various types of heat-reflective *coatings* (HRC) on Hot Mix Asphalt (HMA) surfaces with three different aggregate gradation types: *asphalt concrete-wearing course*, *porous asphalt-20*, and *Stone matrix asphalt-smooth*.

This study uses three variations of HMA aggregates (*asphalt concrete-wearing course*, *porous asphalt-20*, and *Stone matrix asphalt-smooth*) coated with four types of HRC: white epoxy resin, green epoxy resin, green acrylic emulsion, and BeCool paint. Data was collected through direct testing on coated HMA samples. Cooling performance was analyzed by measuring surface temperature changes, skid resistance was measured using the *British Pendulum* Test, and abrasion resistance was tested using the Dry Track Abrasion method with the Dry track abrasion Test apparatus.

The research results indicate that all types of HRC are effective in reducing surface temperature. Green Epoxy Resin on dense-graded HMA demonstrated the best cooling performance, reducing peak temperature by up to 35,1°C and achieving the lowest final temperature (27,5°C). White Epoxy Resin on dense-graded HMA also recorded the lowest peak temperature among the other HRC types. For resistance to friction, Green Acrylic Emulsion (EAH) actually increased or maintained the *British Pendulum* Number (BPN) compared to black HMA, with BPN values for *Asphalt concrete-wearing course* EAH at 67,2, *Porous asphalt-20* EAH at 70,6, and *Stone matrix asphalt-smooth* EAH at 68,5. Conversely, epoxy resin-based HRC and BeCool tend to reduce BPN values. In terms of durability (dry abrasion), epoxy resin-based HRC (White and Green) demonstrated the most superior and consistent performance. White epoxy resin on *asphalt concrete-wearing course* had the lowest mass loss (1,630%). Conversely, BeCool in *Stone matrix asphalt-smooth* showed the highest mass loss (12,519%). There is a moderate positive correlation (Spearman's  $\rho=0,462$ ) between mass loss due to abrasion and increased  $\Delta T$  (poor cooling performance).

**Keywords** : Heat-Reflective *Coatings* (HRC), Urban Heat Island (UHI), Asphalt Cooling Performance, Skid Resistance, Abrasion Durability