

# Impacts of recycled crumb rubber powder and natural rubber latex on the modified asphalt rheological behaviour, bonding, and resistance to shear

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## ABSTRACT

The objective of this study is to investigate the rheological properties, bonding and resistance to shear of the rubberized modified binders under different conditions. A base asphalt binder with penetration grade 60/70 was utilised in this study. The crumb rubber and natural rubber latex were added at different percentages for the modified bitumen production, and computed based on the mass of bitumen. Silane additives at the rate of 0.1% by mass of asphalt binder were used as a surfactant. A series of rheological properties and recovery test were conducted on all binders. While bond test and Layer-Parallel Direct Shear (LPDS) test were carried out in order to simulate the crack movement of pavement. The results show that the addition of crumb rubber and latex positively impacts the performance of the asphalt binder. The crumb rubber and natural rubber latex modified asphalt binder has comparatively identical elastic recovery outcomes, while it also helps in enhancing the stiffness in terms of softening and penetration value. However, natural rubber latex modified asphalt binder performed much better than crumb rubber modified asphalt binder in terms of torsional recovery. Whereas, rotational viscosity test has been useful in adopting the suitable temperature which is 160 °C in order to satisfy the needs of better workability and to ensure it is pumpable. Storage stability test proved that the modified asphalt binders are homogenous since the temperature differences are less than 5 °C. The dynamic shear rheometer (DSR) test proved that the modified asphalt binder has better resistance to rutting. Through DSR findings and activation energy, the modified asphalt binder were categorized as less susceptible to temperature changes. Finally, the crumb rubber modified asphalt binder did well in terms of bonding strength, while the natural rubber latex modified asphalt binder performed well in terms of resistance to shear. Overall, both rubberized modified binders performed better than the control sample.

## **KEYWORDS**

Asphalt modification; Crack-sealing; Crumb rubber; Latex; Physical behaviour; Recovery; Bonding; Shear resistance

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