CRACK GROWTH ANALYSIS OF POLYMER MODIFIED ASPHALT USING LINEAR AND NON LINEAR FRACTURE MECHANICS

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ABSTRACT
Asphalt was produced and analysed using a 50/70 grade bitumen modified with a linear styrene-butadiene-styrene polymer up to 7.5% w/w, and also with a 30/45 grade bitumen to compare the effect of base bitumen stiffness. Monotonic and dynamic notched semi-circular bending (SCB) methods were utilised to assess the effect of polymer modification of bitumen on the crack propagation properties of an asphalt concrete.

The fundamental material properties of fracture toughness (K_{IC}), critical energy release rate (J_{IC}) and critical crack tip opening displacement were determined, and the effect of loading rate on K_{IC} and J_{IC} was assessed. Increasing polymer content was found to produce improved cracking resistance in terms of K_{IC} and J_{IC}. By using an image analysis technique and assuming a plastic hinge model values of the rotational factor, r, appropriate for the SCB geometry were also determined.

Under dynamic testing, Paris Law constants for the materials were determined, and fatigue lifetime was found to be significantly improved with increasing polymer content.

KEY WORDS: Fatigue, fracture toughness, J-integral, semicircular bend