Recycled hybrid fiber-reinforced & cement-stabilized pavement mixtures: Tensile properties and cracking characterization

Farhan, A.H., Dawson, A.R., Thom, N.H.

Cement-stabilized aggregate mixtures (CSAMs) have been used effectively within semi-rigid pavement structures. However, the sensitivity to cracking under tensile loading is the main problem that may cause a deterioration due to reflection to the overlaying layers. The primary objective of this research is to show the extent to which the steel fibers extracted from old tires might enhance the pre and post-cracking behavior of CSAMs and to understand how they affect the cracking characteristics. Mechanical performance was evaluated in terms of indirect tensile strength, modulus of elasticity, and post-peak load carrying capacity. Cracking properties were studied quantitatively, at the mesoscale level, using a combination of x-raying of the internal structure and fractal analyses through an image processing technique. A new methodology was suggested and implemented for this evaluation. Despite the low cement content, results indicated a decrease in the material stiffness with fiber addition and an improvement in both pre- and post-cracking behavior. There is a clear enhancement in the toughness and deformability of the mixtures indicating a ductile material. Better cracking behavior was observed after fiber incorporation. Finer cracks and more dispersion of these cracks suggest a reduced potential for reflection cracking. A fracture mechanism was proposed and confirmed by examining various cracking patterns.