

Postprint: Study on Strength Parameters of Asphalt Mixture Based on Boundary Effect Theory

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Abstract

To investigate the strength parameters and fracture performance of asphalt mixtures, an improved boundary effect model was developed based on boundary effect theory, incorporating the influence of pre-notch offset distance and introducing an equivalent peak load conversion formula. Fracture tests were conducted on three-point bending specimens of AC-13 graded asphalt mixture with different offset distances at 5°C. The extended finite element method (XFEM) was employed to simulate three-point bending specimens of identical dimensions, with load-displacement curves used to verify the reliability of the numerical model. The peak loads obtained from both experiments and numerical simulations were substituted into the improved model to derive the tensile strength and fracture toughness of the asphalt mixture. Finally, the model results were used to perform inverse fitting to obtain the influence curve of offset distance on peak load. The results indicate that both the model-derived and inverse-fitted results are in close agreement with experimental data, demonstrating that the improved boundary effect model not only overcomes the limitation of the original model in its inability to be applied to mixed-mode fracture specimens, but also provides a predictive method for determining the elastic-brittle fracture performance of asphalt mixtures.

Full Text

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