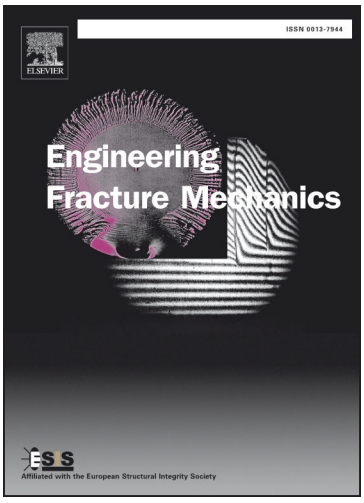

On the low temperature mixed mode fracture analysis of asphalt binder – theories and experiments

M.M. Mirsayar

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On the low temperature mixed mode fracture analysis of asphalt binder – theories and experiments

M.M. Mirsayar*

Zachry Department of Civil Engineering, Texas A&M University, College Station, TX 77843-3136, USA

* Corresponding author: M. M. Mirsayar, E-mail address: mirmilad@tamu.edu, Tel.: +1 (979) 4193589

ABSTRACT

Brittle fracture of asphalt binder is studied in this paper at low temperatures and under mixed mode crack tip deformation. A set of fracture tests are conducted by two new laboratory specimens made of a type of asphalt binder. The suggested specimens can provide pure mode I (opening), mixed mode I/II, and pure mode II (sliding) crack propagation conditions. The crack propagation angles and fracture toughness values were measured from experiments under pure mode I, pure mode II and mixed mode I/II conditions. The experimental results were then evaluated using different fracture criteria: strain energy density (SED), maximum tangential stress (MTS), and maximum tangential strain (MTSN). The role of the first non-singular term of the elastic stress and strain field (generally called T-term) on the predictions provided by each criterion is discussed. It was found that both specimens are significantly affected by the T-term, and adding T-term significantly improves the predictions provided by each criterion. It was shown that for the mixed mode conditions, the strain-based criteria provide better predictions for the fracture toughness than stress-based and energy-based criteria. The results of this paper will help researchers to understand the mechanism of mixed mode crack propagation in asphalt binders, and as a result in pavement structures, at low temperatures.

Keywords: Asphalt binder; mixed mode crack propagation; experiments; low temperature; fracture criteria