Abstract

The extensive application of recycled asphalt mixtures (RAM) requires a better understanding of its fatigue performance and there is need to establish an accurate prediction model for fatigue life. The fatigue-healing performance of RAM containing different recycled asphalt pavement (RAP) contents was investigated by using four-point bending test with virgin mixtures as a reference. The linear portion during the steady decline of the flexural stiffness was utilized to establish a linear method for fatigue life prediction. The effects of RAP content, aging, and immersion factors on the fatigue-healing performance of RAM were studied. A fatigue-healing life prediction model considering RAP content, initial flexural stiffness (E_0), strain level, long-term aging at 85 °C and moisture immersion at 60 °C was developed through regression analysis of data obtained from various fatigue tests. The test results indicated that E_0 at the 500th loading cycle exhibited higher accuracy for life prediction based on linear rule when compared with the traditional E_0 at the 50th loading cycle. With an increase in RAP content, the fatigue life of RAM decreased, while the E_0 showed a linear increase and the healing index gradually decreased. The decrease in fatigue life of RAM due to moisture effect was greater than that due to long-term aging effect. Aging effect for 5 d and moisture immersion for 7 d reduced the fatigue life of RAM by 17.9 % and 47.4 % respectively. The fatigue-healing life prediction model can accurately predict the fatigue life of RAM within the range of 0–45 % RAP content. Aging was found to have the greatest negative effect on the healing performance of RAM, followed by moisture effect, while the effect of RAP content was minimal. This study contributes to the prediction of remaining fatigue life for RAM after long-term service and improving its service levels.