Investigating Resistance Curves of Asphalt Concrete using Digital Image Correlation

Abstract

This research explores utilizing the concept of resistance curves in analyzing properties of asphalt concrete using Digital Imaging Correlation (DIC). The formation of cracks in asphalt concrete pavement is a complicated process. The concept of R-Curves is used in this study to investigate crack growth in asphalt concrete. For this research, the Semi-Circular Bend [SC(B)] fracture test is used to study the crack growth characteristics of asphalt concrete. By using DIC, the change in crack length can be captured. For this study, a camera captures images of the specimen's surface during the test and the crack growth is recorded. The accumulated fracture energy is calculated which is used to construct the R-Curves.

Result Analysis

➢ Load displacement curves using the MTS data and the DIC data were very similar.
➢ The R-Curve of the test at two temperatures are rising curve.
➢ At the very beginning of the test, the crack-length cannot be captured by DIC, but the crack opening width can be captured.
➢ Test at -17°C only captured CMOD by gauge because of the brittle characteristic.

Conclusions

➢ DIC can be used to measure CMOD rather than a clip gauge when applicable.
➢ Preliminary data indicate that R-Curves of asphalt concrete can be captured using DIC and MTS loading frame.
➢ There are many open research areas relating to R-Curves of asphalt concrete, including the development of the cohesive zone before macro-cracks form and extracting information on interpreting R-Curves at different temperatures.

Future Work

➢ More fracture test data will be collected.
➢ Image analysis will be further developed.
➢ Run different asphalt lab tests relying on DIC to run these tests quickly and efficiently.
➢ Further mechanical analysis will be investigated.
➢ Cracking resistance of asphalt concrete will be evaluated.
➢ Simulation of asphalt concrete fracture.