

## **ABSTRACT**

Pavement macrotexture contributes greatly to road surface friction, which in turn plays a significant role in reducing road incidents. Conventional methods for macrotexture measurement techniques (e.g., the sand patch method, the outflow method, and laser measuring) are either expensive, time-consuming, or of poor repeatability. This thesis aims to develop and evaluate affordable and convenient alternative approaches to determine pavement macrotexture. The proposed solution is based on multi-view smartphone images collected in situ over the pavement. Computer vision techniques are then applied to create high resolution three-dimensional (3D) models of the pavement. The thesis develops the analytics to determine two primary macrotexture metrics: mean profile depth and aggregation loss. Experiments with 790 images over 25 spots of three State Roads and 6 spots of the INDOT test site demonstrated that the image-based method can yield reliable results comparable to conventional laser texture scanner results. Moreover, based on experiments with 280 images over 7 sample plates with different aggregate loss percentage, the newly developed analytics were proven to enable estimation of the aggregation loss, which is largely compromised in the laser scanning technique and conventional MPD calculation approach. The root mean square height based on the captured images was verified in this thesis as a more comprehensive metric for macrotexture evaluation. It is expected that the developed approach and analytics can be adopted for practical use at a large scale.