

Chen, Yuanhang, “Integrated Laser 2-D Surface Imaging System for Thickness Measurement of Thermoplastic Pavement Marking Materials”

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Thermoplastic pavement marking materials (TPMM) provide delineation on highways around the world. The thickness of TPMM on pavement is a very important parameter to control the quality of TPMM, calculate durability of TPMM, and provide information for the maintenance and replacement of TPMM. Traditionally, the thickness measurement is conducted by using pre-embedded plates and measuring the thickness of TPMM after spraying of the marking materials. This method is labor intensive and cannot obtain a continuous-thickness profile. Developing an automatic thickness measurement system for marking materials is critical to pavement management and public safety.

The measurement system developed in this dissertation uses laser devices to detect the thickness of TPMM. A dedicated digital laser signal processing circuit is developed to restore thickness information. Both optical and electrical filtering techniques are applied in the design. The thickness measurement system includes two versions: (1) a pushcart measurement device and (2) a vehicle-mounted measurement device, which provide continuous real-time thickness measurement of TPMM. Both devices consist of two major parts: a hardware system to measure the thickness of marking materials using a laser triangulation technique, and a software package to analyze and process the measured data in real time.

Lab and field tests under various conditions with marking materials on real pavement surfaces were conducted. The test results showed that the measurement system is capable of reaching the resolution of 5 mils on pavement. The developed system for thickness measurement of TPMM has a 267 KHz working frequency, which is the highest among similar devices. The high speed allows the system to provide higher accuracy and more flexibility in various applications.