An algorithm based on image processing for asphalt concrete feature structure

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Abstract

The objective of this paper is to present an algorithm based on a 3D computational modeling of C.T scan images that comes out from asphalt concrete samples. An asphalt mixture is divided in to aggregates; asphalt mastic and air void phases. The 3D microstructure of the asphalt concrete is reconstructed from slices of tow dimensional X-ray images. An expert system, based on image processing technique, is used to merge the outputs that resulting from images whit laboratory measurements of asphalt mixture. The results indicate that there is a good relation between properties derived from image processing and laboratorial properties of asphalt samples.

Keywords: compact, C.T scan images, image processing, NDT.

1. INTRODUCTION

Asphalt mixture or hot mix asphalt (HMA) is a composite material of three phases, aggregate, sand mastic and air void. The proportions, distributions and interactions of these three phases define the micromechanical behavior of asphalt pavement [1]. In this paper using X-ray CT-scanning image of asphalt mixture and image processing technique the microstructure of the asphalt mixture achieved. Several studies have performed to achieved the application of digital image processing techniques for asphalt concrete Mixture [1]. And subsequently the features of a sample section determine (aggregate, sand mastic and air void) using an algorithm. The parameters that obtained from the image processing are related to the experimental parameters that achieved in laboratory.

Several studies deal with modeling the microstructure of an asphalt mixture include investigating the sensitivity of aggregate size within sand mastic have done [2]. In some study by recognizing the microstructure of asphalt, aggregate characteristics have been achieved [3, 4, 5,].

In this paper, we first explain the attribute of collected data. The Image Processing and thresholding will be described afterwards. The new algorithm for Representation of Asphalt feature will be explained in the next section. In the end, result and discussion will be presented. E. Masad, V. K. Jandhyala, N. Dasgupta, N. Somadevan and N. Shashidhar had applied X-ray Computed Tomography to Characterization of Air Void Distribution in Asphalt Mixes [6]. Z.Q. Yue , S. Chen and L.G. Tham had developed a finite element model of geomaterials using digital image processing [7]. Hainian Wang and Peiwen Hao, presented an approach to simulate the IDT test of asphalt mixture by FEM based on the microstructure characteristics. The X-ray CT was adopted to obtain the internal structure information of the HMA specimen.[8] Sanjeev Adhikari, and Zhanping You, had Investigate the Sensitivity of Aggregate Size within Sand Mastic by Modeling the Microstructure of an Asphalt Mixture [9].

2. DATA

The data collection consist of two steps, at first preparing 60 cylindrical samples in 7*10 dimension with known mixture schema and achieved features of core sample such as volume of voids, bitumen and aggregate percentage in laboratory then scanning the samples and obtaining images with 1mm distance interval to yield 70 slices per cores. Figure 1 shows a 3D image that acquired through X-ray tomography imaging. The physical properties of the bitumen used were summarized in Table1.