Joint Transportation Research Program

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Determining Asphalt Mixture Properties Using Imaging Techniques

Introduction

The current techniques used to determine the volumetric properties of asphalt mixtures have changed little since their initial adoption. However, with today's technologies, it should be possible to accurately measure materials properties in real-time. Bulk specific gravity (G_{mb}) is one important measurement that must be made on compacted asphalt mixture specimens to determine the volumetric properties of asphalt mixture. Air voids content (V_a), voids in the mineral aggregate (VMA), and voids filled with the asphalt (VFA) are three important volumetric properties used to control the manufacture and performance of asphalt mixtures.

Current conventional methods for determining compacted asphalt mixture specimen G_{mb}, AASHTO T166 and vacuum sealing (CoreLok), are somewhat limited and subject to some restrictions. For example, T166 should not be used with compacted specimens that absorb more than 2% water. The CoreLok method can often experience difficulties when used with mixture specimens that make use of larger aggregate sizes, or specimens that may have

Test set up for determining the bulk specific gravity of compacted asphalt mixture specimens

rougher exteriors. Using imaging technology to determine the G_{mb} of compacted asphalt mixture specimens can result in better characterization of the mixtures through a higher degree of measurement accuracy than can be done with current techniques.

The main objective of this study is to provide a method that accurately measures the volume, and thus the G_{mb}, of compacted asphalt mixture specimens using a 3-dimensional scanner. To this aim, the project objectives were threefold—(1) develop a testing procedures and testing condition for compacted asphalt specimens, (2) complete a parametric study to determine the optimum values of input parameters, and (3) evaluate the capability of the scanner to measure G_{mb} through a comparative analysis with current standard methods.

Findings

This study recommends a potential imaging method to measure the compacted asphalt specimen G_{mb} accurately and efficiently, thus eliminating the limitations and disadvantages associated with current standard methods. The following are the key findings drawn from this research study.

- Imaging techniques can be a reliable alternative for measuring the G_{mb} of any type of asphalt mixture specimen and can do so more quickly and accurately than current standard methods.
- There is no water absorption limitation with imaging techniques, such as the 2% limit found in AASHTO T166.
- The imaging technique is highly repeatable, when compared to CoreLok and AASHTO T166 methods.
- The accuracy of imaging techniques can eliminate the need for measurement replication.
- The proposed imaging method allows the G_{mb} measurement of asphalt mixture specimens, regardless of mixture type, aggregate size, specimen dimension, and how the specimen is obtained (laboratory produced or field cores).
- The proposed imaging method can produce a highly accurate G_{mb} measurement in 8 minutes or less.
- Measuring asphalt mixture G_{mb} by imaging does not require specific operator expertise, therefore the measurement is independent of the operator skill.

Implementation

The proposed method directly addresses the measurement of compacted asphalt mixture G_{mb} in a relative short time and more accurately than current standard methods. Using the candidate technique will save time and resources when determining asphalt mixture volumetric properties, increase the accuracy of such measurements and deliver the measurements in real-time to get more accurate and timely results using fewer resources.

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