



The Ohio Department of Transportation Office of Research & Development Executive Summary Report

A COMPARATIVE EVALUATION OF CORELOK DEVICE IN DETERMINING RELIABLE BULK SPECIFIC GRAVITY AND MAXIMUM SPECIFIC GRAVITY TEST RESULTS

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Problem Statement

Bulk Specific Gravity (G_{mb}) and Theoretical Maximum Specific Gravity (G_{mm}) of compacted hot mix asphalt mixtures are required for the computation of volumetric properties such as air voids, voids in mineral aggregates, voids filled with asphalt, and percent maximum density at a specific number of gyrations. These properties are used to evaluate the acceptability of mixes. In Ohio, determination of specific gravity values is accomplished by the American Association of State Highway and Transportation Officials (AASHTO) procedures. Although the current AASHTO procedures have proved adequate for conventional dense graded mixtures, erroneous specific gravity values have been reported when the tests were performed on coarse graded mixtures. To improve the accuracy of specific gravity measurement, a new device called CoreLok has been developed. The CoreLok is a vacuum sealing device that has been designed to assist in the determination of G_{mb} and G_{mm} of asphalt mixtures. The primary intent of using the CoreLok device is to obtain faster results while, at the same time, improving the accuracy of results. Based on CoreLok's performance claims and evaluations, a number of agencies have included the CoreLok in their specifications while a few others are evaluating the device for potential use. The present study was initiated to assist ODOT to determine if the CoreLok device has potential application for Ohio's conditions. The study included a range of materials and multiple tests to arrive at sound conclusions as to the device reliability, repeatability, precision and durability.

Objectives

The objective of this study is to conduct a comparative evaluation of the recently developed vacuum sealing technology using the CoreLok device and the traditional AASHTO procedures for the asphalt mixtures used in Ohio.

Description

An experiment was designed to systematically compare the bulk and maximum specific gravity values of a variety of lab compacted asphalt mixtures through a series of well-controlled experiments that involved CoreLok and AASHTO procedures.



Asphalt mix type, aggregate source, and compaction levels were chosen as experimental variables. The asphalt mixtures, aggregate sources and compaction levels selected to prepare the samples truly represented Ohio's materials and construction practices. The study involved six technicians and two test labs. A thorough statistical analysis of the data was conducted.

Conclusions & Recommendations

The test data and the analysis led to the following conclusions:

- Based on test results obtained on 34 samples, the G_{mm} values obtained by

both test procedures are statistically similar at 95% confidence interval.

- Tests on 109 samples showed that the CoreLok G_{mb} values are lower than the AASHTO G_{mb} values. Statistical analysis revealed that the difference is statistically significant at 95% confidence interval.

- The difference in G_{mb} values between the two procedures is statistically significant regardless of the type of mix, aggregate source and compaction level.

- Repeatability tests indicated that CoreLok G_{mb} values are highly repeatable.

- Air voids values estimated using the CoreLok device are always 1.2% greater than corresponding AASHTO values and is statistically significant at 95% confidence interval.

- The CoreLok equipment is found to be capable of producing precise, consistent and repeatable test results. Additionally, the equipment is user friendly and easy to maintain. One test can be completed in less than 10 minutes resulting in a time saving of approximately 30 minutes for each test and hence appears to be an economically viable alternative.

Implementation Potential

Overall, the CoreLok method for determining specific gravity of asphalt mixtures shows promise as an alternative method to the traditional AASHTO test method. The individual test results exhibit repeatable, consistent and comparable results. The equipment is user-friendly, durable and fairly inexpensive. With continued use, perhaps it is possible to further refine the test data. There could be potential advantages in specifying this device in terms of reduced testing time. If ODOT intends on using the CoreLok, it is recommended not to change its current specification which is based on historical data and instead use an appropriate correlation factor to relate the CoreLok and AASHTO values.