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RESEARCH PROJECT TITLE

Quality Control/Quality Assurance
Testing for Joint Density and
Segregation of Asphalt Mixtures

SPONSOR

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Quality Control/Quality Assurance Testing for Joint Density and Segregation of Asphalt Mixtures

tech transfer summary

Longitudinal joint quality control/assurance is essential to the successful performance of asphalt pavement and has received considerable attention in recent years.

Problem Statement

A longitudinal joint is the interface between two adjacent and parallel hot-mix asphalt (HMA) mats. Inadequate joint construction can lead to a location where water can penetrate the pavement layers and reduce the structural support of the underlying base and subbase layers.

Furthermore, water that penetrates asphalt layers may reside there and make the layers more susceptible to moisture damage through freeze-thaw cycling and/or subject the layers to large hydraulic loads if the water cannot dissipate quickly due to heavy loading.

Objectives

The objectives of this project were as follows:

- Evaluate available test methods for longitudinal joint quality control
- Develop density and permeability specifications to ensure the longitudinal joint with proper performance
- Identify the best joint construction method in Iowa
- Evaluate the effect of segregation on longitudinal joint density performance

Research Methodology

Five projects were selected for sampling and evaluation with each one representing a typical longitudinal joint construction technique. The five longitudinal joint construction methods were the HMA butt joint, warm-mix asphalt (WMA) butt joint, use of a joint heater, edge restraint by milling, and a modified butt joint via the hot-pinching technique.

The testing procedures included field testing and laboratory testing.

Field testing and sampling consisted of obtaining pavement density using the Troxler PaveTracker non-nuclear gauge and the National Center for Asphalt Technology (NCAT) permeameter.

The laboratory testing included the density tests in accordance with the American Association of State Highway and Transportation Officials (AASHTO) T166 standard and the AASHTO T331 method by the IntroTek Inc. CoreLok system. A Karol-Warner (K-W) permeameter was used for the in-lab permeability test.

An indirect tensile strength (IDT) test was performed to break the core samples. Finally, the asphalt content and washed-gradation were determined according to the AASHTO T308 and AASHTO T30 procedures, respectively.

Key Findings

- The CoreLok method (AASHTO T331) yields lower density values in general and thus higher air void values than the AASHTO T166 method.
- The PaveTracker density gauge and NCAT permeameter are not recommended as viable tools for quality control purposes.
- It is recommended that the minimum required longitudinal joint density that the contractor achieve should be 90.0 percent and 88.3 percent of theoretical maximum density based on the AASHTO T166 and AASHTO T331 methods, respectively.
- The corresponding K-W in-lab permeability criteria identified according to the minimum required longitudinal joint density is $1.50e-03$ cm/s.
- The longitudinal joint for each project shows quite different changes in asphalt content and types of segregation as compared with the pavement mat. Results of this study indicate that the lower density of longitudinal joints could be a combination of gradation segregation, significant asphalt content variation, and a lack of field compaction.
- The milling and filling, infrared joint heater, and the modified butt joint with the hot-pinch longitudinal joint construction methods may create improved joint density over the traditional butt joint.



Longitudinal joint with fine segregation

Recommendations

To construct quality longitudinal joints, the following steps need attention:

- Use a stringline to assure the roller pass is straight.
- Extended augers should be within 12 in. from the paver end gate to reduce longitudinal joint segregation.
- Slight excess of asphalt at a longitudinal joint, generated by overlapping during placement of the cold lane to the hot lane shall not be scattered across the mat. This material shall be stacked over the joint.
- Do not lute (push back) the overlapped material, assuming the proper overlap was placed. If the overlap exceeds 1.5 in., remove the excess carefully with a flat-end shovel.

Based on literature and testing results in this study, the following recommendations are made on longitudinal joint quality control and assurance testing methods:

- Cut 6 in. sample cores for longitudinal joint quality control purposes.
- The seismic wave testing method appears to be a promising way for field longitudinal joint quality assurance. However, additional tests should be performed to prove its applicability.

Implementation Readiness/Benefits

The results of the research are ready for implementation. Density and permeability specifications for longitudinal joint quality control are available. Both fine and coarse segregation have been identified on the longitudinal joint.

This study shows the restrained-edge by milling method performs the best, while the traditional butt joint method exhibits lower density. The seismic wave testing method appears to be a promising way for field longitudinal joint quality assurance.



Longitudinal joint with coarse segregation