Kansas Department of Transportation

TECHNICAL SUMMARY

Evaluation of Lightweight Aggregate for Internal Curing on Concrete Pavement in Kansas

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Placing concrete around sensors

Introduction

The purpose of this project and the Internally Cured Concrete (ICC) test section was to evaluate the benefits obtained through internal curing using pre-saturated Lightweight Aggregate (LWA). The pavements will be evaluated to determine if there is a significant reduction in permanent panel warping. Permanent panel warping, caused by excessive moisture loss at the pavement surface during curing, can lead to poor ride quality. Excessive warping can also lead to structural failure of the pavement such as mid-panel cracking, corner breaks, and base pumping. Additional testing was performed to determine any additional benefits to concrete strength and durability.

Project Description

Two test sections were constructed on the mainline of US-54 near Iola, Kansas: a Control section and an ICC section using lightweight aggregate. Traditional laboratory testing was conducted on each test section to compare fresh and hardened concrete properties including, but not limited to, slump, temperature, air content, unit weight, strength, permeability, and freeze/thaw. Also, several strain gages and moisture sensors were embedded in each test section to monitor the actual strain and moisture content present in the concrete. In addition, a Dipstick Profiler was used on five panels to get a full panel surface profile at the highest and lowest temperatures for several days after pavement construction. Last, HIPERPAV III analysis was used to compare early age stress and cracking risk.

Project Results

The plastic and hardened concrete results presented in this report indicate no significant impact of the LWA material. For the majority of the properties tested, when comparing the results from the two sections, the values fall within the multiple laboratory precision expected when testing from the same concrete batch. However, the reduction in unit weight, the slight reduction of elastic modulus, and the slight increase in tensile strength of the ICC indicate a

potential improvement in overall durability and potentially increased service life. Additional research into these properties would be required to support that data.

The methods used to collect strain, moisture, and deflection data were highly successful. All methods of data collection including strain, curvature, moisture, deflection, and HIPERPAV III results infer the use of lightweight aggregate and internally cured concrete reduce the initial strain and undesirable deformations in the concrete. However, the test sections were not able to be constructed at the same time due to lack of staff, weather delays, and contractor's schedule, and therefore, were constructed 3 months apart. As a result, the significant weather differences between the placement dates have been observed to have impacted the data from the strain gages and moisture sensors. Therefore, it cannot be concluded with certainty if the use of LWA in the ICC improved the quality and durability of the concrete compared to the Control section. General condition surveys will be performed every five years of the 20-year design life, or until a major rehabilitation occurs and the original sections can no longer be surveyed.

Project Information

For information on this report, please contact Daniel Wadley, P.E., Chief, Bureau of Research, Kansas Department of Transportation; 2300 SW Van Buren, Topeka, KS 66611; (785) 291-3845 phone; Dan.Wadley@ks.gov.

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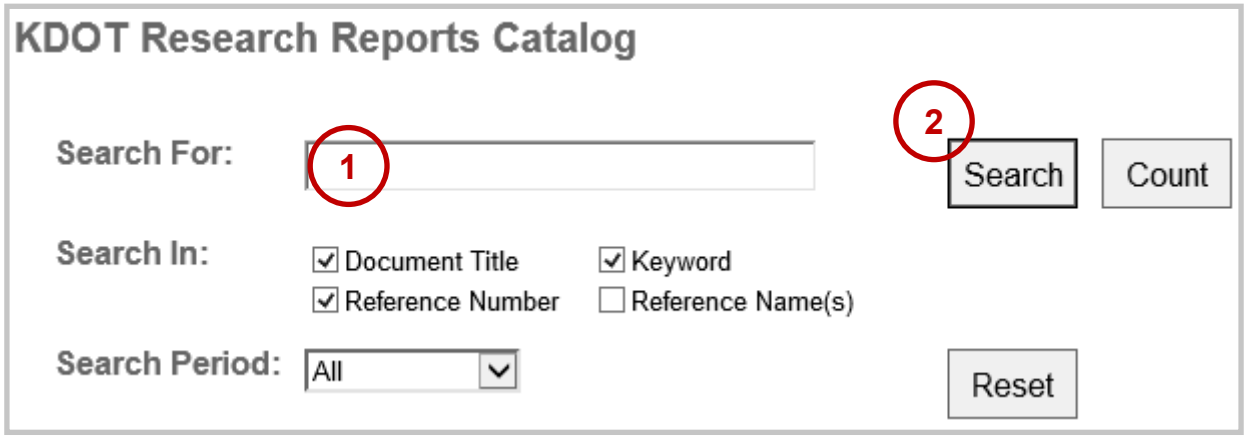

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