Impacts of Internal Curing on the Performance of Concrete Materials in the Laboratory and the Field

tech transfer summary

National Concrete Pavement Technology Center

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RESEARCH PROJECT TITLE
Impacts of Internally Cured Concrete Paving on Contraction Joint Spacing

SPONSORS
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PRINCIPAL INVESTIGATOR
Peter Taylor, Director
National Concrete Pavement Technology Center, Iowa State University
515-294-9333 / ptaylor@iastate.edu
(orcid.org/0000-0002-4030-1727)

CO-PRINCIPAL INVESTIGATOR
Halil Ceylan, Director
Program for Sustainable Pavement Engineering and Research (ProSPER), Institute for Transportation, Iowa State University
(orcid.org/0000-0003-1133-0366)

MORE INFORMATION
www.cptechcenter.org

National CP Tech Center
Iowa State University
2711 S. Loop Drive, Suite 4700
Ames, IA 50010-8664
515-294-3230

The mission of the National Concrete Pavement Technology Center is to unite key transportation stakeholders around the central goal of advancing concrete pavement technology through research, tech transfer, and technology implementation.

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This research aimed to assess whether joint spacings could be increased in slabs containing lightweight fine aggregate (LWFA) as a source of internal curing.

Objective

The objective of this project was to investigate the effects of internal curing on the performance of practical concrete mixtures designed for the construction of jointed plain concrete pavements (JPCPs) in Iowa.

Background

Concrete curing involves techniques and methods to maintain the moisture and temperature of fresh concrete within desired ranges at early ages, which allows concrete to develop strength and durability. Various curing regimes, including external wet curing, insulation membrane curing, and internal curing, can be used for different applications and design characteristics.

Internal curing is designed to provide water reservoirs inside the concrete that aid curing without affecting the water-to-cementituous materials (w/cm) ratio of the mixture. Lightweight aggregates (LWAs) are commonly employed in the US to achieve internal curing.

Internally cured (IC) concrete has several advantages over conventionally cured concrete:

- Improved hydration in terms of uniform moisture distribution
- Reduced autogenous, plastic, and drying shrinkage, reducing the likelihood of shrinkage cracking
- Reduced concrete permeability and enhanced resistance to sulfate attack
- Improved strength and permeability at the interface transition zone (ITZ)
- Reduced modulus of elasticity (MoE) and enhanced residual stress relaxation due to the presence of LWAs
- Reduced moisture gradient along the concrete section, reducing warping in pavements
- Reduced coefficient of thermal expansion (CTE) and thermal conductivity, reducing temperature gradients throughout the concrete and reducing curling in pavements