RESEARCH
PROJECT CAPSULE [12-4C]
September 2012
TECHNOLOGY TRANSFER PROGRAM

Evaluation of Portland Cement Concrete with Internal Curing Capabilities

JUST THE FACTS:

Start Date:
May 1, 2012

Duration:
18 months

End Date:
October 30, 2013

Funding:
SPR: TT-Fed/TT-Reg

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Sponsored jointly by the Louisiana Department of Transportation and Development and Louisiana State University

POINTS OF INTEREST:

Problem Addressed / Objective of Research / Methodology Used Implementation Potential

PROBLEM

Proper curing is the key to durable and sustainable concrete structures. When a concrete mixture is designed, delivered, poured, and consolidated, curing is the last and the most critical part for a final product of great quality. Insufficient curing will cause cracking in the concrete and, in turn, leads to a non-durable and sustainable concrete structure. Current Louisiana specification requires all concrete decks to be water-cured for 10 days. Based on field experience, this is a very expensive operation, and the most difficult one to enforce and monitor. Therefore, there is a great need to develop a new concrete mix that has a self-curing capability, which will reduce the time demand for water curing, minimize or eliminate cracks in the concrete deck, and help achieve durability and sustainability in concrete structures.

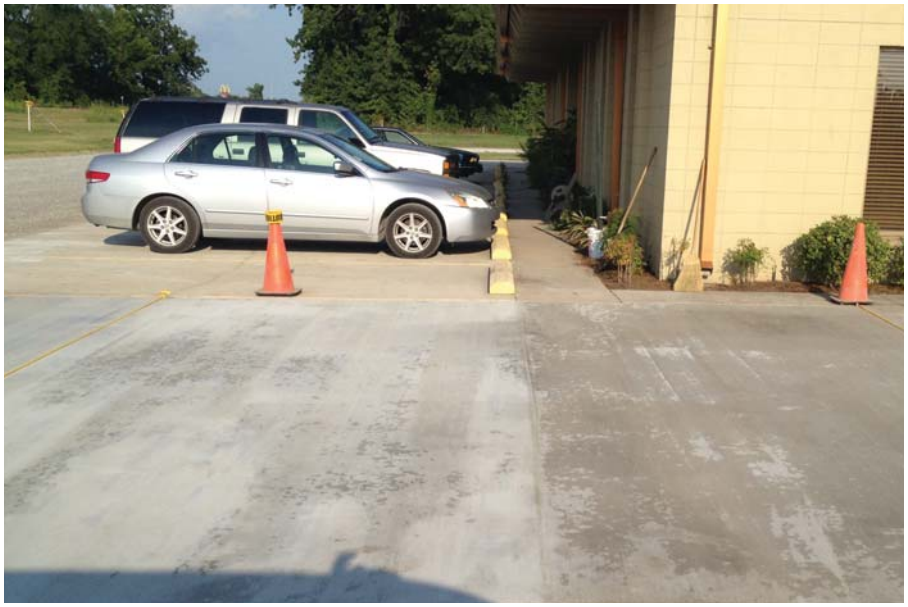

Figure 1
Portland cement concrete parking lot slabs showing the difference between internally cured concrete (right) versus conventional concrete (left). Note the great difference in surface appearance noting the presence of moisture in the internally cured concrete.

OBJECTIVE

The objective of this research is to investigate internally cured concrete produced for bridge structures in Louisiana's environment to improve or guarantee the quality of concrete structures. This research will investigate the use of differing percentages of lightweight aggregates for internal curing benefits, as well as other internal curing agents such as super-absorbent polymer additives.

METHODOLOGY

Task 1 – Design the Testing Program

Two control mixtures will be tested for this study. Concrete conforming to a Class AA(M) structural mixture and a Type B paving mixture will be fabricated as control mixtures. Two types of internal curing concrete will be investigated: (1) using saturated lightweight aggregate as the internal curing agent and (2) using super-absorbent polymer additives as the internal curing agent.

Concrete will be produced with air contents in the range of 2-7 percent, and slump of 5±2 in. The concrete will use a 60/40 coarse aggregate to sand ratio. The coarse aggregate will be a #67 limestone.

Task 2 – Concrete Testing

Comparative testing will be conducted on fresh and hardened concrete. Fresh concrete property comparative testing will include slump, air content, unit weight, set time, and restrained ring shrinkage. Hardend concrete property comparative testing will include compressive and flexural strength, static modulus of elasticity and Poisson's Ratio as well as surface resistivity.

Task 3 – Data Analysis

Statistical analysis will be used to compare internally cured concrete with conventional concrete. With positive results, an implementation plan will be developed for LADOTD.

Task 4 – Implementation Plan

An implementation plan will be developed with positive results. It is anticipated that implementation of this technology will make LADOTD concrete more resistant to drying shrinkage cracking. A change in specifications may be needed to reap the full benefits of internally cured concrete. Additionally a new product code may need to be developed for internal curing admixtures on the Qualified Product List. Benefits of the technology will be detailed and locations for implementation will be determined by the construction and materials divisions of the Department.

Task 5 – Final Report

A final report will be prepared and will include the results and findings of the study. A thorough literature search has begun and will be completed and included in the final report. A recommendation for use and implementation of internally cured concrete will also be detailed.

IMPLEMENTATION POTENTIAL

This project will provide immediate benefit for bridge deck construction and the technology will be applicable to all concrete structures that require curing. The result of this project will reduce the construction cost and lead to an increased crack spacing on bridge decks. The research results can be easily implemented on bridge projects. This technology is also promoted by the Federal Highway Administration (FHWA).