JOINT TRANSPORTATION RESEARCH PROGRAM

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Evaluation of Sealers and Waterproofers for Extending the Life Cycle of Concrete

Introduction

Concrete pavements represent a large portion of the transportation infrastructure. While the vast majority of concrete pavements provide excellent long-term performance, a portion of these pavements have recently shown premature joint deterioration. Substantial interest has developed in understanding why premature joint deterioration is being observed in jointed portland cement concrete pavements (PCCP). While some have attributed this damage to insufficient air void systems, poor mixture design, or chemical reaction between the salt and the paste, it is the hypothesis of this work that a component of this damage can be attributed to fluid absorption at the joints and chemical reactions between the salt and chemistry of the matrix. This discusses the role of soy methyl esters–polystyrene blends (SME-PS) as a potential method to extend the service life of concrete pavements by limiting the ingress of salt solutions.

The report discusses field application of the SME-PS blends for field investigation in Lafayette and Fishers.

Low temperature-differential scanning calorimetry (LT-DSC) techniques identified noticeable differences between plain mortar samples and mortar treated with SME-PS. The report also discusses the development of a test to assess chloride solution ingress during temperature cycling.

The aim of this work is to provide background on some aspects that can lead to joint deterioration and to provide early documentation showing that sealers may help to reduce the impact of deicers on joint damage, thereby extending the life of the concrete pavement. It should be noted that these sites as well as others are still ongoing and should be monitored for long-term performance.

Major Findings

- SME-PS has been found to reduce salt ingress and freeze–thaw damage.
- Work was done using DSC techniques to determine the amount of reaction occurring during temperature

Field observation showing damage in pavement joints.

change; e.g., freeze–thaw and chemical reaction events.

- Field applications of SME-PS show that salts do not penetrate as far when compared with unsealed joints verified by titration tests and visual chloride penetration tests.
- Joint details are an important part of pavement durability, and saw-cut depths can affect the service life of pavements. Within this study is an observed joint that was sawn to only one inch, and cracking occurring away from the joint and has been growing ever since.

Suggestions for Implementation

- It is recommended that the design of longitudinal and transverse joints in portland cement concrete pavements in Indiana be reconsidered. When considering only the durability of the concrete joint, it appears that removing the conventional sealant and sealing the concrete with a penetrating sealer

like SME-PS may extend the life of the joint. The redesign of the joint, however, also considers the potential for incompressible materials to enter the joint. Further, the redesign of the joint requires that the subgrade be able to function properly with additional fluid that may come.

- Quality control when sawing joints is important. The saw cut should be approximately one third the depth of the pavement in order to ensure cracking occurs within the saw cut if stresses are high enough in the pavement to generate a crack.

Recommended Citation for Report

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Field observation showing damage in pavement joints containing water.